Michigan Department of Transportation

Road Design Manual

Bureau of Development

ROAD DESIGN MANUAL

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Engineering Manual Preamble

This manual provides guidance to administrative, engineering, and technical staff. Engineering practice requires that professionals use a combination of technical skills and judgment in decision making. Engineering judgment is necessary to allow decisions to account for unique site-specific conditions and considerations to provide high quality products, within budget, and to protect the public health, safety, and welfare. This manual provides the general operational guidelines; however, it is understood that adaptation, adjustments, and deviations are sometimes necessary. Innovation is a key foundational element to advance the state of engineering practice and develop more effective and efficient engineering solutions and materials. As such, it is essential that our engineering manuals provide a vehicle to promote, pilot, or implement technologies or practices that provide efficiencies and quality products, while maintaining the safety, health, and welfare of the public. It is expected when making significant or impactful deviations from the technical information from these guidance materials, that reasonable consultations with experts, technical committees, and/or policy setting bodies occur prior to actions within the timeframes allowed. It is also expected that these consultations will eliminate any potential conflicts of interest, perceived or otherwise. MDOT Leadership is committed to a culture of innovation to optimize engineering solutions.

The National Society of Professional Engineers Code of Ethics for Engineering is founded on six fundamental canons. Those canons are provided below.

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform Services only in areas of their competence.
3. Issue public statement only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, reasonably, ethically and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

MICHIGAN DESIGN MANUAL
ROAD DESIGN

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CHAPTER 1 • PLAN PREPARATION

1.01 DEVELOPMENT METHODS

1.01.01 References

(revised 11-28-2011)

A. Geometric Design Guides - Design Division

B. Guidelines for Plan Preparation – Design Division

C. Michigan Manual on Uniform Traffic Control Devices, Current Edition

D. Standard Plans and Special Details – Design Division

E. Standard Specifications for Construction, Current Edition

Existing plans for a recent project, similar in nature to the proposed project, are an excellent reference.

1.01.02 General

(revised 3-23-2026)

This chapter provides the information and details necessary to prepare a set of plans. The plans must contain all the information essential for bidding and constructing the project. Although innovation and creativity are encouraged in the preparation of plans, the importance of general uniformity must be emphasized. Plans must be adaptable to the diverse requirements of the Design Division and Construction Field Services Division. At the same time the plans must be a functional reference, familiar to the users. A general format must be followed by all Designers.

1.01.03 Survey and Mapping Methods

(revised 12-28-2020)

The choice between a ground survey, an aerial survey, a laser scanning survey (LiDAR), or a combination depends in part on the type and length of project, the information required, and the time schedule.

Some projects may not require a survey or may require only a minor pick up survey. Old plans are valuable sources of information on these projects.

Refer to Chapter 14, Procedures for Plan Preparation, for more information on surveys and mapping.

1.02 PLAN SHEETS

1.02.01 Title Sheet

(revised 3-23-2026)

The location map shown on the title sheet will generally be obtained from either county or city maps which are available in ProjectWise in the Reference Documents. For a particular project, a suitable map or section of one is chosen and incorporated on a standard title sheet cell. Because first impressions often sell the product, the title sheet must be neat in appearance and layout.

1.02.01A Project Location

The project must be located on the map and the limits (P.O.B. Stationing and P.O.E. Stationing) outlined to clearly show and stand out from the rest of the map. The map must be oriented with north to the top of the sheet and with a north arrow shown near the map.

The map must show the entire project limits and other features that will easily identify the location. Preferably, at least two trunklines, names of major crossroads, and an incorporated city or village, township, and county must be shown on the location map. The town, range and section numbers must also be shown on the map.

The point of beginning and the point of ending must be identified by control section, physical reference, job number, stationing, and control section mileposts. Station equations and stationing of major crossroads must also be shown.

The location map must also show bridge numbers, railroad crossing numbers, and railroad companies within the project limits for both existing and proposed crossings.

1.02.01B Traffic Data

Existing year traffic data and projected 20-year traffic data must be located on the upper left part of the title sheet. Pertinent counts including ADT, DHV, percent commercial, and the year taken are shown in tabular form. For freeway projects, the commercial DDHV must also be listed. These counts are usually present counts and projected counts. Counts are obtained from the Bureau of Transportation Planning (see Chapter 14 of this manual).

The design speed and posted speed must also be shown. If the design speed changes within a project, show the various limits by stationing, crossroads, or mile points.

1.02.01C Project Identification

The following format must be used for identifying projects:

MICHIGAN DEPARTMENT OF TRANSPORTATION

ROUTE: I- & M-****
CITY OF ***
***** TOWNSHIP**
***** COUNTY**

SECTION CONTROL SEC JOB NO.

For filing and reference purposes, both the control section and job numbers must be shown in the appropriate blocks in the bottom margin. If the project has multiple job numbers, show them in the title block. Projects with multiple control sections must show the major control section (as programmed) first with others following in parentheses.

1.02.01D Length and Type of Work

The length of the project, in hundredths of a mile, and the type of work must be shown in the bottom of the approval block.

Example:

MICHIGAN **DEPARTMENT OF TRANSPORTATION** XXXXX X. XXXXXX, P.E. - DIRECTOR		
MILES: CONTRACT FOR:		
	DRAWING	SHEET
		SECT

1.02.01E Project Signature and Plan Sign Off

To supplement the title sheet data, plan sign off must be performed by the MDOT Project Manager and Consultants (if applicable) using the Project Signature Sheet. The instructions tab of the Project Signature Sheet overviews the steps required to implement digital signatures denoting completion of plans. Failure to collect the necessary signatures via the Project Signature Sheet may delay the targeted letting date, as the plans would not be considered complete. All signatories of the Project Signature Sheet, both internal and external, are required to be professionally licensed engineers in the State of Michigan; other licensed individuals can be added based on specific project needs.

It is important to note that the signatures on the Project Signature Sheet mean different things for internal and external Project Managers. Internal signatories are acting with their position's authority as a Department employee, and because the project was designed by, or for, the Department, the signature verifies that the plan development process was followed and that the project(s) are ready to be submitted to the MDOT Quality Assurance Section for letting.

Signatures and stamps from external consultants certify not only that the plan development process was followed, but also to certify design components within the plans. The Prime Consultant may choose to have additional signatories on the Project Signature Sheet upon reviewing which subconsultants created or contributed to specific plan sheets and the appropriate licensing requirements of their disciplines.

For consultant-designed projects, it is the responsibility of the Prime Consultant to develop the Project Signature Sheet utilizing the latest available version. The Prime Consultant will identify and populate the Project Signature Sheet with the appropriate signatories, file names, and sheet ranges of the external design team(s). All sheets in the plan set must be included in the Project Signature Sheet. Upon completion of the Microsoft Excel file, the Prime Consultant will submit the file to the MDOT Project Manager to facilitate obtaining all applicable digital signatures for the project. As part of the submittal, the Prime Consultant will also provide the email addresses of applicable external signatories to the MDOT Project Manager.

Consultants must place their company logo on the plan sheets that they were in responsible charge of, as well as denoting the sheets on the Project Signature Sheet.

For internal projects with only one Project Manager, the MDOT signatory of the Project Signature Sheet must match both the individual listed on the "Notice to Bidders – Inquiry" and the individual assigned to the Project Manager role in JobNet unless previously coordinated by the MDOT Quality Assurance Section. Please note that compliance with this requirement may require processing a Change Request in JobNet to reassign the MDOT Project Manager.

Packaged projects that contain multiple job numbers or internal projects containing both road and bridge disciplines must have the signatory of the Project Signature Sheet and the individual identified in the "Notice to Bidders – Inquiry" be the licensed MDOT Project Manager responsible for the job number or discipline type (road or bridge) representing the majority of the work.

Once all applicable valid digital signatures are obtained, place the final completed Project Signature Sheet (pdf) in the Letting Plans and Proposal folder in ProjectWise along with the corresponding project plans (as applicable) and proposal. Place the final Microsoft Excel file version of the Project Signature Sheet in the corresponding Supporting Documents folder.

Additional instructions are included in the digital Project Signature Sheet.

1.02.01F Deleted

Section Deleted

1.02.02 Project Information Sheet

(revised 6-17-2013)

The purpose of the Project Information Sheet is to show, in a convenient location, the Utilities, Notes Applying to Standard Plans, and the Plan Index.

Information on the Project Information Sheet should be project specific, current, and complete.

1.02.02A Utilities

The preliminary utility list should be prefaced with and followed by the standard notes that best fit the project.

The preliminary utilities list should be from: a current survey, old plans, or the information retrieval system. It should be updated to the current date. Utility information can also be obtained from the field review section, the utility section, or the Region/TSC Utility/Permit Engineer. The final utility list shall be from the Region/TSC Utility/Permit Engineer.

The list should include the name and address of the utility, the type of utility, and a contact person, listing a phone number and address if available.

1.02.02B Notes Applying to Standard Plans

Current standard plans and special details that are applicable to the project are listed on the Project Information Sheet. Special details called for on the note sheet must also be physically attached to the construction plans.

Standard plans are engineering drawings showing standard details of various construction items which present the current policies of MDOT and are approved for repetitive use. In order for these drawings to become Standard Plans, they must first be approved by MDOT Administrators and have FHWA approval. The approved drawings are then made available on the MDOT Web site.

During the time these plans are being processed for approval, they are often included in the construction plans as special details.

Even though these plans are labeled "Standard Plan" in the title block, they are still considered special details when included in the construction plans. Do not change the “standard plan” label to “special detail” or remove the plan number and/or plan date on these plans. Special details are also available on the MDOT Web site.

1.02.02C Index

The index is always located on the right side of the Project information sheet. Plan sheets should be arranged in the order as shown in Section 1.03.01. The index should show only the sheets included in the project. If bridges are included in the project (package project) they would be indexed "Section 2 - Bridge Plans" under the road sheets which would be referenced "Section 1 - Road Plans".

1.02.03 Vicinity Maps

(revised 4-21-2014)

A vicinity map may be required for projects involving new route locations or significant right-of-way acquisitions. The map may be drawn to any recognized scale which is at least 750 scale (1"=750'), that permits showing the entire project on one plan sheet, whenever possible. A scale smaller than 750 scale is not recommended because of its inability to display detail.

The level of detail may vary as needed and might include some of the following items:

- Centerline
- Right-of-way limits
- Topographical features such as county roads, city limits, lakes, rivers, railroads, drainage courses, etc.
- Section corners, ¼ corners, section numbers and lines, township and range, north arrow

The vicinity map may be combined with the drainage map at the discretion of the Designer.

1.02.04 Drainage Maps

(revised 1-29-2018)

The drainage map should show ditch lines using arrows to show the direction of flow, culverts, bridges, etc., for both existing and proposed conditions. Drainage structure sizes, both upstream and downstream, should also be shown. Show all county drains within the project limits.

When a drainage course is a county drain, it should be indicated on the plans and drainage sheet. If the survey does not indicate the information, check with the MDOT Drainage Coordinator in the Environmental Section of the Bureau of Highways.

The ROW width for the county drain must be shown on the plans. If the drain has no specified ROW width, it should be wide enough to allow working room for maintaining the drains outside the highway ROW Right of way widths should always be coordinated with the MDOT Drainage Coordinator (Utilities Design Supervising Engineer), the respective Region/TSC Drainage Coordinators(s) and verified by the County Drain Commissioner.

An additional drainage sheet may be required on urban projects showing existing sewers and structures. Upon completion of the drainage design, proposed sewers, structures, and their quantities may be added to this sheet.

The drainage map should also include the following items or information:

- The direction of flow for all existing and proposed ditches, drains, sewers and culverts
- North Arrow
- Names of streets, highways, county roads, railroads, rivers, etc.
- Outline of the proposed road
- Tabulation of drainage data for all culverts 30” or greater in diameter
- Drainage districts

For small or intermediate sized culverts the tabulation only needs to include design runoff and the drainage area. Drainage areas which are equal to or greater than 2 square miles require a more elaborate tabulation. (See MDOT Drainage Manual Section 5.3.4 for information on this tabulation.)

1.02.05 Typical Cross Sections

(revised 8-18-2014)

Typical cross sections are included in plans to give a graphic display of the existing and proposed cross sections of the roadway. They also describe to the contractor where each typical section will apply. All integral parts of the roadway and the roadbed should be shown including: subbase, base, surfacing, shoulders, slopes, medians, barriers, curbs, gutters, ditches, sidewalks, and so forth.

1.02.05A Stationing

Only the alignment required to construct the project should be shown. Stationing should be continuous with no overlaps or gaps. Stationing for superelevated sections should include the superelevation transitions. Each different condition that cannot readily be shown on one typical section should have its own section. Stationing, where that section applies, should be shown under the section. An overall Right of Way dimension shall be included. The designer should ensure that the entire project has an appropriate typical cross section.

1.02.05B Scale

Typical cross sections should be drawn to a scale that will allow the typical to fill the width of the page. Show the scale (horizontal and vertical) in the title block.

For horizontal dimensions, use decimals, not feet and inches (only for fractional dimensions, example 12’ not 12.00’; 2.5’ not 2’-6”; 2.67’ not 2’-8”). Vertical dimensions are typically in inches (example 18” not 1’-6” or 1.5’).

1.02.05C Notes, Charts, Legends & Conventions

Typical section notes should be placed on the lower right corner of the first typical cross section sheet.

The HMA application chart shall be shown on the first typical cross section sheet which has an HMA section. This chart shall include: the HMA mix, the rate of application, the performance grade, and remarks.

All concrete typical sections should indicate the location of longitudinal joints required as detailed in the Road Sample Plans.

1.02.05D Existing Typical Cross Section

Often, a separate existing typical cross section is needed to show the existing conditions and removals.

When the existing conditions are incorporated into the proposed cross section, they should be shown with dashed lines.

Typical sections should show pavement and shoulder slopes and grading or subbase slopes. Also, show existing and proposed crown point location.

1.02.06 Miscellaneous Details

(revised 6-17-2013)

Occasionally, a miscellaneous detail may need to be added to address a special item or treatment on a project. The drawing is placed in the construction plans with the miscellaneous detail sheets.

1.02.07 Note Sheet

(revised 6-17-2013)

The purpose of the Note Sheet is to show, in a convenient location, the General Notes applying to the project.

1.02.08 Miscellaneous Estimates

(revised 10-22-2012)

The miscellaneous estimates section is for listing all pay items that do not appear elsewhere in the plans. This estimate usually includes the following items:

- Contractor Staking
- Concrete and HMA Quality Initiative
- Project Cleanup
- Erosion and Sedimentation Control Items
- Slope Restoration Items
- Subgrade Correction Items
- Maintaining Traffic Items
- Pavement Joints
- Pavement Markings and Signs if separate sheets are not part of the plans

Items are not limited to those shown above nor are these items always shown on the miscellaneous estimate sheet. If pay items can conveniently and clearly be shown on the plans, there is no need to include them in the miscellaneous estimate sheet.

Quantities shown in the miscellaneous estimate area should be separated by job number and local participation, when applicable. If a project includes several Act 51 participating cities, a column for quantities in each city will be necessary.

1.02.09 Legend Sheets

The legend sheet shows all the standard symbols and conventions used in the plans. These include symbols for drainage, utilities, real estate, topography, paving and removals. A separate legend sheet can be included in most major projects, however, the necessary information can also be shown on construction plan sheets and/or removal sheets. If the legend crowds or clutters the plan sheets, a separate legend sheet would be in order.

1.02.10 Survey Information Sheet

(revised 10-22-2012)

Beginning with Datum Notes, this sheet lists benchmarks and horizontal control points, with witnesses and coordinates. Horizontal alignment points (P.C., P.I., P.T., and P.O.T.) found or set by the surveyor and government corners are also included.

1.02.11 Alignment/ROW Sheets

(revised 10-22-2012)

An Alignment/ROW sheet should be incorporated with the plan set.

The Alignment/ROW sheet should show the following:

- All alignments pertinent to the project: existing legal and proposed construction. Alignments station-referenced to the Public Land Survey System, Section, Township and Range, showing the PLSS corners with bearing and distance ties to the intersections of the alignments and the government lines. These ties shall only appear on the Alignment/ROW Sheets within the plan set.
- ROW lines dimensioned from the legal alignment from which the lines were established.
- Curve data for all project alignments shall be shown on the Alignment/ROW sheet only. Curve data shall be placed **once**, on the Alignment/ROW sheet on which the curve's P.I. is located.
- Subdivision plat information shall be shown on the Alignment/ROW sheets, as well as on the Removal and Construction sheets.
- MDOT parcel numbers and property boundary information shall be shown on the Alignment/ROW sheets **only**.
- Proposed Right of Way dimensions
- Coordinates for ROW Monuments, P.I.'s, P.C.'s, and P.T.'s
- North Arrow

1.02.12 Removal, Construction Plan, and Profile Sheets

(revised 1-27-2020)

1.02.12A Removal

Separate Removal Sheets should be considered depending on the type, location, and complexity of the project. Removal Sheets are almost always needed for projects in congested urban areas.

An early determination should be made whether or not to include removal items on the construction plan sheets. If this would cause the plans to become cluttered and difficult to read, then separate Removal Sheets should be used. The Removal Sheets should show all existing topography within the project limits.

All items for removal will be indicated on these sheets. Once it has been determined that an item is to be removed and it has been indicated on the Removal Sheet, the item should no longer appear on the construction plan sheet. Slope stake lines should be shown to determine removal limits. The edges of proposed pavement or back of curb may also be beneficial in determining removals.

Subdivision plat information shall be shown on the Removal Sheets.

The Removal Sheets shall only show the alignment required to construct the project.

1.02.12B General

Construction plan and profile sheets are the "meat" of a set of plans. Plan sheets are “overhead” maps or pictorial representations of the project to be constructed. Plan sheets indicate what items need to be removed, replaced, relocated, reconstructed, constructed, or adjusted. Plan sheets must be clear, complete, correct, and uniform to convey to the contractor how to construct the project and what materials will be needed.

P.C., P.I., and P.T. Station labels shall be shown for the alignment required to construct the project.

If the scope of work involves a significant amount of drainage and utility renovation or removal, separate plan sheets may be required for each phase of construction (removal, utility and drainage, and construction).

Profile sheets show existing elevations and proposed elevations of the finished construction project. They also show drainage details including existing and proposed ditch elevation, top of curbs, drainage structures, sewers, and other utility information. Profile sheets should also show grading information, such as front and back slopes, peat location and treatment, and excavation and embankment quantities.

Profile sheets may not be required on all projects, such as when the grade is not changing, or it is changing at a uniform rate.

1.02.12C Guidelines

1.02.12C1 Plan and Profile Scale

- Rural Projects
    - Plan
        - 1" = 100' (1" = 80' for reconstruction)
    - Profile
        - Horizontal: 1" = 100'
        - Vertical: 1" = 10'
- Urban Projects
    - Plan
        - 1" = 40' (Preferred) 1" = 50' (Acceptable)
    - Profile
        - Horizontal: 1" = 40' (Preferred) 1" = 50' (Acceptable)
        - Vertical: 1" = 4' (Preferred) 1" = 5' (Acceptable)

The preferred larger scale of 1"=40' is more accommodating for congested areas and for detailed grades. Reduced scales, 1"=200' or smaller, can be used for staging plans, pavement markings, vicinity or drainage maps and interchange drawings so that the entire project or interchange can be shown on one plan sheet.

1.02.12C2 Sheet Breaks

Preferred sheet breaks are as follows:

- 200 Scale: 2400' per sheet (24 stations)
- 100 Scale: 1200' per sheet (12 stations)
- 80 Scale: 1000' per sheet (10 stations)
- 50 Scale: 600' per sheet (6 stations)
- 40 Scale: 500' per sheet (5 stations)

1.02.12C3 Information

Plan sheets should include the following, except for the noted items which may be shown on separate sheets.

1. North orientation arrow.
2. City limits.
3. Township, range, and section.
4. Existing pavement description including width and type (indicate limits of milling or surfacing).
5. ROW, (existing and proposed) including cross roads.
6. Slope stake lines.
7. House numbers on urban projects and rural projects, if available.
8. Property owners names on rural projects, when available.
9. Existing drainage, direction of flow, size, and type of all existing culverts and sewers.
10. Pay items and leaders to specific work types.
11. "This Sheet" quantity listings shall include only items that are not included elsewhere on the sheet.
12. Detail of guardrail installation(s).

13. Existing utilities – NOTE: Flag all gas, oil & underground electric power lines as "hazardous or flammable material". Flag all underground telephone, water transmission, and fiber optics as “caution critical utility”. All other underground private and municipal utilities should be shown in standard line coding with the type of utility, size, type of pipe (if known) and flow arrows (if applicable). Generally, overhead utilities (excluding overhead high voltage transmission lines) are not shown on the plans, unless these utilities are in the vicinity of structures such as bridges or culverts where cranes are in operation.
14. Existing Driveways.
15. Streets and Crossroads - name, width, surface, etc.
16. Soil survey boundaries identified with soil series.

Profile sheets shall show the following when applicable.

1. Proposed plan and ditch grade (include curb grades).
2. Type lines (showing front slope, back slope, ditch information, superelevation, and transitions, etc.).
3. Crossroad or street profiles.
4. Sidewalk profiles and/or top of curb grade profiles.
5. Existing ground profile and ground points - side profiles.
6. Vertical Curves.
7. K-value
8. P.I. station and curve length
9. Tangent Grades.
10. Temporary roads.
11. Water table information.
12. Rock, peat, muck, undercut locations, and treatments.
13. Cross culverts.
14. Existing and proposed underground utilities (sewer, water, telephone, electrical, pipelines, etc.).
15. Existing drainage structures and pipes - dashed lines.
16. Proposed drainage structures and sewers - solid lines.
17. Proposed flow line elevations to nearest hundredths of a foot.
18. Existing (surveyed) flow line elevations to nearest hundredths of a foot. Estimated existing flow lines should be shown to the nearest tenth of a foot.
19. Earthwork limits and quantities.
20. Other miscellaneous quantities.
21. Station equations.

Profile sheets should reference the alignment required to construct the project or plan grade profile line showing both existing grade and proposed grade. Side profiles should also be indicated, usually a set distance left and right of the alignment, i.e., 30 feet left and 30 feet right. Rural projects would use the side profiles to plot existing and proposed ditch grades; urban projects to indicate top of curb grades or sometimes gutter or sidewalk grades. Rural projects also usually include ground points at even stations and usually 100 feet left and right of centerline. These points give the designer an indication of the lay of the land in the project area but certainly do not replace the need for cross sections.

1.02.12C4 Sheet Orientation and Stationing

Plan sheets should be set up to avoid breaking at important design features such as interchanges, intersections, or curves starting or ending at the beginning or end of a sheet. Sheets on curves should be angled to produce a balanced sheet; the tangent sections should be near the center of the plan sheet.

Stationing should be from left to right, should not be overlapped sheet to sheet, and should be the same as the profile stationing. Plan and profile stationing should ideally begin and end with a station multiple of 100 feet (e.g. station 3+00 or 6+00). Stations will be based on hundreds of feet. Each “tick” mark is identified as follows: 1, 2, 3, etc. Alignments will be "ticked" and labeled at 100 foot intervals.

1.02.12D Quantities

Pay items, pay units, and estimated number of units are shown on the construction plan and profile sheets.

Construction quantities can be shown by individual notes, in tabular form as quantities per sheet, or a combination of both methods. Important items to remember when placing quantities on the plan and profile sheets

1. Use the proper (correct) pay items. Pay items should agree with the special provisions, supplemental specifications, standard specifications, and the pay item code book.
2. Use the correct pay units from the same sources as above. Various pay items have more than one unit of measure. The designer is to use judgment to decide which unit of measure is best for the situation.
3. Pay items should be included in only one place on plan and profile sheets, i.e., if pay items are shown by note and leader they should not also appear in the "quantities this sheet" compilation.
4. All quantities should be computed and checked for accuracy.
5. All information required to construct the pay item must appear in its proper location and meet all policies, procedures, standards, and guidelines established by MDOT, FHWA, AASHTO, and other agencies. Guardrail installations, where length, location, and offsets are extremely important, are an excellent example of the need for complete information.
6. Agency Participation, if applicable.

Quantities generally shown on the plan sheet or the plan portion of a plan and profile sheet include:

- Removals and adjustments (if separate removal sheets are not included).
- Pavement and surfacing quantities including curb, curb and gutter, valley gutter, shoulders, sidewalks, etc.
- Guardrail and median barrier.
- Erosion control item locations.
- Sewers, drainage structures, culverts and other utility alterations.
- Driveway and approach treatments.

Profile sheets will not include quantities. Excavation quantities are shown on the removal sheet. Embankment and subbase quantities are shown on the construction sheet.

1.02.13 Interchange Ramp Plan and Profile

(revised 10-22-2012)

Each interchange ramp should be shown on a separate plan and profile sheet(s). The format for ramp sheets is the same as those for mainline plan and profile sheets.

Care should be exercised in setting the grades on ramps, especially where the ramp, the mainline, and the crossroad are close together or connected. Detail grades of the gore area are always needed. Detail grades for crossroad intersection are sometimes necessary to ensure proper grades. (See Section 1.02.15.)

1.02.14 Crossroad Plan and Profile

(revised 10-22-2012)

If a project involves extensive work on crossroads, including relocation or changes in elevation, separate plan and profile sheets should be included for the crossroads. Again, mainline plan and profile guidelines should be followed when setting up crossroad plan and profile sheets.

Particular care should be exercised at intersections of crossroads and trunklines. Grades should be set to favor the through roadway, usually the trunkline, but a smooth ride from the crossroad across the trunkline should also be considered. Detail grades are very useful in determining good grades through intersections and their use should always be considered when reconstructing major intersections, especially in urban areas. (See Section 1.02.15.)

1.02.15 Detail Grades

(revised 10-22-2012)

1.02.15A General

Detail grades are exaggerated drawings that help the designer to set good grades through problem areas. Detail grades should be considered whenever two roadways intersect on a project with grade changes. Problem areas may include ramps merging with or diverging from the mainline, gore areas, ramp intersections with crossroads, mainline and crossroad intersections, major driveways, auxiliary lanes, and many others.

Detail grades will help the designer to:

1. Determine a smooth, rideable grade through the problem area.
2. Determine good drainage throughout the intersection.
3. Avoid excessive crown drops.
4. Avoid excessive cross slopes that could exceed recommended maximum break over slopes.

1.02.15B Guidelines

A plan sheet is prepared to cover the problem area at an exaggerated scale, usually 1"=20' (20 scale).

Profile lines are then determined; i.e., alignments of mainline and crossroads, edge or curb lines, and intermediate lines for wide pavements or intersections (usually lane lines or joint lines).

A grid for cross sections is established. Depending on the area, this may be in 10' intervals or up to 25' intervals.

Elevations are placed on the drawing, (or possibly using X and Y coordinates) starting with the known elevations, i.e., the established mainline grade, the existing crossroad elevations or proposed grade, or proposed ramp grades, etc.

Other elevations are filled in from normal crown drops, superelevations, shoulder slopes, cross slopes, etc.

To avoid clutter on complex detail grades it may be simpler to assign point numbers to each intersection point on the grid and assign letters to each line (profile or cross section).

Profiles are then plotted on the same horizontal scale and on an exaggerated vertical scale. This scale is job dependent and should be readable when placed on an 11" x 17" sheet. Cross sections should also be plotted.

Profiles and cross sections are then massaged until the intersection meets all criteria for grade, crown, cross slope, and acceptable rideability.

The finished detail grades will also help to determine drainage requirements. Low spots will determine drainage structure placement, runoff to culverts or ditches and so forth.

1.02.16 Maintaining Traffic/Stage Construction

Many projects will require construction staging so that the highway, or at least part of the highway may still be used by the motorist. All projects should be reviewed early in the design stage with the Region/TSC to determine if staging plans are needed. When staging is required, the designer should include staging sheets and/or special provisions in the final plans that indicate, pictorially and in text, what stages and construction sequences are required.

Generally, each stage should have a typical cross section showing the following:

1. Temporary pavement or shoulders
2. Lanes to remain open
3. Removals
4. Location of barricades or barriers
5. Lane widths and other dimensions
6. Signal poles

The text should adequately describe each step of the stage so that there is no misunderstanding as to what, where, and how things should be done.

If staging is not complicated, it may be possible to spell out the staging requirements with a special provision. If so, plan sheets will not be necessary.

In addition to staging plans, maintaining traffic plans showing construction signing should be prepared if the signing is altered from the standard construction sign layouts shown in the Maintaining Traffic Typical Cross Sections. The Region/TSC Traffic and Safety Engineer will mark the sign types and location on a base plan prepared by the designer. The final construction signing plans are then completed by the designer.

(See Chapter 8 Maintaining Traffic of this manual for more information.)

1.02.17 Signing Plans

(revised 11-28-2011)

Occasionally, as part of the contract, construction projects will include permanent signing along a relocated highway or upgraded signing along an existing highway.

The Design Division - Traffic Sign Unit is responsible for preparing permanent signing plans. Working together, the designer and a representative from the Traffic Sign Unit, will determine sign types (ground mount, cantilever, truss, etc.), size, location, legend, and other details. These details will be shown on base plan sheets, usually prepared as strip plans on a small scale, i.e., such as a 200 scale. Standard signing plans from Traffic and Safety are then added to the plans. The signing standards show the details necessary to fabricate and construct the permanent signing.

1.02.18 Pavement Marking Plans

(revised 7-26-2021)

Pavement marking plans show the details of the permanent markings for lane lines, edge lines, and special markings such as: stop bars, directional arrows, turning guide lines, and cross hatching.

Pavement marking plans are prepared at a suitable scale that will show individual longitudinal lines and special markings. All markings shall be drawn representative of their patterns and shapes. There must also be a clear differentiation between existing and proposed markings through line styles and/or labeling.

A callout should be shown for each non-continuous section of a longitudinal line. Callouts for longitudinal lines consist of the following format:

PAVT MRKG, [material], [width], [color] [pattern], [cycle]

Patterns include: solid, double solid, broken, solid and broken, and dotted. Cycle is indicated for broken, solid and broken, and dotted lines in the form: [length]’ mark, [length]’ gap

Callouts for special markings are shown in the following format:

PAVT MRKG, [material], [pay item name or similar description]

When a special marking type appears on the same plan sheet multiple times, it is acceptable to label a single instance of each type and add “(TYP)” at the end of the callout rather than label each instance separately.

Recessing of longitudinal lines or special markings must be indicated in the callouts or via a general note on each plan sheet.

Quantities are to be shown per plan sheet. If there are no pavement marking plan sheets or the plan sheets do not cover all markings, such as when using Witness, Log, $1,250.00, place the quantities not associated with a pavement marking plan sheet on the Miscellaneous Quantities plan sheet under the heading “Permanent Pavement Markings”.

Again, close coordination with the Design Division – Pavement Markings Unit is needed to prepare detailed and complete pavement marking plans. The Michigan Manual of Uniform Traffic Control Devices and the current PAVE series of standard plans gives details for pavement markings. Also see Section 7.04 Pavement Markings.

1.02.19 Miscellaneous Plans

(revised 11-28-2011)

Occasionally, a project may require traffic signal plans, municipal utility plans, wetland mitigation plans or other miscellaneous plan sheets. Traffic signal plans are prepared by the Operations Field Services Division - Traffic Signal Unit. Municipal utility plans, such as water mains, street lighting, sanitary sewers, etc. would be prepared by or coordinated through the Utility Section of the Design Division. Wetland mitigation plans are coordinated with the Roadside Development Unit of the Design Division.

1.02.20 Log of Borings

(revised 11-28-2011)

Many construction projects require numerous soil borings, pavement coring, and other geotechnical information. Soil borings and cores are needed for a variety of reasons, including but not limited to:

1. Subgrade information
2. Pavement structure type and depth
3. Foundation (signs, trusses, retaining walls, bridges, etc.) information
4. Proposed sewer, culvert, and other underground utility information
5. Location of water table
6. Signal poles

When there are only a few borings required on a project, they can be shown on the plan or profile sheet where they are located. In most cases, however, separate log of boring sheets should be prepared. These sheets show the number and location of the boring and a sketch which includes the depth and a description of the material encountered. The Design Division’s Guidelines for Plan Preparation have a sample soil boring sheet which is a good reference when preparing log of borings plan sheets.

Information that needs to be supplied along with the Borings are: date the boring was taken, who performed the boring, and the level of the water table (or "dry").

Construction Field Services Division and the Region/TSC Soils Engineer will analyze the boring information and make recommendations regarding pavement structure, subbase requirements, subgrade undercutting, foundation recommendations, sewer and culvert trench undercutting, bedding, dewatering needs, and other special treatments.

1.02.21 Special Details

(revised 10-22-2012)

Special Detail plan sheets are used to show project specific items and details not covered by the standard plans. They are located in a folder in ProjectWise for MDOT internal access. These details are typically draft versions of new or revised standard plans awaiting final approval. These special detail sheets should be included in the final set of construction plans.

Modified Special Detail sheets may also be prepared by the designer to show other necessary details not covered by a standard plan or special detail provided by the Standards Unit. These may include gore details, guardrail installations, surfacing details and transitions, modifications of standard items, drainage details and so forth. See Section 1.02.02B for more information.

1.03 MISCELLANEOUS

1.03.01 Order of Plan Sheets

(revised 10-17-2016)

Plans should be assembled in the following order:

- Title
- Project Information
- Legend
- ROW Vicinity/Drainage Map
- Note
- Miscellaneous Quantities
- Typical Cross Sections
- Miscellaneous Details
- Survey Information
- Alignment
- Removal, Construction, Drainage & Profile
- Water Main & Sanitary Sewer
- Maintaining Traffic/Construction Staging Plans
- Detail Grades
- Culvert Plans
- Detention Basin Details
- Wetland Mitigation Plans
- Rest Area/Landscape Plans
- Permanent Signing Plans
- Pavement Marking Plans
- Lighting Plans
- ITS Plans
- Signal Plans
- Log of Borings
- Special Details
- Bridge Plans

Removal, construction, drainage if needed, and profile sheets should be arranged in this order according to station limits.

Only the sheets included in a set of plans should appear in the index of the title sheet.

1.03.02 Plan Preparation Conventions

(revised 3-16-2015)

1.03.02A Drafting

See the Sample Plans for examples of drafting conventions, symbols, line weights, etc. to use in preparing plans.

1.03.02B File Naming Conventions

1.03.12B1. Plan and Proposal Milestones

See Chapter 3 of Design Submittal Requirements.

1.03.12B2. Reference Information Documents

See Section 14.65 and Design Submittal Requirements.

1.03.03 Contract Time Determination (CTD)

(revised 1-25-2021)

Refer to the Department's Construction Scheduling website.

1.03.04 Roadway Cross Sections

(revised 10-22-2012)

Roadway cross sections are very valuable to the designer. They are one of the main items used to design the project. Cross sections are used by the designer to visualize what the roadway will look like in the field.

Roadway cross sections show the existing roadway conditions. They are used to determine earthwork, draw slope stake lines, determine right of way needs, fit proposed to existing, determine driveway and crossroad grades, determine clearing and removal limits, determine drainage requirements, set front and back slopes, and determine much more information needed to design the project.

Cross sections should be plotted for all projects with grade and slope changes. Exaggerated cross sections can be very helpful in setting curb grades on urban projects.

The roadway cross sections are not included in the plans but should be sent to the project engineer before the project is under construction. The sections can be very informative to the construction personnel and, many times, help to explain the design shown on the plans.

1.03.05 Design File Sharing

(added 1-29-2024)

As part of the plan development process, the Department may be solicited to provide design files to outside entities before the design has been completed. These may be requested from utility companies in response to the Request for Utility Information (refer to Section 14.16), coordination with outside entities who desire to participate on the project, or others.

If files are requested because of necessary coordination with a Department project, a separate data-sharing agreement is not required. However, because shared files may not be reflective of the final design and are not the official reference information documents (refer to Section 14.65), it is important to disclaim for any reviewers that the design illustrated on the shared files is subject to change.

Before any files are shared, the Department must receive a signed copy of the "Design File Sharing Disclaimer" from the recipient. A template has been created to facilitate this transaction in OneSpan. A signed version of this document must be placed in ProjectWise in the Pre-Construction -> Correspondence folder. Please contact the Engineer of Road Design in the Design Division for additional details.

1.04 LOG PROJECTS

1.04.01 Preparing a Log Project

(revised 6-17-2013)

Most designs for construction projects will be prepared using full size plan sheets. Occasionally a project may be very straightforward and uncomplicated. In such cases, the design can be completed with sketches and a written narrative. Such a design is called a "Log Project".

In a log project the title sheet, typical cross sections, and details are prepared on 8½ x 11” sheets. The work plan (log of project), including pay items, is written in narrative form describing what and where construction operations will occur.

Locations are referenced by station which is often obtained by a distance measuring device or from old plans, rather than an accurate survey. Existing right of way maps, reduced to 8½ x 11” are sometimes included in the log.

Log projects provide a simple design when specific detail or accuracy is not required. Because of the complexity and the need for detail in most major road design projects, the use of log plans are not very common. In general, projects with estimated construction cost exceeding $2.5 million should be prepared using full size plan sheets.

Log projects include much of the same information that is in a normal plan project, including utilities, standard notes, applicable standard plans and special details, typical cross sections, maintaining traffic details, staging, pavement markings, signing, and so forth. All project detail sheets and the descriptive write-up are prepared on 8½ x 11” sheets and should be included with the supplemental specifications, special provisions, and other bid documents in the proposal format.

The sheets for log projects should be assembled in the same general order listed for plan sheet projects as they apply for the log project (see Section 1.03.01). If a sheet index is listed, it should be listed on a separate sheet following the title sheet. Generally the log of project write up precedes the typical cross sections. However the reverse may apply as necessary to provide a logical sequencing of information.

Log projects are required to include Pay Items for Monument Preservation, Monument Preservation Vertical, Monument Box, Protect Corners, and Monument Box Adjust.

1.04.02 Earth Disturbances

(added 10-20-2008)

Information related to soil erosion and sedimentation controls for an earth disturbance, which is normally included in a full size set of plans, is sometimes also required in a log project. An earth disturbance is a human-made change in the natural cover or topography of land, including cut and fill activities, which may result in or contribute to soil erosion and subsequent sedimentation of the waters of the state. Earth disturbances in log projects, which contain work items such as culvert extensions or shoulder widening within the Right-of-Way or within the limits of a grading permit, will require inclusion of SESC measures.

If an earth disturbance occurs within 500 feet of a lake or stream, or is one acre or greater in area, the following twelve elements are required to be included in the log documents. These elements constitute an earth change plan as outlined in R 323.1703 of the State Administrative Rules (Part 17).

7. A scaled drawing of the work site
8. Township, Range & Section
9. A site location sketch
10. Proximity to lakes and streams (Distance and direction to)
11. Predominant land features (USGS description)
12. A slope description (Typicals or copy of contour maps)
13. General soil types (Borings not required, just description of general soil types.)
14. Limits of earth change (Using slope stake lines and ROW lines)
15. Drainage features or dewatering operations (Culverts, sewers or water diversions)
16. Timing and sequence of earth change (Reference to Construction Progress Schedule)
17. Description and location of SESC measures (Show key numbers in the log)
18. Maintenance plan for SESC measures (See SESC Manual for maintenance of key items.)

Preferably, SESC measures should be included in the proposal using key numbers from the SESC Manual. Otherwise, plan notes can be used. If a ditching operation utilizes a project log, language in the proposal should refer to the Maintenance Division's guidance document for this item of work (#1230), a copy of which is also included in the latest SESC manual.

Refer to Section 2.05 for detailed information on including SESC measures on plans. Contact your environmental coordinator or region resource specialist if you have any additional questions regarding earth disturbances and earth change plans.

MICHIGAN DESIGN MANUAL
ROAD DESIGN

CHAPTER 2 • GRADES & EARTHWORK

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CHAPTER 2 • GRADES & EARTHWORK

2.01 REFERENCES

(revised 11-28-2022)

A. A Policy on Geometric Design of Highways and Streets, AASHTO, 2018 7th Edition

B. Roadside Design Guide, AASHTO, Current Edition

C. Standard Plan R-96-Series, Soil Erosion & Sedimentation Control Measures

D. Standard Plan R-100-Series, Seeding and Tree Planting

E. Standard Plan R-103-Series, Treatment of Peat Marshes

F. Standard Plan R-105-Series, Grading Cross Sections

G. Standard Plan R-107-Series, Superelevation and Pavement Crowns

H. Guidelines for Plan Preparation – Design Division

I. Geotechnical Manual, MDOT, Current Edition

2.02 VERTICAL ALIGNMENT – GENERAL

(revised 11-28-2011)

Vertical alignment establishes the profile gradeline of a proposed road construction project. The grade can be over virgin land as in the case of a relocation project or along an existing roadway, as in the case of a resurfacing project. In either case and in most proposed construction projects, a gradeline should be established.

Obviously a gradeline must always be established for new construction or relocation projects. Most reconstruction and rehabilitation projects will require new gradelines if improvements for sight distance, superelevation, and drainage are included. A simple resurfacing project can usually be constructed without establishing a new vertical alignment.

Establishing the vertical alignment is based on many factors, including terrain, existing conditions, soils, drainage, coordination with the horizontal alignment, location of bridges, culverts, crossroads, design speed, earthwork balance, etc. The Designer must work with other Divisions, mainly Construction Field Services Division and Traffic and Safety to provide the best possible vertical alignment. The final product should be safe, functional, aesthetically pleasing, and economical.

2.02.01 Grades

(revised 11-28-2011)

Terrain in Michigan is mostly level with some areas of rolling topography. Therefore, the Designer can usually achieve good vertical alignment, especially on new and reconstruction projects. Grades can be kept relatively flat with long vertical curves for long sight distances. In rolling terrain, more care is needed in establishing the vertical alignment.

Maximum grades depend on the functional classification of the roadway, location (urban or rural), design speed, terrain, and the scope of the construction project. MDOT generally uses a maximum grade of 3% for freeways and major trunklines and 4% for secondary and county roads. Steeper grades within AASHTO limits may be used when warranted.

Minimum grades depend more on drainage than on other factors. Uncurbed roads with ditch drainage can have a level longitudinal grade if the crown adequately drains the pavement. Independent ditches should be used when the grade is less than 0.3%. A desirable minimum is typically 0.5%, but grades of 0.3% may be used for paved roadways. See Section 3.03.02D.

If the grade is very flat, independent gutter grades may be necessary. (See Chapter 6 - Surfacing, Section 6.06 - Curb and Gutter.)

Gradelines for new construction are established by a series of tangents connected at their intersections (P.I.'s). The gradeline may be above or below the existing ground line depending on the type of soil, location of the water table, existing or proposed features such as bridges, crossroads, etc., and many other factors. The Region Soils Engineer can be helpful in establishing a new gradeline.

The series of tangent gradelines are smoothed out and refined by the use of parabolic vertical curves.

2.02.02 Deleted

Section deleted. Information incorporated into Chapter 3.

2.02.03 Principles and Procedures for Gradelines

(revised 8-26-2019)

2.02.03A General

The profile gradeline of a roadway construction project has a major impact on the facility's cost, aesthetics, safety and operation. The Designer must evaluate many factors when establishing the profile gradeline. These factors include but are not limited to:

1. Maximum and minimum grades.
2. Stopping, passing, decision, and intersection sight distance.
3. Earthwork balance.
4. Terrain, topography, and soil classification.
5. Bridges and culverts.
6. Railroad crossings.
7. Highway intersections and interchanges.
8. Highway safety.
9. Aesthetics, erosion control, and landscaping.
10. Snow and ice.

11. Coordination with other geometric features (horizontal alignment, design speed, etc.)
12. Utilities.
13. Drainage and water levels.
14. Highway location and classification.
15. Construction costs.
16. Airports.
17. Driver's View.
18. Presence of or future plans for bicycle or pedestrian infrastructure.

2.02.03B Earthwork Balance

When possible and without sacrificing safety and sight distance factors, the gradeline should be set to achieve an earthwork balance. Elimination of large quantities of borrow or excess excavation will help to keep costs down and lead to an economic design.

Mass diagrams, which illustrate the accumulated algebraic sum of excavation and embankment volume, were historically used in balancing earthwork. Current methods of payment have generally replaced the need for mass diagrams.

2.02.03C Bridges

Gradelines must be set to meet existing bridges and to provide adequate vertical clearance when going over or under existing highways, railroads, power lines or waterways.

Close coordination with Bridge Design is important when setting grades involving existing or proposed bridges. See Section 7.01.08 of the Bridge Design Manual for bridge underclearance requirements. When a facility will cross water, the underclearance and the waterway opening become important concerns. Coordination with MDOT Bureau of Planning and the Michigan Department of Environment, Great Lakes, and Energy (EGLE) may also be necessary.

2.02.03D Drainage

Grades should be set to provide adequate cover over culverts and to have minimum freeboard above the headwater levels at culverts, underdrain outlets and bridges. (See Chapter 4 - Drainage and the MDOT Drainage Manual.)

Drainage is also a concern when designing sag vertical curves, when flat grades are necessary and when vertical curves are on a bridge deck or under a bridge. To improve drainage on bridge decks, the high point of the vertical curve should be moved off the bridge deck, if possible. Similarly, the low point of a vertical curve under a bridge should be moved outside the shadow of the bridge, if possible.

2.02.03E Soils

Soils have a major impact on the location of a gradeline. Granular well drained soils can have the gradeline located anywhere, while poorly drained loamy soils may require a grade at least 4 ft.-0 in. above ground level. The Soils Manual and Construction Field Services Division can be used for guidance for establishing grade through the different soil classifications.

2.02.03F Erosion Control

Erosion controls will be necessary on any construction project, however careful planning in establishing a grade can minimize erosion effects. Some considerations follow:

1. Avoid steep longitudinal grades.
2. Avoid steep side slopes.
3. Minimize disturbed areas.
4. Make use of existing vegetation.
5. Conform to the existing contours and drainage of the area.

Refer to Section 2.05 for detailed information on this topic.

2.02.03G Airports

Grades need to be established that will not interfere with the glide paths for runways. The glide paths are obtained from the Aeronautics Division or Federal Aviation Administration.

2.02.03H Water Table

Areas with high water table may require review with the Region Soils/Material Engineer to determine the appropriate grade lines. In many soil series, the water table varies with the seasons and information relating to how the depth of water table may affect the roadway and structures should be collected and analyzed.

2.02.03I Multi-Modal

Grade should be a consideration in areas where multi-modal facilities are existing or planned. For example, larger grades are undesirable because ascents are difficult for some multi-modal users and descents can cause increases in speed that the user is either uncomfortable with or unable to manage safely. See Section 12.12.09 for grade limitations for shared use paths.

2.03 TYPICAL CROSS SECTIONS

(revised 8-26-2019)

A typical cross section shows, in elevation view, what is to be constructed. The proposed typical section can be superimposed on an existing road cross section as in the case of a resurfacing or widening project or be entirely new as in the case of a new or relocated roadway. Typical cross sections show all details of the proposed roadway including lane width (including bike lanes), shoulders, slopes, ditches, curb and gutters, sidewalks or pathways, subbase, and pavement. Typical cross sections are important and necessary for determining earthwork quantities. Some examples are shown in the Guidelines for Plan Preparation. Also, all the above design elements should meet AASHTO safety requirements.

2.03.01 Slopes

(revised 5-26-2026)

Slopes are measured as a ratio of vertical distance to horizontal distance, a *1:4 slope indicates 1 foot vertical drop in every 4 feet horizontally*. Slopes should be as flat as practical for existing conditions and type of roadway. 1:6 slopes are desirable for foreslopes or fill slopes for new trunkline construction. Slopes 1:3 or flatter are considered traversable if there are no other obstructions within the clear zone. See Section 7.01.30 for barrier warrants at embankments.

The following general criteria should be used for foreslopes, based on the fill height:

- Freeways and free access roads where Right-of-Way is adequate
    - Less than 10 ft. use 1:6 slope
    - 10 ft. to 25 ft. use 1:4 slope
    - Over 25 ft. use 1:2 slope
- Roadways where Right-of-Way is limited
    - Less than 10 ft. use 1:6 to 34 ft. from the edge of the through lane, then 1:3 slope
    - 10 ft. to 20 ft. use 1:4 slope
    - Over 20 ft. use 1:2 slope

In situations where ditch backslopes are involved and slopes must be steepened, for instance, to stay within the proposed or existing ROW, the ditch backslope should be steepened in preference to steepening the foreslope.

- The preferable traversable ditch cross sections are:
    - 1:6 foreslope use 1:3 backslope
    - 1:5 foreslope use 1:3.5 backslope
    - 1:4 foreslope use 1:4 backslope

Other combinations are less desirable and their use should be limited where high angle encroachments are expected, such as at the outside of curves. However, it is understood that in certain situations (high fills, deep cuts, limited ROW, physical obstructions, etc.) the use of 1:2 slopes may be necessary.

2.03.01A Fill Slopes

Fill slopes start at the shoulder point and go to existing ground. As fill heights increase, economy may dictate the need for steeper slopes. The Designer should attempt to minimize the use of slopes requiring guardrail or other barrier protection. A non-recoverable slope is defined as one which is traversable but from which most motorists will be unable to stop or return to the roadway. Vehicles on such slopes typically can be expected to reach the bottom, and generally slopes between 1:3 and 1:4 fall into this category. Fixed obstacles will normally not be constructed along such slopes and a clear runout area at the base is desirable.

2.03.01B Cut Slopes

Cut slopes can be foreslopes (from the shoulder point down to a ditch) or backslopes (from the ditch or a no ditch section up to existing ground.) Usually, cut foreslopes should be 1:4 or flatter. Backslopes should be as flat as right-of-way and existing conditions allow.

2.03.01C Barn Roof Section

Barn roof grading sections can be used under certain conditions to provide a section in high fills that provides the required clear recovery area and will not require guardrail or other protective barrier. Standard Plan R-105-Series shows the barn roof section. The section changes slope, i.e., flatter to steeper, beyond the normal clear zone. However, slopes steeper than 1:3 should not be used.

Barn roof sections are not appropriate in the following situations:

1. A crossroad over a freeway where guardrail is required at the structure.
2. Inside an interchange area where there is sufficient right-of-way to design using 1:4 slopes or flatter.
3. Locations where no runout area can be developed at the toe of slope, such as locations with large drainage ditches.

2.03.02 Drainage

(revised 8-26-2019)

Drainage is an important consideration in any highway construction project. Proposed drainage affects the establishment of the gradeline and the development of the typical cross section. Drainage is generally open drainage, using ditches and overland flow; closed drainage, using curb and gutter and enclosed sewers; or some combination of the two. For a complete discussion on drainage, refer to Chapter 4 - Drainage and the MDOT Drainage Manual.

2.03.02A Shoulder and Ditch Sections

Shoulder and ditch sections are the norm for open drainage projects. Storm water flows off the pavement, across the shoulder and foreslope, and into the ditch section. The ditch carries the water to a natural outlet. Ditch types include round bottom, valley, berm, toe of slope, “V” ditch and no ditch section. These are all shown on Standard Plan R-105-Series. The ditch section is often influenced by the location of the project, i.e., heavy snow areas would warrant a wider ditch section.

2.03.02B Curbed Sections

Curbed sections are most often used in urban situations. They may also be used when right-of-way is limited, where sidewalk or side paths may be present or planned, or in high fills where the curb is used for erosion control. Curbed sections generally drain to an enclosed sewer but sometimes outlet to a downspout or spillway.

Curbed sections are also used for roadside control and at intersections.

2.04 EARTHWORK - GENERAL

(revised 12-28-2020)

Earthwork is the term used to describe operations used in constructing the grading cross section for the proposed roadway. Earthwork has two main components, excavated (cut) and embankment (fill) material. Excavated materials, if suitable, can be moved and used to construct embankments. If on a project, excavated material is not sufficient to construct embankments, additional material or borrow must be brought in. Borrow material and sources are typically the responsibility of the contractor.

Granular materials, used for subbase and swamp backfill, must meet specifications and sources may not be readily available close to the project site. Topsoil is scarce in some areas and material for topsoil surface may have to be transported long distances to the project.

Excavation and embankment quantities are estimated electronically or manually as follows:

Electronically: Prismoidal Method

1. Use design software to model existing materials that are being removed and proposed design elements.
2. Use design software to extract prismoidal meshes between the existing ground Digital Terrain Model (DTM) and the modeled elements.

Electronically: End Area Volumes

1. Extract the existing ground cross sections from survey or photogrammetry Digital Terrain Models (DTM's) at suitable intervals.
2. Use design software to compute the proposed (design) cross sections. Modify them if necessary in special areas.
3. Use design software to compute the areas of cut and fill at each section and the resulting volumes (using the average end area method.)

Manually: End Area Volumes

1. Obtain the existing cross section from a manual survey or by extracting them from a DTM using design software.
2. Plot the original ground and proposed cross sections manually using MicroStation, automated using design software, or a combination of both.
3. Use design software to calculate end areas at each cross section.
4. Using the average end area method, calculate the desired volumes of cut and fill, utilizing spreadsheet software.
5. Sum the cut volumes and the fill volumes for the entire project or the specific project locations.

Some areas require special care in plotting sections. For example, ramp intersections with mainline (gore areas) need to have match lines to avoid double estimating of the overlapping cuts or fills. Alternately, export the mainline proposed cross section to the DTM, and create a composite of the proposed mainline and existing ground. Then, extract cross sections from the composite DTM surface, therefore taking into account the proposed mainline roadway.

2.04.01 Excavation

(revised 6-22-2026)

Excavation can be in other forms than regular roadway excavation. Following is a brief description of some of these special or project specific items.

2.04.01A Station Grading

This item is often used on projects where normal earthwork items are not practical, or when recommended by Region Construction.

Station grading is typically paid for by station and requires a special provision. The Designer should include an estimate of excavation and embankment requirements for the Contractor's information for bidding purposes.

2.04.01B Trenching

This item is used when a uniform section is to be excavated such as for a widening or reconstructing a shoulder. The excavation is typically a uniform width and depth.

Trenching is a standard specification pay item and because of uniformity an excavation quantity does not need to be estimated.

2.04.01C Topsoil Stripping

Topsoil removal shall be as follows:

- Peat and Muck Areas - Topsoil shall not be removed.
- Borrow and Clear Vision Areas - Topsoil shall be removed to the required depth and width. Topsoil may be stockpiled near its original location, unless otherwise specified.
- Roadway Cut Areas - Topsoil shall be removed within the slope stake lines.
- Roadway Embankment Areas - Topsoil shall be removed within the slope stake lines, unless otherwise specified.

Topsoil from the roadway shall be stockpiled within the right-of-way and outside the limits of construction or used in the slopes as specified. Temporary stockpiling of topsoil may be permitted on private property with the proper permits from the owner and as approved.

Topsoil Stripping in both cut and fill sections is paid for as earth excavation. The quantity is included in the earth excavation total, but is also presented separately for estimating purposes. Depth of stripping is determined by information from the Region Soils Engineer. It is shown on the plans as follows:

- Excavation, Earth [insert number] Cyd
- Embankment, CIP [insert number] Cyd

* Includes [insert number] Cyd of Topsoil Stripping

Designers are reminded that in fill areas, the volume removed by topsoil stripping, leaves a void that will require an equal additional volume of embankment to replace it. While the topsoil stripping in the fill section is added to the excavation quantities, an equal volume must also be added to the estimated quantity for embankment. Failure to account for this additional volume in fill areas can result in significant shortages for projects involving significant earthwork.

2.04.01D Rock Excavation

This item is fairly rare in Michigan, but when rock is encountered, the designer should contact the Region Soils Engineer to discuss options and decide the necessity for contacting the Geotechnical Services Unit of Construction Field Services Division to order rock cores to define the type and hardness of rock. This will give the contractor direction as to the appropriate method of excavation to be used (blasting, ripping, etc.). If cores are taken it is required that the rock core information be included on the soil boring plan sheets. A plan note should also be included on the soil boring plan sheet inviting the contractor to inspect the cores prior to bidding.

The standard pay item is “Excavation, Rock”.

2.04.01E Peat Excavation

Plans must show the limits and depth of peat areas and the method of treatment. Treatment methods are shown on Standard Plan R-103-Series. “Excavation, Peat” is a standard pay item.

Disposal of the excavated peat material is as specified in the current edition of the Standard Specifications for Construction, or disposal areas can be shown on plans.

Federal Executive Order 11990 for "Protection of Wetlands", May 24, 1977, and US DOT Implementing Internal Order 5660.1A for "Preservation of Wetlands", September 29, 1978, both stipulate that "...the proposed action includes all practical measures to minimize harm to wetlands which may result from such construction." FHWA interprets this to mean that, muck should not be stored permanently beyond the plan fill slope in wetlands.

The Department has revised Standard Plan R-103-Series to eliminate reference to permanent wasting of muck beyond the plan fill slope. This means that, usually, the excess material must be hauled to an upland waste site.

While FHWA has taken a firm stance in opposing the wasting of muck outside of plan fill slopes across wetland, Design must reach agreement with FHWA as to how each individual wetland area will be treated on a project. FHWA recognizes that there occasionally will be extenuating circumstances that could cause them to selectively relax their rigid adherence to their Wetland Policy.

The following is taken in part from a FHWA Lansing Office letter of January 4, 1984 to the Department.

In accordance with Executive Order 11990, new construction located in wetlands shall be avoided unless there is no practicable alternative to the construction and the proposed action includes all practicable measures to minimize harm to wetlands which may result from such construction. Practical measures to minimize harm include avoiding the permanent or temporary storage of muck in wetlands wherever possible. Some guidelines to further define this issue might be:

1. Permanent storage of excavated muck in wetlands or in the 100-year floodplain will not be allowed except in very extreme circumstances. Even then, the use of these areas will require FHWA approval and acquiring the required EGLE and Corps of Engineers permits.
2. The temporary or permanent storage of dry muck in wetlands should not be necessary.
3. The temporary storage of wet muck in a wetland may, at times, be justified for such time as is necessary to dry out prior to final shaping of the slope and/or hauling to an approved upland disposal area.
4. In our opinion, the temporary disposal areas in wetlands, from most desirable to least desirable, are:
    a. Between the one-on-one slope and the plan slope (also acceptable for permanent storage in fills less than 13 ft.-0 in. in height).
    b. In the median area (for dual lane roadway projects).
    c. On the side of the roadway where the remaining muck is the shallowest or the remainder of the wetland is the smallest.
    d. Adjacent area outside the highway Right-of-Way.

FHWA will permit permanent storage of waste muck, outside the plan fill slope, in an upland site without specific approval. An "upland" site is not to be interpreted as "offsite", i.e., another wetland area off the project.

FHWA appears to not favor temporary storage in a wetland area. They must specifically approve it and approve the limits at the same time as giving other wetland permissions.

The FHWA wetland review during the design stage must occur prior to submitting applications for EGLE and Corps of Engineers permits. FHWA may deny any extra use of a wetland even if a project has received EGLE and U.S. Fish and Wildlife Service approval, in an earlier environmental clearance, to use the wetland.

Wetlands are defined in Executive Order 11990 as "those areas that are inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, natural depressions, wet meadows, river overflows, mud flats, and natural ponds.

No localized slope change will be permitted, to circumvent this federal edict, by showing a flatter plan fill slope than shown on the typical cross-section.

The plans should show estimated quantities of peat, marl, and soft clay, for each swamp area, that are to be hauled to upland disposal sites.

2.04.01F Subgrade Undercutting

This item is used to remove unsuitable and unstable soils and soils susceptible to frost action before constructing the final section. Subgrade undercut areas are backfilled with undercut excavated material, sound earth, or granular material depending on the type of undercut. Backfilling is included in the item "Subgrade Undercutting, Type [Insert Type]." The type of subgrade undercutting depends on the backfill. (Type I is backfilled with selected clay or other approved material; Type II is backfilled with granular material; Type III is backfilled with reworked material from subgrade undercut areas or other approved material and Type IV is backfilled with dense-graded aggregate or open-graded aggregate encapsulated with a geotextile separator.) The Region Soils Engineer will generally provide subgrade undercut quantities.

2.04.02 Embankment

(revised 12-27-2022)

2.04.02A Regular Embankment

Regular Embankment is sound earth obtained from either roadway excavation or from borrow areas. Embankment is generally paid for as embankment compacted in place, therefore no shrinkage factor is applied to the volume.

2.04.02B Granular Embankments and Backfill

Granular materials are used as backfill in swamps and subgrade undercut areas. If granular material is plentiful from the roadway excavation, it can also be used as regular embankment.

Granular material used to backfill swamp excavation is paid for as ”Backfill, Swamp” and is generally measured in its original position. When granular material is used to backfill subgrade undercut areas it is not paid for separately.

2.04.02C Subbase

Subbases are constructed of granular material between the subgrade (constructed of regular embankment) and the pavement structure. The subbase layer provides structural support and good drainage beneath the pavement.

Payment can be either “Subbase, LM” (loose measure) or “Subbase, CIP” (compacted in place).

2.04.02D Topsoil Surface

There are two basic topsoil pay items: “Topsoil Surface, Furn” and “Topsoil Surface, Salv”.

The Designer should confer with the Region Soils Engineer to get a recommendation for topsoil. Other topsoil resource people are the Region Resource Specialist and the Roadside Development Unit.

Generally the quality of topsoil within the right of way is very poor on existing highways and it should not be recycled as topsoil. Nearly all resurfacing, rubblizing, safety and guardrail upgrading, lane widening as well as other types of upgrading work have unacceptable roadside topsoil for salvaging. On these types of projects “Topsoil Surface, Furn” should be used. Occasionally some salvaged topsoils may be acceptable but in insufficient quantity.

More than enough good quality salvaged topsoil is usually available on all new construction projects (new highway routes). Use the pay item “Topsoil Surface, Salv” on such projects. Excess topsoil can be used in fill slopes as shown on the plans or as directed by the Engineer.

Topsoil material is spread on exposed slopes that are to be seeded. “Topsoil Surface, Furn” or “Topsoil, Surface, Salv” should be estimated at a specific uniform depth but not less than 4". When topsoil is obtained from stockpiled topsoil or from any other source, the topsoil items include loading, hauling and placing the topsoil on site.

2.04.02E Adding Embankment to Existing Slopes (Widening Projects)

Widening projects often require placing embankment on an existing slope. If the existing slope is quite high and/or steep (1:6 or steeper), the Contractor must step the existing slope. Refer to Standard Plan R-105-Series.

2.05 EROSION & SEDIMENTATION CONTROL - GENERAL

(revised 4-22-2019)

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) has designated MDOT an Authorized Public Agency (APA) under the authority of Act 451 of 1994, the Natural Resources and Environmental Protection Act.

EGLE regulates soil erosion and sedimentation control in Michigan under Part 91, *Soil Erosion and Sedimentation Control (SESC)* and Part 31, *Water Resources Protection*, of Act 451. These two programs are linked by way of state administrative rule 323.2190 (Rule 2190), promulgated under Part 31. Rule 2190 allows an APA to obtain storm water coverage without obtaining SESC permits.

As an APA, MDOT has established procedures to address SESC as required by Part 91. The procedures consist of a commitment to follow the department's design and construction manuals, standard plans, standard specifications, and project specific requirements shown in the plans and contract documents. This commitment is embodied in the MDOT Soil Erosion and Sedimentation Control Manual. Every designer needs to be familiar with the information contained in the SESC Manual.

The APA designation allows MDOT to undertake earth change activities without obtaining individual soil erosion and sedimentation control (SESC) permits. The APA designation carries with it an obligation to self-regulate efforts to remain in compliance with established procedures. Failure to remain in compliance will jeopardize MDOT's APA status.

Without APA status, an individual SESC permit would be required from the county or municipal enforcing agency whenever a project meets one or both of the following criteria.

- The project disturbs one or more acres.
- The disturbance, regardless of size, is within 500 feet of a lake or stream.

At a minimum, the plans must include enough information to satisfy the requirements of state administrative rule 323.1703 (Rule 1703). Many of these elements are present in any set of MDOT plans and no additional detail is necessary. The remaining elements, shown in italics below, are included in the contract documents by virtue of reference to the Standard Specifications for Construction and the SESC Manual. The twelve elements of a SESC plan are:

- Scaled Drawing
- Legal Description
- Site Location Sketch
- Proximity to Lakes and Streams
- Predominant Land Features
- Contour Interval or Slope Descriptions
- Description of Soil Types
- Physical Limits of Earth Change
- Drainage and/or Dewatering Features
- *Timing and Sequence of Earth Change*
- Description and Location of SESC Measures
- *Maintenance Plan for SESC Measures*

The inherent erosion potential of any area is determined by four interrelated principal factors: soil characteristics, climate, vegetative cover, and topography. In addition to these principal factors, the designer must also consider sensitive areas such as lakes, streams, or wetlands; vegetation to be retained; areas not to be used for materials or equipment storage; and critical areas such as highly erosive soils or slopes.

Due to the site specific nature of these factors, the region Soils/Material Engineer (or other designated region staff) is responsible for recommending quantities and locations for SESC measures. However, it is the designer's responsibility to seek this input early in the plan development process and incorporate the information into the project plans prior to requesting plan reviews by others. The goal is to include adequate pay items and quantities on the plans to allow the contractor, working with the construction staff, to minimize soil erosion and prevent the loss of sediment off the right-of-way or into the waters of the state.

Every designer must have a current SESC training certificate. In addition to the knowledge gained through the EGLE training, there are many sources of information available within the Department to help the designer during plan development. Designers should become familiar with and use each of these sources:

- Section 4.03.04 of this manual provides information on drainage design considerations to provide for post construction management of storm water.
- SESC Manual - Each of thirty seven standard controls is detailed in an Erosion & Sedimentation Control Detail (E&S) sheet in the SESC Manual. These E&S Details include information on the appropriate use, construction details, measurement and payment, and maintenance considerations.
- Standard Plan, R 96 Series, "Soil Erosion & Sedimentation Control Measures," summarizes all of the specific controls available to the designer for inclusion on the plans to minimize erosion and control sedimentation during construction.
- Drainage Manual - The Drainage Manual addresses all aspects of roadway drainage including temporary and permanent measures to minimize erosion and control sedimentation.
    - Section 4.4.3.2.3 Erosion Control in Ditches includes guidelines for permanent stabilization treatments for various ditch grades
    - Chapter 9 Stormwater Best Management Practices (BMPs) covers all aspects of designing for storm water management including a comprehensive discussion of the factors the designer must consider when evaluating the erosion potential at a site and the selection of SESC measures.
    - Table 9.1 lists the approved BMPs available to the designer to manage stormwater flows both during and after construction.
- Technical Training - All new design staff are encouraged to take the NHI Course "Design and Implementation of Erosion & Sedimentation Control." This two day class covers a range of topics related to the design and application of soil erosion and sedimentation controls on transportation projects. Contact the technical training coordinators at Construction Field Services Division to see when the course is available.

- MDOT Staff - Expert advice is available from region staff including the soils and drainage engineers, resource analyst, and environmental permit coordinator; and from Lansing staff in the Design Hydraulics Unit and Construction Field Services Division, Geotechnical Services Section.

2.05.01 General SESC Concepts

(revised 10-20-2008)

MDOT's SESC procedures require that the Department set up, install, and maintain adequate SESC measures to prevent sediment from entering the waters of the state or from leaving MDOT right of way. Temporary measures must be properly maintained until the disturbed areas can be permanently stabilized. Some SESC measures function as temporary controls and remain in place to ensure permanent stabilization of the area.

Three general principles guide the establishment of SESC measures:

- Preventing erosion is more effective than controlling sediment
- Controlling sediment is more cost effective than repairing damage caused by loss of sediment
- Specific control measures may be more effective than generalized procedures

2.05.01A Protect Exposed Soils

Protecting exposed soil will help minimize the amount that can be detached and transported as sediment. Calling for time or spatial limits on the exposed area is especially necessary adjacent to sensitive areas in order to minimize the potential for harmful impacts.

2.05.01B Manage Runoff

Runoff management tools are designed to utilize proper grading, diversions, barriers or intercepting ditches to minimize concentrated flows and divert runoff away from sensitive or critical areas during construction. This can be done by minimizing slope steepness and length by the use of benches and interceptor ditches. The concept is to divert clean runoff before it becomes sediment laden.

2.05.01C Minimize Concentrated Flows

Concentrated flows generate more energy and velocity than sheet flows. Greater depth and velocity can potentially generate more erosion and suspension of eroded materials. If concentrated flows develop, control measures such as check dams can be used to reduce the velocity. Level spreaders can be used to reestablish sheet flows. A level spreader is any control measure that disperses the concentrated flow reducing the depth of flow and energy. Level spreaders can also improve the efficiency of other measures such as vegetated swales, filter strips, or infiltration measures that are dependent on sheet flow to operate efficiently.

2.05.01D Reduce Velocity

Velocity reduction is a key component of many temporary and permanent SESC measures. Control measures such as check dams are placed perpendicular to the direction of flow whether it is concentrated or sheet flow to slow the velocity of the water by creating "speed bumps." The measures must be selected based on the anticipated depth and velocity of flows over the disturbed soils.

2.05.01E Capture Sediment

Effective sediment control measures are designed and implemented to slow the runoff velocity and retain the sediment-laden water to allow soil particles to fall from suspension and settle out of the runoff. This will facilitate transport reduction and thereby reduce the volume of sediment leaving the site.

2.05.02 Plan Preparation

(revised 5-26-2026)

Soil erosion and sedimentation control measures and locations are detailed on the plans for the areas within the limits of earth disturbance. Unless stated otherwise in the contract documents, the limits of earth disturbance will extend ten feet beyond the slope stake line except in areas adjacent to wetlands where the earth disturbance limits will be at the slope stake line. The extra ten feet is allowance for the movement of equipment and materials.

The SESC measures established for the project must provide adequate controls within the entire limits of earth disturbance. Noncontiguous clearing areas must also be considered when setting up SESC measures on the plans.

SESC measures must suit the specific construction project. Each of the following must be considered in preparation for selecting specific measures:

- Specific requirements included in environmental permits
- Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator)
- Extent of earth disturbance on the project
- Soil types in the construction area
- Steepness and length of slopes
- Water resources on and adjacent to the project
- Staging and sequence of the construction activity
- Duration of the project
- Increase in impervious surface area
- Potential equipment egress points

By the preliminary plan review stage, the designer should have completed an analysis of the potential for soil erosion and sedimentation to occur during the construction phase. The soils engineer and others should have been contacted for suggestions. A combination of standard and site specific E&S measures should be incorporated and adequate pay item quantities included giving the contractor and construction staff the tools they will inevitably need to execute the project.

The following discussion is not intended to be all inclusive but rather to get the designer thinking about what must be considered and how they can be mitigated by the careful selection of SESC pay items.

2.05.02A Construction Staging

While the designer often does not know exactly when construction will begin on a project, it is necessary to consider how the progression of the work may impact the need for SESC. Refer to specific environmental permits and clearance documents for any seasonal limitations that may influence the selection and quantities of various SESC measures. In addition to providing a variety of pay items and miscellaneous quantities, it may be beneficial to include plan notes requiring placement of SESC measures prior to starting specific earth disturbing activities within the construction area.

2.05.02B Sensitive Areas

Minimize and clearly mark all clearing limits near sensitive areas on the plan and include quantities of silt fence (E&S-26) or protective fencing to protect sensitive areas and their buffers (E&S-6). Call for retaining existing vegetation in an undisturbed state in these areas to the maximum extent practicable. Call for permanent stabilization and installation of permanent SESC measures in these areas as early in the construction process as feasible.

2.05.02C Construction Related Activity

Consider all construction-related activity, including equipment staging and material storage areas. Call for gravel access approach (E&S-14) to prevent tracking sediment from the construction site. Aggregate cover (E&S-8) can be considered for stabilizing equipment storage areas and access points.

2.05.02D Flow Rates

Design to minimize increases in the volume, velocity, and peak flow rate of stormwater runoff from the site during and after construction in order to protect downstream properties and waterways from erosion. Call for energy dissipators when increased velocity cannot be avoided. Refer to Section 4.03.04 and the Drainage Manual for more information on designing to minimize non-point source pollution.

2.05.02E Sediment Traps and Check Dams

The proper placement and spacing of Sediment Traps (E&S-20) and Check Dams (E&S-37) is essential to SESC. This combination of measures is effective where ditch grades change from a steep to flat grade; when the ditch grade varies significantly over a short distance; and just prior to the point at which the ditch outlets to a watercourse or off of the right-of-way. In ditch cuts in sandy soils, the sediment trap/check dam pairs can be spaced further apart provided that the grades are consistent. In clay soils, the placement of these pairs will depend much more on the depth of ditch cut, length of cut and grade. In flat ditch cuts these pairs can be spaced at up to 500-foot intervals and still remain effective; they may however require more frequent sediment removal.

2.05.02F Temporary Detention

Include plan notes if necessary to require the installation of temporary detention facilities, such as Sediment Basin (E&S-21), Sediment Traps (E&S-20), or Detention Basins, prior to clearing and grading operations. These measures must be sized and located to account for both on-site storm water flow and also sheet flow or additional concentrated flow from off-site. Consider the need for Filter Bag (E&S-18) or Turbidity Curtain (E&S-1) to prevent the loss of sediment when these temporary measures are emptied in preparation for being brought online for permanent use at the end of the construction project.

2.05.02G Dewatering

Dewatering discharges must be controlled to protect downstream properties. When routing non-stormwater discharges the flow rate must be controlled to minimize scouring and flushing of sediment trapped in the system. Call for Filter Bag (E&S-18), Gravel Filter Berm (E&S-13), or Turbidity Curtain (E&S-1) to prevent the loss of sediment during this operation.

2.05.02H Soil Stabilization

Select soil stabilization measures to be appropriate for the time of year, site conditions, and estimated duration of use. Include a variety of temporary SESC pay items on the plans for specific locations and provide miscellaneous quantities for use as needed throughout the construction phase. Refer to Section 2.05.05 for a description of the designer's responsibilities regarding turf establishment measures.

2.05.02I Slope Protection

Design cut-and-fill slopes in a manner that will minimize erosion potential by:

- Reducing continuous length and steepness of slopes with terracing and diversions
- Avoiding steep longitudinal grades
- Avoiding steep side slopes
- Minimizing disturbed areas
- Retaining existing vegetation
- Conforming to the existing contours and drainage of the area
- Calling for Slope Roughening and Scarification (E&S-32)

2.05.02J Concentrated Flows

Protect disturbed areas from concentrated flows routed through temporary conveyances, such as Diversion Dike (E&S-10), Intercepting Ditch (E&S-11), Intercepting Ditch and Diversion Dike (E&S-12), or Pipe Drop (E&S-17). Consult the Hydraulics Unit for guidance on sizing the conveyance whenever runoff or groundwater must be intercepted and concentrated.

2.05.02K Riprap

When Riprap (E&S-7) is called for to stabilize a ditch or outlet, consider calling for Silt Fence (E&S-26) or Mulch Blanket (E&S-33) to be placed adjacent to the riprap. The will prevent sediment from adjacent unprotected areas from being deposited in the riprap and being carried into the receiving water or off the Right-of-Way during the next rainfall event.

2.05.02L Inlet Protection

Include inlet protection to protect all in-service storm drain inlets from sediment or construction related pollutants. Take into consideration inlets located down gradient on side streets and cross roads in addition to those on the mainline. Consider the location of the project in terms of soils, anticipated rainfall and urban/rural nature of the area and include adequate quantity of these measures to allow for replacement as they lose their effectiveness due to fine sediment accumulation.

2.05.02M Alterative Controls

New materials are continually being introduced to the construction market as a result of the expansion of the NPDES stormwater program. If a project warrants their use, contact Construction Field Services Division for assistance with the selection of a previously approved special provision or for assistance in preparing a project specific special provision to address a particular need. Refer to Chapter 11 for special provision preparation and approval guidelines.

2.05.03 Hydraulic Design Considerations

(revised 10-20-2008)

While many of the SESC measures typically included on plans require no formal hydraulic design, there are others that call for input from hydraulics, materials, or construction experts across the Department. Hydraulic design considerations are discussed in Chapter 9 of the Drainage Manual and may involve:

- Sizing or spacing for improved effectiveness
- Materials selection
- Dual-use temporary and permanent storm water management

2.05.04 Showing SESC Measures on Plans

(revised 8-18-2014)

Standard Plan R-96-Series shows standard SESC measures and their intended use. They are indicated on the plans by a legend at the location they are to be used. This legend must correspond to Standard Plan R-96-Series, which in turn corresponds to the individual E&S detail sheets in the SESC Manual.

Not all E&S measures are contract items (pay items) in and of themselves. Standard pay items may be required to complete the construction of the E&S measure as is the case with Diversion Dike (E&S-10) where the diversion dike is constructed using the pay item Embankment. Conversely, the E&S measure may require the omission of work as is the case with Vegetative Buffer at Watercourse (E&S-22), which calls for retaining vegetation adjacent to a watercourse.

Many of the E&S measures include optional work that may be included to increase the effectiveness of the measure or to address a specific site condition. The optional work often includes the addition of a sediment trap, check dam or silt fence. Since the need for the optional measures is not known at the time of design, these items of work are often included as miscellaneous quantities on the plans. The designer should always refer to the information on the E&S Detail sheets when placing E&S measures on the plans.

The success of the SESC measures selected during design depends in part on the ability of the contractor to translate the measures indicated by key numbers and notes on the plans to the most effective location and placement in the field. Suggestions on how best to accomplish this include:

- Show inlet protection, sediment traps, and check dams on the profile sheets to more clearly indicate location.
- Include control measures for use during the mobilization, clearing and removal process.
- Call for SESC measures at the break point of ditches.
- Call for intermediate measures within the construction area not just at the right of way line or at the edge of sensitive areas.
- Call for silt fence where it will function as intended - not at the top of backslope.
- Call for silt fence in all four quadrants of cross culvert outlets.
- Include miscellaneous quantities of the pay items such as the following for use as needed:
    - Temporary Seed
    - Silt Fence
    - Gravel Access Approach
    - Sediment Trap
    - Check Dam
    - Inlet Protection
- Identify erosion control measures on the construction sheet with the 'Erosion Control Number' cell. Pay for erosion control items in the main list of 'Quantities This Sheet'. Do not show key number next to pay item. See Road Sample Plans.
- Include plan notes to indicate required sequence of placement of SESC measures to maximize their effectiveness.
- Include an adequate quantity of the pay item "Erosion Control, Maintenance, Sediment Rem".
- Use special provisions for non-standard SESC measures when necessary and show these measures on the plans.
- Clearly identify sensitive areas such as lakes, streams, or wetlands, and include Vegetated Buffer at Watercourse (E&S-22);
- Delineate areas that are not to be used for materials or equipment storage and call for these areas to be clearly identified in the field.
- Clearly identify critical areas such as highly erosive soils or slopes.
- Show key numbers for E&S Details that do not have pay items associated with them such as Slope Roughening and Scarification (E&S-32), when these measures are critical for successful control of erosion and sediment control.

2.05.05 Turf Establishment

(revised 9-17-2012)

For all projects requiring turf establishment contact the Roadside Development Unit of the Design Division for procedures and materials recommendations four weeks before they are needed.

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Appendix 3B National Network – Federally-Designated Routes

CHAPTER 3 • ALIGNMENT AND GEOMETRICS

3.01 REFERENCES

(revised 11-28-2011)

A. A Policy on Design Standards - Interstate System, AASHTO, 2005

B. A Policy on Geometric Design of Highways and Streets, AASHTO, 2018 7th Edition

C. Highway Capacity Manual, 2000, published by Transportation Research Board, National Research Council.

D. Geometric Design Guides - Design Division

E. Michigan Manual on Uniform Traffic Control Devices, Current Edition

F. Roadside Design Guide, AASHTO, 2006

G. Standard Plan R-107-Series, Superelevation and Pavement Crowns

H. MDOT Sight Distance Guidelines

3.02 DEFINITION OF TERMS

(revised 9-22-2025)

Acceleration Lane - An auxiliary lane, including tapers, for the acceleration of vehicles entering another roadway.

Arterial Road – A roadway which provides a high speed, high volume, network for travel between major points.

Auxiliary Lane – Portion of the roadway adjoining the traveled way for speed change, turning, storage for turning, weaving, truck climbing, passing and other purposes supplementary to through-traffic movement.

Average Daily Traffic (ADT) - The average 24 hour traffic volume, based on a yearly total.

Broken Back Curve - Two curves in the same direction joined by a short tangent distance.

Compound Curve - Two connecting horizontal curves in the same direction having different radii.

Collector Road – Roadway linking a Local Road to an Arterial Road, usually serving moderate traffic volumes.

Crash Analysis - A site specific, predictive Highway Safety Manual safety review of crash data performed to identify whether or not a specific geometric design element has either caused or contributed to, or could cause or contribute to a pattern or concentration of crashes at the location in question. The analysis is a critical component used in determining the appropriate application of geometric design criteria and in the evaluation of design exception / variance approval requests.

Critical Grade - The grade and length that causes a typical truck or other heavy vehicle to have a speed reduction of 10 mph or greater.

Cross Slope – Transverse slope rate of traveled lane or shoulder.

Cross Slope Break - Algebraic difference in rate of adjacent lane cross slopes having slopes in same direction (eg., between thru lanes or thru and auxiliary lanes).

Crown Line Crossover – The algebraic difference in rate of adjacent lane cross slopes at the crown point.

Crown Runout - **(also called Tangent Runout)** - The distance necessary to remove adverse crown before transitioning into superelevation on curves. (Referred to as “C” distance in Standard Plan R-107-Series.)

Deceleration Lane - An auxiliary lane that enables a vehicle to slow down and exit the highway with minimum interference from through traffic.

Design Hour Volume (DHV) - The hourly volume used to design a particular segment of highway.

Directional Design Hour Volume (DDHV) - The directional distribution of traffic during the DHV.

Free Access Highway - A highway, with no control of access, usually having at-grade intersections, which may or may not be divided.

Freeway - A divided arterial highway with full control of access and grade separations at intersections. Freeway includes the ramps.

Gore Area - The "V" area immediately beyond the convergence or divergence of two roadways bounded by the edges of those roadways.

Grade Separation - A structure that provides for highway traffic to pass over or under another highway or the tracks of a railway.

Horizontal Clearance – An operational offset providing clearance for external vehicle components such as mirrors on trucks and buses and for opening curbside doors of parked vehicles. A minimum 1 ft.-6 in. horizontal clearance from the face of curb to an obstruction is required on curbed roadways. If the roadway and curb are separated by a shoulder, the shoulder width is included as part of the clearance.

Interchange - A system of interconnecting roadways in conjunction with grade separations providing for the interchange of traffic between two or more intersecting roadways.

Level of Service (LOS)- A qualitative measure describing operational conditions within a traffic stream; generally described in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. Levels of service are given letter designations, from A to F, with LOS A representing the best operating conditions and LOS F the worst.

Local Road – A road which serves primarily to provide access to farms, residences, business, or other abutting properties.

Passing Lane Section (PLS) - Extra lane(s) to provide additional capacity and reduce delay caused by slow moving vehicles, such as recreational vehicles, during peak periods. These are often desirable in areas where slower vehicles are not necessarily the result of long steep grades.

Passing Relief Lane (PRL) - Common, all-inclusive reference to a traffic lane provided for increased passing opportunities along a route, can be a Truck Climbing Lane (TCL) or a Passing Lane Section (PLS).

Ramp - A connecting roadway between two intersecting roadways, usually at grade separations.

Reverse Curve – Horizontal curves in the opposite direction joined by a short tangent distance or common point.

Roll-over - Algebraic difference in rate of cross slope between traveled lane and shoulder.

Rural - Rural areas are those which are outside of urban areas.

Safety Review - A general safety review of a project performed to identify potential safety enhancements within the limits of a proposed 3R or 4R project. New Construction, Reconstruction, or Construction on Existing Road project type.

Service Road (also Frontage Road) - A roadway usually parallel and adjacent to a highway which provides access to abutting properties by separating local and through traffic.

Sight Distance - The unobstructed distance that can be viewed along a roadway - usually referenced to decision points for drivers.

Spiral Curve Transition - A variable radii curve between a circular curve and the tangent. The radii of the transition and the curve are the same at the curve and increase to infinity at the tangent end of the transition.

Superelevation – The banking of the roadway in the direction of the curve to help counter balance the centrifugal force on the vehicle.

Superelevation Transition (sometimes referred to as superelevation runoff) – The distance needed to change the pavement cross slope in the direction of the curve from a section with adverse crown removed to a fully superelevated section, or vice versa. (Referred to as “L” distance in Standard Plan R-107-Series.)

Truck Climbing Lane (TCL) - An extra lane for heavy vehicles slowed by the presence of a long steep “critical grade”, that provides passing opportunities for non-slowed vehicles.

Urban - An urban area is one in which there is a population of 5,000 or more within a boundary defined by State or local officials (23 U.S. Code §101).

Vehicles Per Hour (vph) - A measurement of traffic flow.

3.03 ALIGNMENT-GENERAL

(revised 1-23-2023)

The geometric design of a roadway consists of horizontal alignment, vertical alignment, and a combination of the two. A properly designed alignment (horizontal and vertical) leads to the safe and efficient movement of all modes of travel.

3.03.A Horizontal Alignment

Horizontal alignment is a major factor in determining safety, driving comfort, and capacity of a highway.

Some important factors to consider when designing for horizontal alignment:

1. Passing sight distance on two-lane, two-way roadways should be maximized.
2. Curves should be as flat as physical conditions permit. Abrupt changes in alignment introduce the element of surprise to the driver and should be avoided.
3. Broken back curves should be avoided because they are unsightly and drivers do not expect succeeding curves to be in the same direction.
4. If possible, the minimum distance between reverse curves should be the sum of the superelevation transitions, outside the curves, plus the crown runout lengths. The crown runout can be eliminated in some situations. See the Geometrics Unit (Design Division) for additional guidance. When it isn't possible to obtain the desired distance between reverse curves, up to 40% of the transition may be placed in the curves.

3.03.B Vertical Alignment

Vertical alignment establishes the profile grade of a proposed road construction project. The grade can be over virgin land as in the case of a relocation project or along an existing roadway, as in the case of a resurfacing project. In either case and in most proposed construction projects, a profile grade should be established.

Obviously a profile grade must always be established for new construction or relocation projects. Most reconstruction and rehabilitation projects will require new profile grades if improvements for sight distance, superelevation, and drainage are included. A simple resurfacing project can usually be constructed without establishing a new vertical alignment.

Establishing the vertical alignment is based on many factors, including terrain, existing conditions, soils, drainage, coordination with the horizontal alignment, location of bridges, culverts, crossroads, design speed, earthwork balance, etc. The Designer must work with available resources such as the Geometrics Unit of the Design Division to provide the best possible vertical alignment. The final product should be safe, functional, aesthetically pleasing, and economical.

3.03.C Combined

Horizontal and vertical alignments are permanent design elements. It is extremely difficult and costly to correct alignment deficiencies after the highway is constructed.

A proper combination of horizontal and vertical alignment is obtained by engineering study using the following general controls.

1. Vertical curvature superimposed on horizontal curvature, generally results in a more pleasing appearance. Successive changes in profile not in combination with horizontal curvature may result in a series of humps visible to the driver for some distance.
2. Sharp horizontal curvature should not be introduced at or near the top of a pronounced crest vertical curve. This condition may make it difficult for the driver to perceive the horizontal change in alignment. This can be avoided if the horizontal curvature leads the vertical curvature, i.e., the horizontal curve is made longer than the vertical curve.
3. Sharp horizontal curvature should not be introduced at or near the low point of a pronounced sag vertical curve. Because the road ahead would appear to be fore- shortened, a relatively "flat" horizontal curve should be used to avoid this undesirable phenomenon.
4. Horizontal curvature and profile should be made as flat as possible at intersections where sight distance along both roads or streets is important.

See Chapter 3 of ***A Policy on Geometric Design of Highways and Streets***, AASHTO, 2018 7th Edition for elements of design.

3.03.01 Horizontal Alignment – Design Controls

(revised 11-28-2022)

3.03.01A Minimum Radius

The minimum radius is a limiting value of curvature for a given design speed and is determined from the maximum rate of superelevation and the maximum side friction factor. The minimum radius of curvature should be avoided wherever practical. Attempt to use flatter curves, saving the minimum radius for the most critical conditions. The minimum radius (R_{min}) is shown in the Standard Plan R-107-Series superelevation tabulation at the bottom of each column for each design speed. Values for R_{min} are also tabulated for the straight line superelevation table in Section 3.04.03.

3.03.01B Minimum Curve Lengths

Curves should be sufficiently long for small deflection angles to avoid the appearance of a kink.

Curves on rural free access trunklines should be at least 500 feet long for a central angle of 5° and the minimum length should be increased 100 feet for each 1° decrease in the central angle. The minimum should be approximately 15 times the design speed with a desirable length of at least 30 times the design speed. For example, a design speed of 60 mph multiplied by 15 gives a minimum curve length of 900 feet.

3.03.01C Compound Curves

Compound curves should be used with caution. Although compound curves give flexibility to fitting the highway to the terrain and other controls, designers should avoid them whenever possible. When curves with considerably different radii are located too close together, the alignment will not have a pleasing appearance. On one-way roads such as ramps, the difference in radii of compound curves is not so important if the second curve is flatter than the first. On compound curves for open highways, the ratio of the flatter radius to the sharper radius should not exceed 1.5 to 1. On ramps the ratio of the flatter radius to the sharper radius may be increased to a 2 to 1 ratio.

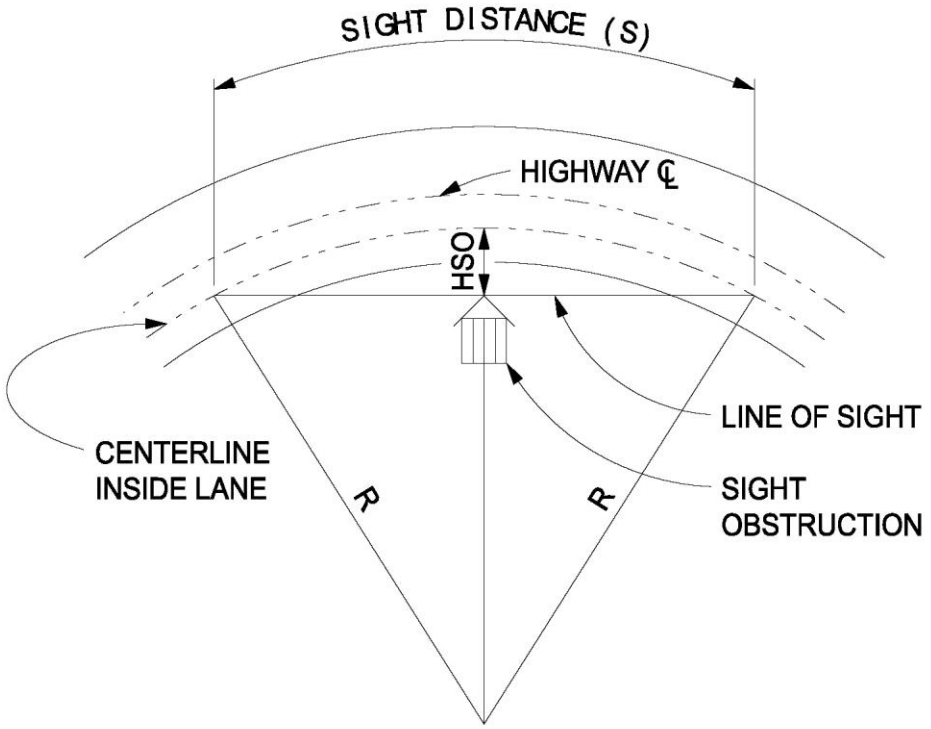
3.03.01D Sight Distances

Both stopping sight distance and passing sight distance must be considered for two-way roadways. On one-way roadways only stopping sight distance is required. The designer must be aware that both horizontal and vertical alignments need to be considered when designing for sight distance.

From Table 3-1 of ***A Policy on Geometric Design of Highways and Streets***, AASHTO, 2018 7th Edition stopping sight distance can be determined from design speed.

Design Speed	Stopping Sight Distance (Design)
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820

For general use in the design of a horizontal curve, the sight line is a chord of the curve and the stopping sight distance is measured along centerline of the inside lane around the curve.



COMPONENTS FOR DETERMINING HORIZONTAL SIGHT DISTANCE

Knowing the stopping sight distance (SSD) and the radius of curve (R) the horizontal sightline offset (HSO) can be calculated from:

$$HSO = R\,(1 - \cos\frac{28.65SSD}{R})$$

or to verify that SSD is met for a given HSO:

$$SSD = \frac{R\cos^{-1}(1 - \frac{HSO}{R})}{28.65}$$

(R, SSD, HSO measured in feet)

These equations are exact only when the vehicle and sight obstruction are within the limits of a circular curve.

When determining sight distances, use ***A Policy on Geometric Design of Highways and Streets***, AASHTO, 2018 7th Edition. The MDOT Sight Distance Guidelines also provide detailed information on sight distance calculation.

The four types of sight distances given are stopping, passing, decision, and intersection.

1. Stopping Sight Distance is defined as the sight distance available on a roadway that is sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path.
2. Passing Sight Distance is defined as the length needed to complete a passing maneuver as described in ***A Policy on Geometric Design of Highways and Streets***, AASHTO, 2018 7th Edition.
3. Decision Sight Distance is the distance required for a driver to detect an unexpected or otherwise difficult-to-perceive information source or condition in a roadway environment that may be visually cluttered, recognize the situation or its potential threat, select an appropriate speed and path, and initiate and complete the required maneuver safely and effectively.
4. Intersection Sight Distance is the distance that allows drivers sufficient view from a minor road to safely cross or turn on a major road.

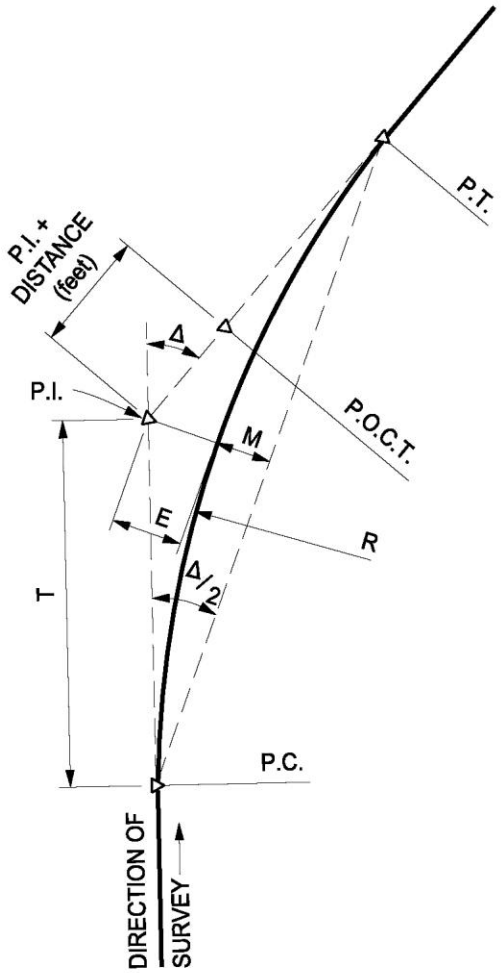
Generally 7.5 seconds of entering sight distance is used for passenger vehicles stopped on a minor road grade of 3% or less to turn left onto a two-lane roadway. An additional 0.5 seconds is added for each additional lane

Adjustments for other varying conditions that may increase or decrease the time gap are provided in ***A Policy on Geometric Design of Highways and Streets*****,** AASHTO, 2018 7th Edition.

The designer is cautioned that the element of Clear vision for at-grade intersections is very important, for safety reasons, particularly on high speed trunklines.

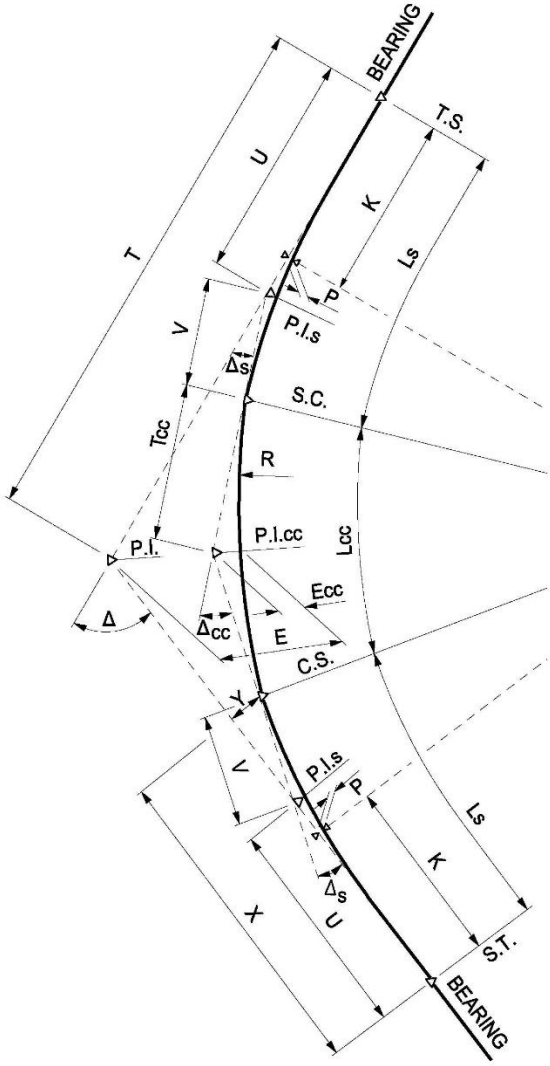
3.03.01E Horizontal Curve Computations

- Δ = Deflection or Central Angle (Delta), degrees
- R = Radius of Curve, ft
- T = Length of Tangent (P.C. to P.I. or P.I. to P.T.) = R Tan (Δ/2), ft
- E = External Distance = R [Sec (Δ/2) - 1] or T Tan (Δ/4), ft
- M = Middle Ordinate Distance = R Versine (Δ/2) or E Cos (Δ/2), ft
- L = Length of Curve = Δ x R ÷ 57.2958, ft
- D = Degree of Curvature = $\frac{5729.58}{R \text{ (ft)}}$ degrees
- P.C. = Point of Curvature
- P.I. = Point of Intersection of Tangents
- P.O.C.T. = Point on Curve Tangent
- P.T. = Point of Tangency



3.03.01F Spirals

Spiral curves are used to transition into circular curves and should be used on new alignments based on the design speed and radius of the curve, as shown on the table in Standard Plan R-107-Series. Spiral curve lengths are normally equal to the superelevation transition length. The relationship between the various elements of spiral curves and their methods of computation are shown below and on the following pages.



Usually the P.I. station and the deflection angle (∆) are established. The spiral length (Ls) equals the length of superelevation runoff; appropriate values for (Ls) can be obtained using Standard Plan R-107-Series. The remaining curve data can then be computed or read from the tables of spiral curve functions found in the Construction Manual.

- T.S. Sta. = P.I. Sta. - T (Sta.)
- S.C. Sta. = T.S. Sta. + Ls (Sta.)
- C.S. Sta. = T.S. Sta. + Ls (Sta.)+ Lcc (Sta.)
- S.T. Sta. = T.S. Sta. + 2Ls (Sta.) + Lcc (Sta.)

The radius of Central Angle (R) should be specified to the nearest 15 feet; all other curve data will be calculated and shown to the nearest one-hundredth of a foot or to the nearest second, whichever is applicable.

- P.I. = Point of Intersection
- T.S. = Tangent to Spiral
- S.C. = Spiral to Curve
- C.S. = Curve to Spiral
- S.T. = Spiral to Tangent

LEGEND AND FORMULAS FOR SPIRALS

R =	Radius of Central Angle, ft
T =	Tangent Length of Entire Curve, ft
Tcc =	Tangent Length of Central Curve, ft
U =	Long Tangent Length of Spiral, ft
V =	Short Tangent Length of Spiral, ft
Ls =	Spiral Length, ft
Lcc =	Central Curve Length, ft
Δ =	Deflection Angle of Entire Curve, degrees
Δcc =	Deflection Angle of Central Curve, degrees
Δs =	Deflection Angle of Spiral, degrees
E =	External of Entire Curve, ft
Ecc =	External of Central Curve, ft
X,Y =	Coordinates of S.C. (or C.S.) , ft
K,P =	Coordinates of Offset P.C. Referenced the Same as X & Y, ft
	$Throw = P\,(Sec\,\frac{\Delta s}{2}\,)$
	$T = (R + P)\,Tan\,\frac{\Delta}{2} + K$
	$E = (R + P)\,Tan\,\frac{\Delta}{2}\,Tan\,\frac{\Delta}{4} + P$
	T and E may be computed from tables of unit length spirals by taking the corresponding T & E values of the required deflection angle and multiplying them by Ls
	$V = \frac{Y}{Sin\,\Delta s}$
	$U = X - Y\,Cot\,\Delta s$
	$\Delta s = \frac{28.6479\ Ls}{R}$
	$\Delta = \Delta cc + 2\Delta s$

	For Δs Between Zero and 5º
	$Y = Ls\ Sin \frac{\Delta s}{3}$
	$X = Ls - \frac{Y^2}{2Ls}$
	$P = \frac{Y}{4}$
	$K = \frac{X}{2}$
	For Δs Between 5º and 10º
	$P = Ls\ Sin \frac{\Delta s}{12}$
	$Y = 4P$
	$K = \frac{Ls}{2} - \frac{4P^2}{Ls}$
	$X = K + R\ Sin\ \Delta s$

3.03.02 Vertical Alignment – Design Controls

(revised 9-22-2025)

Vertical curves are in the shape of a parabola. The basic equation for determining the minimum vertical curve length is:

$$L = KA$$

- WHERE:
  - L = length of vertical curve, feet
  - K = horizontal distance to produce 1% change in gradient, feet
  - A = Algebraic difference between the two tangent grades, percent

(Refer to ***A Policy of Geometric Design for Roads and Streets,*** AASHTO, 2018 7th Edition for additional Vertical Curve Formulas). Also refer to the MDOT Sight Distance Guidelines for more detailed information on sight distance calculation.

3.03.02A Minimum / Maximum Grades

See the "Grade" section of Appendix 3A, the Geometric Design Elements table.

3.03.02B Minimum Vertical Curve Lengths

Minimum length (in feet) of a vertical curve should be three times the design speed in mph.

3.03.02C Stopping Sight Distance

Stopping Sight Distance (SSD) is the principal control of the design of both crest and sag vertical curves. ***A Policy on Geometric Design of Highways and Streets,*** AASHTO, 2018 7th Edition gives values for K and lengths of vertical curves for various operational conditions. See MDOT Sight Distance Guidelines for more detailed information on sight distance calculation.

3.03.02D Drainage

Minimum grades correlate with adequate drainage. A desirable minimum grade is typically 0.5%, but grades of 0.3% may be used for paved roadways. On curbed roadways, when it is necessary to use grades that are flatter than 0.3%, provide enclosed drainage with compensating decreased inlet spacing. In addition, close attention to inlet spacing is critical for sag and crest vertical curves when the K value (rate of grade change) is greater than 167.

Uncurbed roads with ditch drainage can have a level longitudinal grade if the crown adequately drains the pavement. Independent ditches should be used when the grade is less than 0.3%. However, efforts to achieve minimum roadway grades of 0.5% would be of great benefit in the event that future curb and gutter or concrete barrier may be installed.

3.03.02E Other Considerations

Comfort criteria is sometimes a consideration for sag vertical curves. The equation for length of curve for comfort is:

$$L = \frac{AV^2}{46.5}$$

- WHERE:
  - L = length of vertical curve, feet
  - A = algebraic difference of tangent grades, percent
  - V = design speed, mph

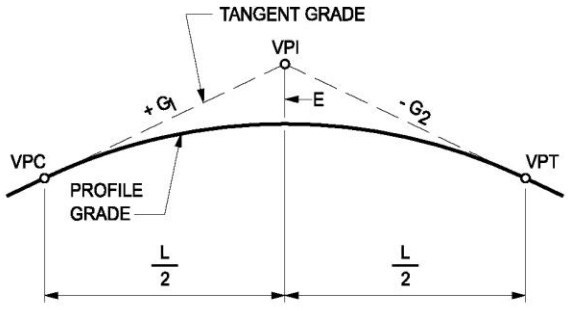
Passing sight distance must be considered on two way roadways. Passing sight distance is the distance required for a motorist to safely perform a passing maneuver as described in AASHTO.

Intersection Sight Distance is the distance that allows drivers sufficient view from a minor road to safely cross or turn on a major road. See Section 3.03.01.D4.

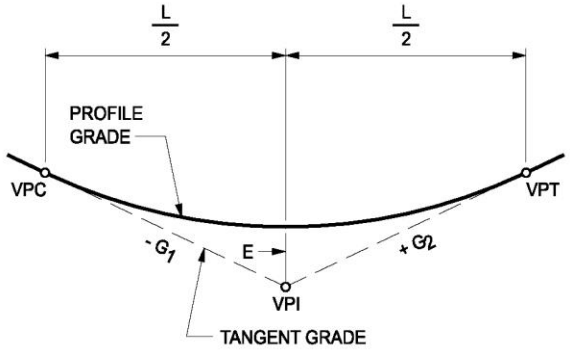
3.03.02F Computations

The following pages show mathematical details used in the design of vertical curves. This section includes definitions, formulas, and examples.

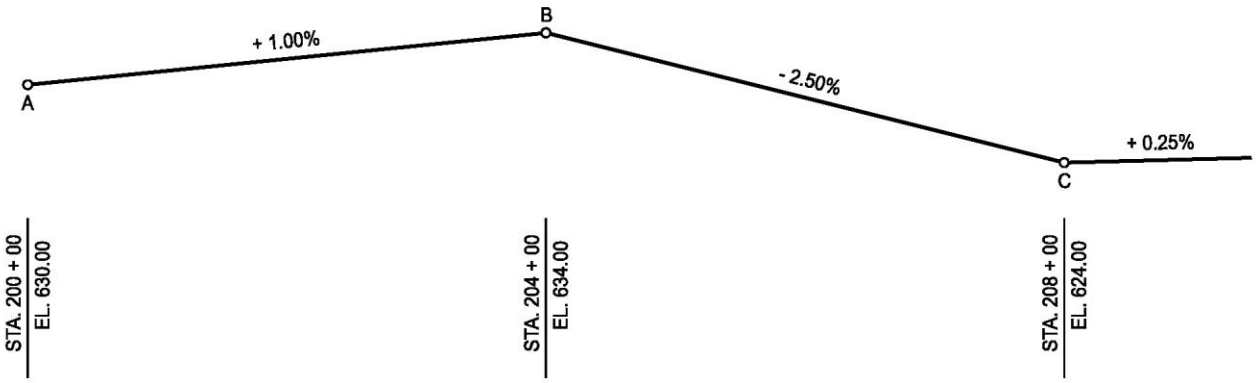
ELEMENT	ABBREVIATION	DEFINITION
Vertical Point of Curvature	VPC	The point at which a tangent grade ends and the vertical curve begins.
Vertical Point of Tangency	VPT	The point at which the vertical curve ends and the tangent begins.
Vertical Point of Intersection	VPI	The point where the extension of two tangent grades intersect.
Grade	G_1G_2	The rate of slope between two adjacent VPI's expressed as a percent. The numerical value for percent of grade is the vertical rise or fall in feet for each 100 feet of horizontal distance. Upgrades in the direction of stationing are identified as plus (+). Downgrades are identified as minus (-).
External Distance	E	The vertical distance (offset) between the VPI and the roadway surface along the vertical curve.
Algebraic Difference in Grade	A	The value A is determined by the deflection in percent between two tangent grades.
Length of Vertical Curve	L	The horizontal distance in feet from the VPC to the VPT.



CREST VERTICAL CURVE

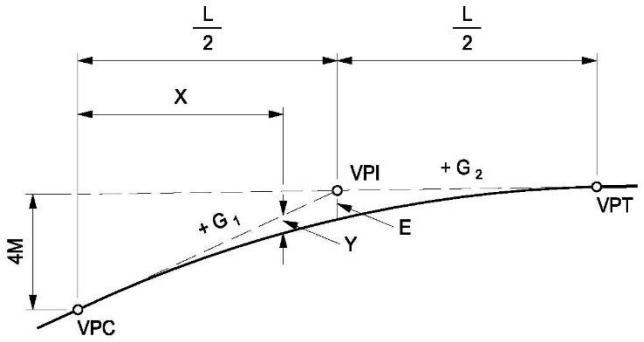


SAG VERTICAL CURVE

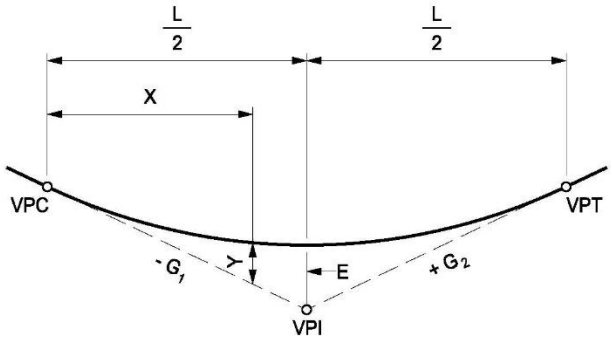


FORMULA: $\dfrac{\text{DIFFERENCE IN ELEVATION BETWEEN ANY KNOWN STATIONS ON TANGENT}}{\text{DISTANCE BETWEEN THOSE STATIONS}}$

EXAMPLE: GRADE A TO B: $\dfrac{\text{ELEVATION AT B - ELEVATION AT A}}{\text{DISTANCE A TO B}} = \dfrac{634.000 - 630.000}{400} = 1.0\%$



CREST VERTICAL CURVE
FIGURE 1



SAG VERTICAL CURVE
FIGURE 2

FORMULAS:

$$E = \frac{A}{800}(L)$$

$$Y = \frac{4M}{L^2}(X^2) \text{ or } \frac{A}{200L}(X^2)$$

WHERE:

E = External distance, feet

A = Algebraic difference of grades (G_1 and G_2), %

L = Length of curve in feet

Y = Offset at distance X from VPC or VPT, feet

GIVEN:

In Figure 1, G_1 = + 4.45% and G_2 = + 1.15%. The length of curve L = 600 ft. The distance x = 150 ft.

REQUIRED: E and offset Y

$$E = \frac{3.3}{800}(600) = 2.48 \text{ ft.}$$

$$Y = \frac{4 \times 2.48}{600^2}(150^2) = 0.62 \text{ ft.}$$

GIVEN:

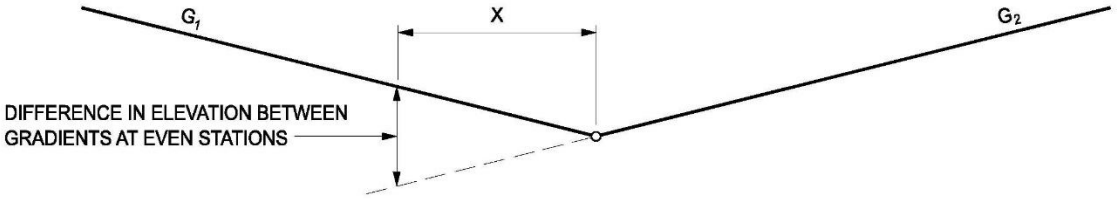
In Figure 2, G_1 = - 4.55% and G_2 = + 3.00%. The length of curve L = 500 ft. The distance x = 150 ft.

REQUIRED: E and offset Y

$$E = \frac{7.55}{800}(500) = 4.72 \text{ ft.}$$

$$Y = \frac{4 \times 4.72}{500^2}(150^2) = 1.7 \text{ ft.}$$

COMPUTATIONS FOR ODD PI



The distance X from any even 100 feet (1 Station) to an odd PI is equal to :

$$\frac{\textit{Difference in Elevation at Even Station}}{\textit{Algebraic Difference of Gradients}} \quad x\ 100$$

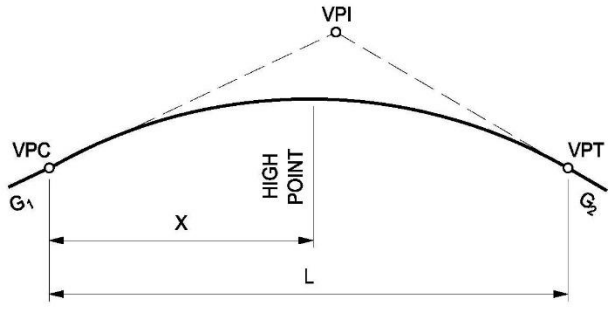
GIVEN:

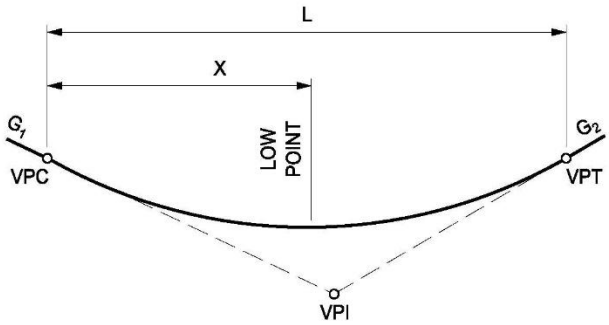
G_1 = - 2.0% and G_2 = + 3.0%. Difference in Elevation of 2.5 ft. between gradients at Station 100 + 00.

REQUIRED: Distance X

$X = \frac{2.5}{5}\ (100)$ VPI is at Station 100 + 50

COMPUTATIONS OF LOWEST OR HIGHEST POINT ON VERTICAL CURVE





X = Distance to lowest or highest point from VCP in feet

G_1 = % of grade back of VPI

L = Length of vertical curve in feet

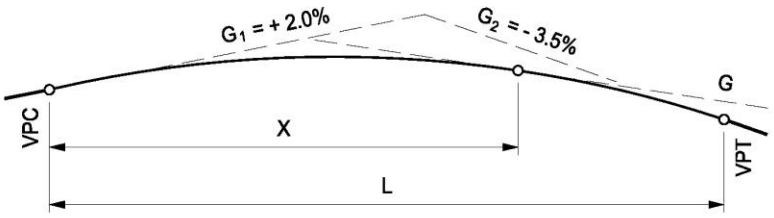
A = Algebraic difference of grades

THEN

$$X = \frac{100 G_1 L}{A}$$

MICHIGAN DESIGN MANUAL
ROAD DESIGN

TO FIND % OF GRADE AT ANY POINT ON A VERTICAL CURVE



L = Length of vertical curve in feet

x = Distance from VPC in feet

$$a = \frac{G_2 - G_1}{L}$$

Gradient at a point on a curve x distance from VPC

$$G = ax + G_1$$

EXAMPLE:

Find gradient at a point 500 ft. from VPC for a 800 ft. vertical curve.

$G_1 = +2\%$ $\quad L = 800$

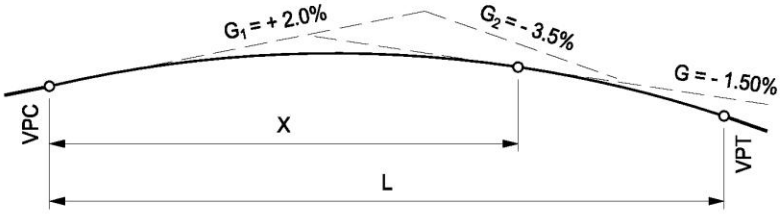
$G_2 = -3.5\%$ $\quad x = 500$

$$a = \frac{-3.5 - 2.0}{800} = -0.007$$

$$G = -0.007\,(500) + 2.0 = -1.50\%$$

Gradient at a point on a curve x distance from VPC

TO FIND A POINT ON CURVE WHERE A GIVEN % OF GRADE OCCURS



Distance x from VPC to point on selected gradient.

$$x = \frac{G_1 - G}{a}$$

EXAMPLE:

Find point on curve where gradient is - 1.50%.

$G_1 = +2\%$ $\quad L = 800$

$G_2 = -3.5\%$ $\quad G = -1.50\%$

$$a = \frac{-3.5 - 2.0}{800} = -0.007$$

$$x = \frac{2.0 + 1.5}{0.007}$$

x = 500 ft.

3.04 SUPERELEVATION AND CROSS SLOPES

(revised 9-22-2025)

The maximum rate of superelevation is determined from the design speed, curve radii, and the maximum allowable side friction factor.

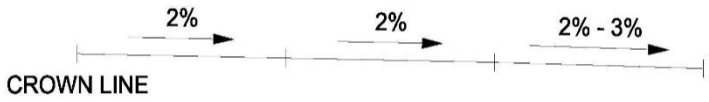
Michigan, because of its climate, limits superelevation to 7% maximum on rural freeways, free access trunklines, and rural ramps. For maximum superelevation on urban freeways and urban ramps see Standard Plan R-107-Series.

Standard Plan R-107-Series (7% E_{max}) is the preferred method for obtaining superelevation rates. Please note that interpolating between the AASHTO 6% and 8% E_{max} charts to obtain an estimated value for 7% E_{max} criteria is not appropriate. Standard Plan R-107-Series should be used. When it is not possible to use the rates provided in Standard Plan R-107-Series, the straight line method may be used on a curve by curve basis as needed. See Section 3.04.03. This method employs a distribution that generally produces more moderate superelevation rates and uses a maximum rate of superelevation of 6%.

The Department uses a standard cross slope of 2% as shown on Standard Plan R-107-Series and Appendix 3A Geometric Design Elements. See Section 6.09 for more information on pavement crowns and cross slope.

Cross slopes up to and including 2% are barely perceptible in terms of vehicle steering. A maximum cross slope of 2% should be used on the two lanes adjacent to the crownline. This will translate to crownline crossover of 4%.

When three or more lanes are inclined in the same direction on free access curbed highways, each successive lane or portions thereof, outward from the first two lanes adjacent to the crown line, may have an increased slope. The cross slope rate may be increased up to 1%. This helps facilitate parabolic crown modifications when existing side conditions do not allow the preferred uniform standard crown rate. This use of multiple crown rates requires additional transition in superelevated sections. See sketch below.



3.04.01 Point of Rotation

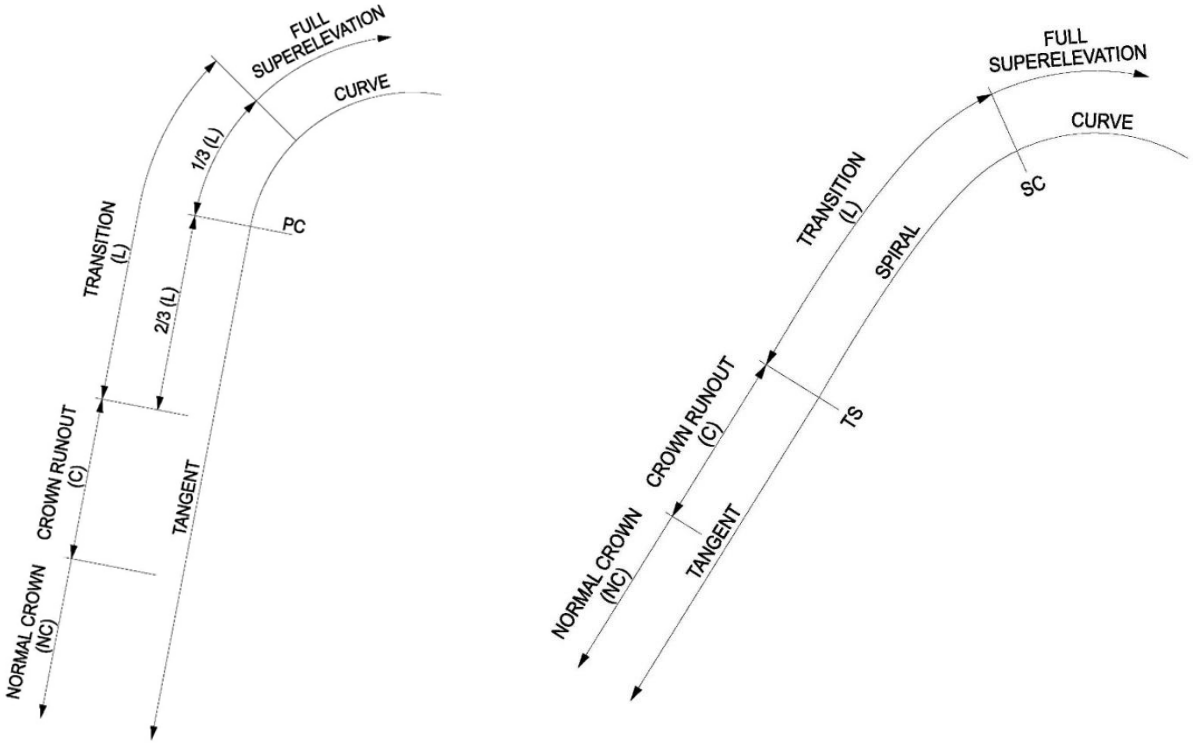
(revised 2006)

Superelevation may be obtained by rotating about the center or about inside or outside pavement edge profiles. Currently our crowned two-way and two-lane roadways are rotated about the pavement centerline per Standard Plan R-107-Series. This method reduces the edge distortion because the required change in elevation is distributed along both pavement edges rather than all on one edge. Uncrowned or straight cross slope pavements, such as ramps, are rotated about the alignment edge. Special consideration should be given to superelevating wider pavements (i.e., three-lane or five-lane sections) as the point of rotation should be determined by site conditions. See Standard Plan R-107-Series.

3.04.02 Superelevation Transitions

(revised 2-21-2017)

The superelevation transition consists of the superelevation runoff (or transition (L)) and tangent runout (or crown runout (C)). The superelevation runoff section consists of the length of roadway needed to accomplish a change in outside-lane cross slope from zero (flat) to full superelevation, or vice versa. The superelevation runoff is determined by the width of pavement (W), superelevation rate (e), and the relative gradient along the edges of pavement (Δ%). As indicated in Standard Plan R-107-Series, one third of the superelevation runoff length is located in the curve. When this cannot be achieved, the runoff length can be adjusted to a 30% minimum and 40% maximum inside the curve. The tangent runout section consists of the length of roadway needed to accomplish a change in outside-lane cross slope from the normal cross slope rate to zero (flat), or vice versa. The tangent runout is determined by the width of pavement (W), normal cross slope/normal crown (N.C.), and the relative gradient. Relative gradient values correspond to the superelevation rates. The gradient may be increased as needed up to the maximum relative gradient for the design speed. A design variance is required for values exceeding the maximum relative gradient.



3.04.03 Superelevation Using a Straight Line Method

(revised 2006)

STRAIGHT LINE SUPERELEVATION

RADIUS Feet	30 mph		35 mph		40 mph		45 mph		50 mph		55 mph		60 mph		65 mph		Freeways				Urban Freeways and Urban Ramps	
																	70 mph		75 mph		60 mph	
	e	Δ%	E	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%
20000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
17000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	2.0	0.30	N.C.	--
14000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	2.0	0.32	2.0	0.31	2.0	0.30	N.C.	--
12000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	2.0	0.36	2.0	0.32	2.0	0.31	2.0	0.30	2.0	0.36
10000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	2.0	0.38	2.0	0.36	2.0	0.32	2.0	0.31	2.0	0.30	2.0	0.36
8000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	2.0	0.40	2.0	0.38	2.0	0.36	2.0	0.32	2.0	0.31	2.0	0.30	2.0	0.36
6000	N.C.	--	N.C.	--	N.C.	--	2.0	0.40	2.0	0.40	2.0	0.38	2.0	0.36	2.0	0.32	2.0	0.31	2.5	0.31	2.0	0.36
5000	N.C.	--	N.C.	--	2.0	0.40	2.0	0.40	2.0	0.40	2.0	0.38	2.0	0.36	2.0	0.32	2.5	0.32	3.0	0.32	2.0	0.36
4000	N.C.	--	2.0	0.45	2.0	0.40	2.0	0.40	2.0	0.40	2.0	0.38	2.0	0.36	2.5	0.33	3.1	0.33	3.8	0.34	2.0	0.36
3500	N.C.	--	2.0	0.45	2.0	0.40	2.0	0.40	2.0	0.40	2.0	0.38	2.3	0.37	2.8	0.34	3.5	0.34	4.3	0.35	2.0	0.36
3000	2.0	0.50	2.0	0.45	2.0	0.40	2.0	0.40	2.0	0.40	2.1	0.38	2.7	0.38	3.3	0.36	4.1	0.36	5.0	0.36	2.4	0.37
2500	2.0	0.50	2.0	0.45	2.0	0.40	2.0	0.40	2.0	0.40	2.5	0.39	3.2	0.39	4.0	0.37	4.9	0.38	6.0	0.38	2.8	0.38
2050	2.0	0.50	2.0	0.45	2.0	0.40	2.0	0.40	2.4	0.41	3.1	0.40	3.9	0.40	4.8	0.40	6.0	0.40			3.4	0.39
1800	2.0	0.50	2.0	0.45	2.0	0.40	2.1	0.41	2.8	0.42	3.5	0.41	4.4	0.42	5.5	0.42					3.9	0.40
1675	2.0	0.50	2.0	0.45	2.0	0.40	2.3	0.41	3.0	0.42	3.8	0.42	4.8	0.42	5.9	0.43					4.2	0.41
1425	2.0	0.50	2.0	0.45	2.0	0.40	2.7	0.42	3.5	0.44	4.5	0.44	5.6	0.44							5.0	0.43
1350	2.0	0.50	2.0	0.45	2.2	0.41	2.9	0.43	3.7	0.44	4.7	0.44	5.9	0.45								
1150	2.0	0.50	2.0	0.45	2.5	0.42	3.4	0.45	4.3	0.46	5.5	0.46										
1075	2.0	0.50	2.0	0.45	2.7	0.43	3.6	0.46	4.7	0.47	5.9	0.47										
850	2.0	0.50	2.4	0.47	3.4	0.46	4.5	0.49	5.9	0.50												
820	2.0	0.50	2.5	0.47	3.5	0.47	4.7	0.49														
800	2.0	0.50	2.6	0.47	3.6	0.47	4.8	0.50														
720	2.0	0.50	2.8	0.49	4.0	0.49	5.4	0.52														
650	2.1	0.51	3.1	0.50	4.5	0.51	5.9	0.54														
600	2.3	0.51	3.4	0.51	4.8	0.53																
500	2.8	0.53	4.1	0.54	5.8	0.57																
450	3.1	0.54	4.5	0.56																		
400	3.5	0.56	5.1	0.58																		
345	4.0	0.58	5.9	0.62																		
300	4.6	0.61																				
232	6.0	0.66																				
$\Delta\%_{max}$		0.66		0.62		0.58		0.54		0.50		0.47		0.45		0.43		0.40		0.38		0.45
Rmin	232		340		485		643		833		1061		1333		1657		2042		2500		1412	

Use 7% superelevation for loop ramps (see Standard Plan R-107-Series). However, special consideration should be given to curves which approach a ramp terminal (stopping condition). If relative gradient (Δ%) values from the tables cannot be obtained for the design radius, use $\Delta\%_{max}$ for the corresponding design speed.
For radii less than those tabulated (but not less than Rmin) use e_{max} and $\Delta\%_{max}$.
Maximum superelevation for urban freeways and urban ramps (with 60 mph design speed) is 5%, otherwise e_{max} = 6%.

3.05 DELETED

Section deleted.

3.06 DESIGN SPEED

(revised 9-22-2025)

Design speed is a selected speed used to determine the various geometric design features of the roadway for all modes of travel. Once selected, all of the pertinent design features of the highway should be related to the design speed to obtain a balanced design.

- **New Construction and Reconstruction Projects:**

  Where practical, it is MDOT desirable practice to design roadway geometrics for new construction or reconstruction based on a recommended project design speed 5 mph greater than the posted speed. This practice is founded in research that shows actual operating speeds are typically greater than the posted speeds. Design speeds shown in Appendix 3A are applicable for New Construction and Reconstruction projects.

- **Construction on Existing Road Projects:**

  For freeway projects, the minimum design speed is the design speed approved at the time of the latest New Construction or Reconstruction project.

  Design speeds used for non-freeway Construction on Existing Road projects are shown in Section 3.09.01. However, if the original posted speed has been raised, the designer may use the design speed approved at the time of the latest New Construction or Reconstruction project.

Also see Section 3.08.01B for information on combined project types.

The project design speed to be recorded on the title sheet is the predominant selected design speed.

3.07 GEOMETRICS

3.07.01 Lane Width, Capacity and Vehicle Characteristics

(revised 9-22-2025)

3.07.01A Lane Width and Capacity

The lane width of a roadway greatly influences the safety and comfort of driving. In urban areas, designers should consider the safety of all users when determining lane widths.

3.07.01B Vehicle Characteristics

There are two general classes of vehicles: passenger and commercial (trucks). The geometric design requirements for trucks and buses are much more severe than they are for passenger vehicles. Consult the Geometrics Unit in the Design Division for the appropriate design vehicle to be used on the job. Intersection radii for various types of commercial vehicles are given on Geometric Design Guide GEO-650-Series, "Flares and Intersection Details". Also, for short radii loops, additional ramp width may be needed to accommodate these vehicles. Generally, the AASHTO WB-67 is the design vehicle to be used in determining the radii to be used in turning movements at trunkline to trunkline intersections and interchanges.

Acceleration and deceleration rates of vehicles are often critical in determining highway design. These rates often govern the dimensions of design features such as intersections, freeway ramps, speed change lanes, and climbing or passing lanes.

3.07.02 Interchange Geometrics

(revised 2-24-2020)

General: Contact the Geometrics Unit in the Design Division for the recommendations / requirements of all geometric features of highway facilities.

3.07.02A Rural and Urban

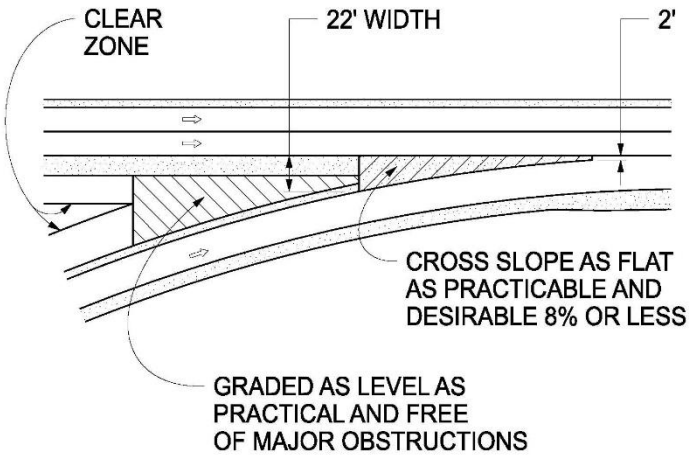
Geometric Design Guides, developed by the Geometrics Unit in the Design Division, show approved criteria for ramp and interchange design. See Geometric Design Guides.

3.07.02B Vehicle Characteristics

The following items should be considered in conjunction with the Geometric Design Guides for interchange design.

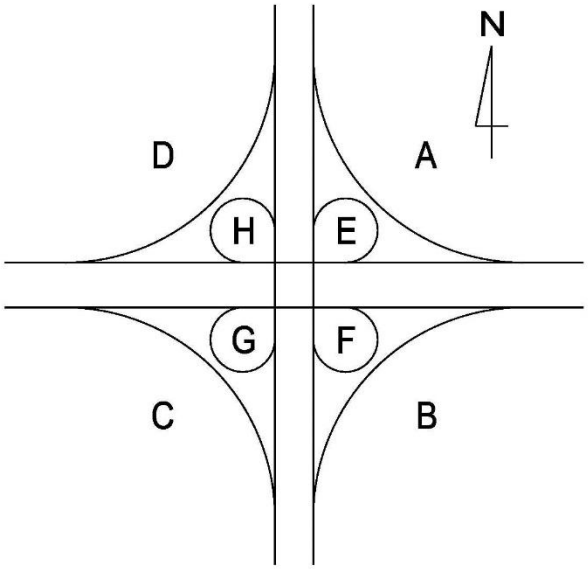
1. Exit ramps should be designed for adequate visibility for the motorist exiting the freeway. Sight distance along a ramp should be at least as great as the design stopping sight distance. There should be a clear view of the entire exit terminal, including the exit nose and a section of the ramp roadway beyond the gore.
2. Exit ramps should begin where the freeway is on a tangent, when possible.
3. Drivers prefer and expect to exit in advance of the structure. Loop ramps that are located beyond the structure, usually need a parallel deceleration lane.
4. Left-hand entrances and exits are contrary to the concept of driver expectancy. Therefore, extreme care should be exercised to avoid left-hand entrances and exits in the designing of interchanges.

5. The geometric layout of the gore area of exit ramps should be clearly seen and understood by the approaching drivers.
6. Potential conflicts with pedestrians and bicycles should be considered when using free flow ramps in urban areas.
7. The cross slope in the gore area between the 2-foot point and the 22-foot point should be as flat as practicable and desirably 8% or less. It is also desirable that the algebraic difference in grades between the gore and the adjacent lane be 5% or less to minimize the effect on vehicles inadvertently crossing the gore area. It is recommended that detail grades for the above paved portion of the gore area be provided to verify both cross slopes and algebraic differences. The unpaved portion beyond the 22-foot point (to the extent the clear zone from each roadway overlaps) should be graded as level with the roadway as practical and be clear of major obstructions. See sketch below.



8. In order to identify the location of ramps at interchanges, the following system of lettering ramps should be used on projects insofar as possible:

   The northeasterly quadrant is designated ramp A. Ramps B, C, & D follow in sequence in a clockwise direction. Interchange interior loops would similarly follow with clockwise designations E, F, G, & H.



3.07.02C Interchange Geometrics

Local or county roads over freeways should be designed for stopping sight distance based on the project design speed.

In interchange areas, the intersection sight distance and clear vision areas at diamond ramp terminals must be according to current Department practice. See MDOT Sight Distance Guidelines, Section 3.03.02E and the Geometric Design Guide GEO-370-Series. The driver's eye position, for a vehicle on a ramp, is assumed to be between 14.5 feet minimum and 18 feet desirable from the edge of the crossroad.

3.07.02D Ramp Radii

The speeds at which ramps may be driven, if they are free flowing, is determined primarily by the sharpest curve on the ramp proper. Loop ramps, because of their design restrictions, have the sharpest curvature, and if possible the designer should not use a radius of less than 260 feet. For radii less than 260 feet, contact the Geometrics Unit of the Design Division.

3.07.02E Single Lane Ramp Widths

Single lane ramp widths are normally 16 ft.-0 in. The total paved width including paved shoulders should not exceed 28 feet. Wider paved widths invite undesirable passing of slow-moving vehicles or invite two-lane operation.

Current ramp widths are shown in Chapter 6, Appendix 6-A.

3.07.03 Speed Change Lanes and Transitions

The change in vehicle speed between highways and ramps is usually substantial, and provision should be made for acceleration and deceleration. Therefore, in order to minimize interference with through traffic on highways, speed change lanes (deceleration and acceleration lanes) are added at turning roadways.

The Geometric Design Guides allow for either parallel or tapered deceleration lanes for exit ramps. Parallel deceleration lanes should be used where the ramp exit is on a freeway curve.

3.07.04 Intersections

(revised 2006)

An intersection is defined as the general area where two or more highways join or cross, including the roadway and roadside facilities for traffic movements within the area.

Intersections are an important part of a highway facility because, to a great extent, the efficiency, safety, speed, cost of operation, and capacity of the facility depends on their design. Although many of the intersections are located in urban areas, the principles involved apply equally to design in rural areas.

The angle of intersection between the approach road and the trunkline should not be less than 60° or more than 120°, with desirable values between 75° and 105°.

The gradient of the intersecting roads should be as flat as practical on those sections that are to be used for storage of stopped vehicles. If possible, side roads should have a "landing" of no more than 3 percent grade. Even though stopping and accelerating distances for passenger cars, on grades of 3 percent or less differ little from the distances on the level, larger vehicles need the flatter landing area.

Where two roadways intersect, crown manipulation of both roadways can be used to improve the drivability of both roadways. In this case, to insure proper drainage, detail grades should be provided. See Geometric Design Guide GEO-650-Series for allowable approach road grades.

Intersection sight distance should be provided on all intersections legs. Clear vision corners should be provided when it is practical. See Section 5.24.

Center lanes for left turns or passing flares may be required at certain intersections. See Geometric Design Guide GEO-650-Series.

Ramp terminals should be according to Geometric Design Guide GEO-370-Series.

3.08 AASHTO GREEN BOOK (GB7) PROJECT TYPES

(revised 9-22-2025)

3.08.01 General

(revised 9-28-2026)

3.08.01A Definitions

Basic Roadway Type: the general geometric character of an existing highway. The project objective may prompt changes to the basic roadway type, such as (but not limited to):

- Providing additional motor vehicle through lanes.
- Adding a raised or depressed median where none currently exists.
- Any change to vertical or horizontal alignment that requires a Design Exception or Design Variance.
- Any geometric change that results in a net decrease in safety performance.

Roadway improvements that can be accomplished without changes to the basic roadway type may include lane reconfigurations (road diets), adding turn lanes, adding channelizing islands, or adding median curbs for access management.

3.08.01B General

The 7th Edition of AASHTO's Policy on Geometric Design of Highways and Streets ("Green Book" or "GB7") categorizes projects into three different project types, with the historic 3R/4R classifications following in parentheses:

- New Construction (4R)
- Reconstruction (4R)
- Construction on Existing Roads (3R)

Previously, Title 23 of the Code of Federal Regulations (CFR) and the Road Design Manual (RDM) classified projects as being one of two types; resurfacing, restoring, or rehabilitating (3R) or resurfacing, restoring, rehabilitating, and reconstructing (4R). While these classifications are still used in multiple areas, the GB7 project types will determine the appropriate geometric design criteria to be applied.

Design projects which include multiple project types default to either the more conservative requirements or require the identification of the logical limits of each type on the project information sheet. A consistent corridor may be determined as a design priority when logical and appropriate for each GB7 project type; for example, establishing a constant lane width throughout a corridor to enhance the driver experience versus patchwork geometrics.

Consider Performance-Based Practical Design (refer to Section 3.17) initiatives for each project type given the needs of each user and transportation mode. Specific applications are provided as follows for each GB7 project type.

Refer to the Road and Bridge Project Classifications Table in this section for common projects and their associated project types.

In the event a project type is unclear, contact the Geometric Design Unit to determine the appropriate classification.

New Construction (4R)

New Construction projects are those in which the majority of the project length is on a new alignment where no existing roadway is present within the existing right-of-way. Design considerations for this project type are included in Section 3.10 for Non-Freeway and Section 3.14 for Freeway.

Unlike the other GB7 project types, New Construction project types do not have any existing performance data for which deviations to the geometric controlling criteria can be justified. Any application of Performance-Based Practical Design on New Construction project types is focused on assessing design alternatives and selecting the most justifiable option using the data that is available. This information would be documented in a Design Exception or Design Variance for any deviations from geometric controlling criteria. Refer to Section 3.08.01E.

Reconstruction (4R)

Reconstruction projects are those in which the existing project involves a change in the Basic Roadway Type. Design considerations for this project type included in Section 3.10 for Non-Freeway and Section 3.14 for Freeway.

Reconstruction project types have more Performance-Based Practical Design flexibility than New Construction project types, but less flexibility than Construction on Existing Road project types. Due to the nature of Reconstruction project types, and the change to the Basic Roadway Type, there will be a portion of the geometric controlling criteria for which existing performance data cannot be applied to the project. For example, accommodating a new center left-turn lane by reducing existing lane widths below criteria cannot be justified in a Design Exception or Variance by citing the existing lack of sideswipe crashes; lane widths are associated with sideswipe crashes in the MDOT Safety Programs Guide. Therefore, unless additional justification is provided (such as through a predictive crash analysis), the default lane width is that which is detailed in Appendix 3A.

Consistent with Performance-Based Practical Design, Design Exceptions or Design Variances will generally be approved when supported by performance data and not citing cost as the single or main consideration. Reconstruction project types can rely on both existing (where applicable) and predicted crash data, whereas New Construction project types will only have predicted crash data available. Performance-Based Practical Design can also be used to forecast performance of design alternatives.

Construction on Existing Roads (3R)

Construction on Existing Road projects are those in which the project utilizes an existing or improved alignment and maintains the existing Basic Roadway Type. Any project that does not meet the criteria for New Construction or Reconstruction is considered Construction on Existing Roads. These types of projects are those in which the existing performance history (such as crash history, level-of-service, etc.) can be used to predict future performance. Design considerations for this project type are included in Section 3.09 for Non-Freeway and Section 3.13 for Freeway.

Performance-Based Practical Design initiatives for Construction on Existing Roads is the most flexible of all categories, as the existing road performance can be applied to the proposed project because the Basic Roadway Type remains the same. This allows for a targeted approach to determine when geometric improvements are necessary based on existing and future performance and avoids investments in upgrades where there is not supporting data that showcases an underlying problem. Chapter 1 of the 7th Edition of the AASHTO Green Book (GB7) states "*Every dollar spent on a road that is performing well and anticipated to continue performing well is a dollar that is not available to be spent on a road that is performing poorly.*"

Projects undertaken because of asset condition (such as those for which the design life has been exceeded or rehabilitation is necessary) will always utilize the existing AASHTO controlling criteria as the basis of design for both freeway and non-freeway projects, with targeted improvements required when any of the following conditions exist:

- A crash pattern involving existing fatal and/or serious injuries has been identified that can be corrected by design modifications of the specific applicable geometric controlling criteria (regardless of project scope, budget, etc.). Crash patterns that exist entirely independent of the geometric controlling criteria are excluded from this requirement. This analysis will be performed by the Region/TSC Traffic and Safety Engineer. Refer to the MDOT Safety Programs Guide for the correlation between crash type and geometric element.
- A benefit-cost analysis (such as that present in NCHRP 876 or IHSDM) indicates that a geometric improvement would cost-effectively mitigate fatal and/or serious injury crashes over the design life of the project. This analysis can be based on risk elements that may be present, but which have not yet manifested themselves into an existing crash pattern. This analysis will be performed at the discretion of the Project Manager and is not mandatory for every project. This will be a collaborative effort between the design team and Region/TSC Traffic and Safety Engineer. Any deviations from existing geometrics proposed through this analysis require approval from the Engineering Operations Committee (EOC).
- If project scoping has identified the need for a Level-of-Service (LOS) analysis that results in an existing or projected unacceptable operational Level-of-Service.
- The Project Manager and the project team determines that improvements are cost-negligible to the project, such as for superelevation rate or cross-slope adjustments.

Section 3.09.01 contains the geometric design criteria for non-freeways when existing geometrics are unable to be retained. Because the MDOT Safety Programs Guide indicates that crash types may be attributable to multiple geometric elements, only those elements that are below the criteria in Section 3.09.01 require improvements. If all existing geometric elements attributable to the crash pattern already meet the criteria in Section 3.09.01, those specific elements are required to be improved to the criteria present in Appendix 3A.

Appendix 3A contains the geometric design criteria for freeways when existing geometrics are unable to be retained.

Improve only the geometric elements that address the identified problems; it is possible that projects may require a combination of improvements. Note that this paragraph does not apply to Level-of-Service deficiencies.

Projects undertaken because of inadequate Level-of-Service or safety performance will utilize the Highway Capacity Manual or the Highway Safety Manual, respectively, to influence design decisions. However, similar to projects undertaken because of asset condition, required geometric design changes are limited to those that meet the project objectives or are cost-negligible to the project.

When the project's scope and objective has identified the need for multimodal facilities in accordance with the Department's Complete Streets and/or Context Sensitive Solutions policies, individual geometric elements may be modified after a predictive crash analysis has been performed and indicates a net safety benefit (reduction in fatal and serious injuries) of all users. Multimodal facilities may be either included directly in the project or the project designed so as not to preclude such facilities in the future; this includes both road and bridge assets. Additionally, consideration must be given to geometric design modifications that would help facilitate the mitigation of an existing missing link in a multimodal network.

MICHIGAN DESIGN MANUAL
ROAD DESIGN

Road and Bridge Project Classification Examples[1]

Example Road Project	GB7 Project Type
New Road	New Construction
Adding lanes for Vehicular Through Traffic	Reconstruction
Addition of a Raised or Depressed Median	Reconstruction
Complete Removal and Replacement of Pavement	Construction on Existing Road
Resurfacing, Milling, or Profiling, Concrete Overlays, and Inlays	Construction on Existing Road
Lane and/or Shoulder Widening	Construction on Existing Road
Passing Relief Lanes	Construction on Existing Road
Adding Auxiliary Lanes (Center-Turn Lanes, Right-Turn Lanes, etc.)	Construction on Existing Road
Roadway Base Correction	Construction on Existing Road
Roadside Safety Improvements (guardrail, delineators, etc.)	Construction on Existing Road
Pedestrian Refuge and Access Management Islands	Construction on Existing Road
Signing, Pavement Marking and Traffic Signals	Construction on Existing Road
Intersection and Railroad Crossing Upgrades	Construction on Existing Road
Pavement Joint Repair	Construction on Existing Road
Crush, Shape, and Resurfacing	Construction on Existing Road
Rubblize and Resurfacing	Construction on Existing Road
Introduction of Curb and Gutter	Construction on Existing Road
Example Bridge Project	**GB7 Project Type**
New Bridge	New Construction
Bridge Replacement	Reconstruction
Complete Superstructure Replacement	Reconstruction
Partial Superstructure Replacement with Additional Lanes	Reconstruction
Bridge Widening to Accommodate Additional Lanes or Non-Motorized Needs	Reconstruction
Deck Replacement with Bridge Widening to Accommodate Additional Lanes	Reconstruction
Deck Replacement without Additional Lanes	Construction on Existing Road
Partial Superstructure Replacement without Additional Lanes	Construction on Existing Road
Partial Substructure Replacement (can include the complete removal of an entire substructure element but not the replacement of all the substructure elements)	Construction on Existing Road
Barrier Replacement	Construction on Existing Road

[1] GB7 Project Classifications must be taken in the context of all requirements listed in Section 3.08.01.

3.08.01C Corridor Minimum Geometric Standards

Minimum corridor-wide geometric standards may be established within a corridor plan to ensure uniformity of the driver experience, promote Context Sensitive Solutions, facilitate maintenance-of-traffic operations, execute Performance-Based Practical Design, and provide a consistent corridor from beginning to end. The Associate Region Engineer-Development (System Manager) and/or Region Planner will be able to assist in determining if a corridor plan is present. Refer to the Scoping Manual for additional information.

Note: Corridor-wide standards are a minimum criteria; when conflicts exist with Section 3.08.01B, the most conservative design will govern. Document these design decisions in the project file.

3.08.01D Other Work Categories

Projects categorized by other work types (such as Capital Preventive Maintenance (CPM), M-Funded Non-Freeway or Freeway Resurfacing, Signal Corridor, Pavement Marking, and Signing Corridor projects) are governed by guidelines that may differ from the three GB7 project types. For information related to specific requirements for these categories of work, other appropriate references must be used. When other work types are packaged with a GB7 project type, the portion of the project that is outside the GB7 project type work limits is governed by the guidelines pertaining to the other work type. Work type overlap may cause a default to more conservative requirements. Engineering judgement will be required to determine the controlling classification when considering how the different included work types will affect the applicability of the existing performance measures to the post-project performance measures.

Note: The applicability of CPM minimum design requirements is contingent on the program eligibility of the roadway. Regardless of the funding source used to design and construct CPM work, CPM minimum design requirements can only be applied to work done on roadways that would otherwise be eligible for funding under the CPM program.

3.08.01E Design Exceptions / Design Variances

Where indicated, a Design Exception (DE) or Design Variance (DV) must be submitted and approved when the AASHTO geometric controlling criteria or Department-specific criteria cannot be met (where required as determined by the GB7 project type). The Geometric Design Unit will review plans during the review process and identify the need for these submissions.

In general, the following conditions apply for freeway and non-freeway projects:

- Reductions of geometric elements from existing conditions that still result in meeting the posted speed of the project do not require a DE or DV provided there is not a crash history present attributable to those specific elements.
- Blanket DEs or DVs are not provided to cover multiple design elements when the design speed is less than the posted speed. Each individual element that does not meet the posted speed requires its own DE or DV.
- Design Exceptions or Design Variances are required when the specific geometric elements that could correct crash patterns are unable to be improved as required.
- Design Exceptions or Design Variances are required for additions to the roadway (such as turn lanes) for which existing performance data is not available.

For underclearance, the following conditions apply:

- Underclearance requirements are located in the Bridge Design Manual Chapter 7. For any projects that could potentially affect bridge underclearance, refer to the Bridge Design Manual as that contains requirements not included here.
- Thin HMA overlays, pavement grinding, concrete joint repair, slurry seal (shoulders only), and seal coat (shoulders only) can maintain the existing vertical clearance without a Design Exception.
- All proposed Design Exceptions pertaining to vertical clearance on Interstate routes (including shoulders) and all ramps and collector distributor roadways of Interstate-to-Interstate interchanges will be coordinated with the Army Transportation Command - Transportation Engineering Agency (ARTTRANSTEA) (formerly SDDCTEA) using MDOT Form 0333. Refer to Bridge Design Manual Section 7.01.08B.

Design Exception and Design Variance applicability is listed in the following table with their corresponding level of documentation and/or approval.

AASHTO Controlling Criteria	Applicability of Design Exception (DE) or Design Variance (DV) with project Posted Speed (PS) Considerations					
	New Construction (4R)		Reconstruction (4R)		Construction on Existing Road (3R)	
	PS ≥ 50 MPH	PS < 50 MPH	PS ≥ 50 MPH	PS < 50 MPH	PS ≥ 50 MPH	PS < 50 MPH
Lane Width	DE	DV[1]	DE	DV[1]	DE[2]	DV[1,2]
Shoulder Width	DE	DV	DE	DV	DE[2]	DV[2]
Horizontal Curve Radius	DE	DV	DE	DV	DE[2]	DV[2]
Superelevation Rate	DE	DV	DE	DV	DE[2]	DV[2]
Stopping Sight Distance (Horizontal and Vertical)	DE	DV	DE	DV	DE[2]	DV[2]
Maximum Grade	DE	DV	DE	DV	DE[2]	DV[2]
Cross Slope	DE	DV	DE	DV	DE[2]	DV[2]
Vertical Clearance[3]	DE	DE	DE	DE	DE[2]	DE
Design Loading Structural Capacity	DE	DE	DE	DE	N/A[4]	N/A[4]
Department-Specific Criteria						
Superelevation Transition[5]	DV	DV	DV	DV	DV[2]	DV[2]
Ramp Acceleration / Deceleration Length[6]	DV	DV	DV	DV	DV[2]	DV[2]
Parabolic / Split Plane Insertion or Retention	DE	DE	DE	DV	DE	DV
Ramp Design Speed Less than the Lower Range Speed in AASHTO Table 10-1.	DE	DE	DE	DE	DE[7]	DE[7]
Ramp Vertical Design Speed Less Than Horizontal Design Speed	DE	DE	DE	DE	DE[7]	DE[7]

[1] Lane width reductions from existing conditions on the National Network require the Design Exception process be followed regardless of design speed.

[2] Applies only when the proposed design either reduces geometric elements below both the existing conditions ***and*** Appendix 3A, or there is an existing crash history that is not being remediated by improving the contributing criteria.

[3] Refer to Bridge Design Manual Chapter 7.

[4] Design loading structural capacities are not evaluated on Construction on Existing Road (3R) projects.

[5] Refer to Section 3.04.02.

[6] Use Geometric Design Guides for appropriate lengths

[7] Applies when the proposed design reduces elements below the existing conditions.

3.08.01F Safety Review / Crash Analysis

An existing crash analysis is required for all Reconstruction and Construction on Existing Road projects (refer to Section 14.24). The Project Manager should contact the TSC Traffic and Safety Engineer during scoping to request a crash analysis be performed throughout the project limits. On corridor projects, only one analysis that includes roadways and bridges is required. Utilize the most recent 5 years of crash data available on RoadSoft to determine where safety enhancements would be beneficial and supported by the data. Crash analyses more than 3 years old must be updated to verify the original results.

A site-specific predictive Highway Safety Manual (HSM) Crash Analysis is required as justification for any Design Exception or Design Variance. It is also required in determining appropriate design criteria (including Crash Modification Factors) according to Section 3.09.01A and Section 3.09.01B. If a specific HSM model does not exist for that roadway type, then perform a crash analysis using the most recent 5 years of crash data available on RoadSoft for the existing conditions and the geometric element in question. Site specific crash analyses more than 3 years old must be updated to verify the original crash analysis.

3.08.01G National (Truck) Network (NN) Lane Widths

23 CFR Part 658 requires that lane widths on the Interstate System and portions of the Federal-Aid Primary System are designed to be 12 ft.-0 in. unless otherwise consistent with highway safety. The portions of the Federal-Aid Primary System that are on the National Network are identified on the MDOT Truck Operators map.

Designers must strive to ensure that all New Construction, Reconstruction, and Construction on Existing Road projects on the National Network have 12 ft.-0 in. lane widths (excluding turn lanes that would take a vehicle off of the network). Existing truck lane widths that do not meet 23 CFR Part 658 may be retained (not reduced) if they otherwise meet the standards relative to the project work type (New Construction, Reconstruction, and Construction on Existing Roads). The requirements in this paragraph for lane width on National Networks take precedence over other PBPD and design flexibility decisions.

In rare circumstances, the designer may have to reduce the lane widths on the National Network from existing conditions. This decision should only occur after all other reasonable accommodations have been explored. Because 23 CFR Part 658 requires that National Network lane widths are 12 ft.-0 in. unless otherwise consistent with highway safety, any reduction from existing widths requires Design Exceptions with additional evidence that the proposed cross-section will cumulatively improve safety. The Design Exception must include the following:

- A predictive crash analysis that indicates a decrease in all vehicular, bicycle, and pedestrian serious injury and fatal crashes over existing conditions.
- Any mitigative measures necessary to ensure the decrease in vehicular, bicycle, and pedestrian serious injury and fatal crashes.
- An analysis that concludes that a WB-67 is capable of navigating all turns necessary to remain on the National Truck Network without encroaching on adjacent lanes.

Note that all lane width reductions on the National Network must be submitted as a Design Exception regardless of design speed.

3.09 CONSTRUCTION ON EXISTING ROAD CONTROLLING CRITERIA (NON-FREEWAY)

(revised 9-22-2025)

3.09.01 Geometric Controlling Criteria

(revised 9-28-2026)

The criteria present in this section provide the minimum dimensional targets for the geometric controlling criteria if existing geometrics are unable to be retained (Refer to Section 3.08.01B) for Non-Freeway Construction on Existing Road project types. Improve the necessary geometric elements; it is possible that projects may require a combination of improvements.

The geometric elements are divided into NHS and Non-NHS tables. Some geometric elements may be divided into Urban and Rural areas (Refer to Section 3.02). These definitions are provided as guidance; specific project context will be established by the Project Manager and project team.

3.09.01A Non-Freeway, NHS

<table>
<tr><th>Geometric Elements</th><th colspan="4">Non-Freeway, NHS - Construction on Existing Road Project Types</th></tr>
<tr><td>Design Speed
(see Section 3.06)</td><td colspan="4">Posted Speed Minimum</td></tr>
<tr><td rowspan="6">Shoulder Width

Minimum shoulder widths apply for:
Rural: Posted speeds greater than 45 mph.
Urban: Posted speeds greater than 45 mph where sufficient right-of-way exists to include shoulders.
At lower speeds minimum shoulder widths are desirable.</td><td colspan="2">Current ADT
Two-Way</td><td>Inside
Shoulder</td><td>Outside
Shoulder</td></tr>
<tr><td rowspan="3">Two Lane and Three Lane with a Center Left Turn Lane</td><td><750</td><td rowspan="3"></td><td>3 ft.-0 in. Gravel</td></tr>
<tr><td>750 to 5000</td><td>6 ft.-0 in. (3 ft.-0 in. Paved)</td></tr>
<tr><td>>5000 to 10,000

>10,000</td><td>8 ft.-0 in. (3 ft.-0 in. Paved)

8 ft.-0 in. (7 ft.-0 in. Paved)</td></tr>
<tr><td>Multilane Undivided</td><td>≤ 10,000
> 10,000</td><td></td><td>6 ft.-0 in. (3 ft.-0 in. Paved)
8 ft.-0 in. (3 ft.-0 in. Paved)</td></tr>
<tr><td>Multilane Divided</td><td>≤ 10,000
> 10,000</td><td>3 ft.-0 in. Paved
3 ft.-0 in. Paved</td><td>6 ft.-0 in. (3 ft.-0 in. Paved)
8 ft.-0 in. (3 ft.-0 in. Paved)</td></tr>
<tr><td colspan="4">Refer to Bridge Design Manual Appendix 6.02 for Bridge Widths</td></tr>
<tr><td>Lane Width</td><td>ADT</td><td colspan="3">Lane Width</td></tr>
<tr><td colspan="2">≤750

>750</td><td colspan="3">10 ft.-0 in.

11 ft.-0 in.

10 ft.-0 in. lanes may be considered in urban areas for multi-lane undivided (regardless of ADT) and multi-lane divided (ADT < 10,000).

12 ft.-0 in. lanes are desirable on the Priority Commercial Network (PCN).

12 ft.-0 in. lanes are required on the National Network (also known as the National Truck Network). Refer to 3.08.01G for retention or reduction of existing National Truck Network lane widths.

Refer to the Truck Operator's Map for the Priority Commercial Network (Green) and National Truck Network (Gold) classifications.</td></tr>
<tr><td>Design Loading Structural Capacity</td><td colspan="4">Refer to Bridge Design Manual Appendix 6.02. Design loading structural capacities are not evaluated on Construction on Existing Road (3R) projects.</td></tr>
<tr><td>Horizontal Curve Radius</td><td colspan="4">Refer to Standard Plan R-107-Series.</td></tr>
<tr><td>Stopping Sight Distance</td><td colspan="4">Refer to 2018 7th Edition AASHTO Green Book or MDOT Sight Distance Guidelines.</td></tr>
<tr><td>Maximum Grade</td><td colspan="4">Refer to Appendix 3A.</td></tr>
<tr><td>Cross Slopes</td><td colspan="4">Traveled way: 1.5%-2%. Shoulder: 4% (6% allowed per Section 6.05.05)</td></tr>
<tr><td>Superelevation Rate</td><td colspan="4">Standard Plan R-107-Series or reduced maximum (6%) Straight Line Superelevation Chart.</td></tr>
<tr><td>Vertical Clearance</td><td colspan="4">Refer to Bridge Design Manual Chapter 7.</td></tr>
</table>

3.09.01B Non-Freeway, Non-NHS

<table>
<tr><th>Geometric Elements</th><th colspan="3">Non-Freeway, Non-NHS - Construction on Existing Road Project Types</th></tr>
<tr><td>Design Speed</td><td colspan="3">Posted Speed Minimum</td></tr>
<tr><td rowspan="5">Shoulder Width

Minimum shoulder widths apply for:
Rural: Posted speeds greater than 45 mph.
Urban: Posted speeds greater than 45 mph where sufficient right-of-way exists to include shoulders.
At lower speeds minimum shoulder widths are desirable.</td><td>Current ADT Two-Way</td><td colspan="2">Inside and Outside Shoulder Width</td></tr>
<tr><td>≤750</td><td colspan="2">2 ft.-0 in. (Gravel)</td></tr>
<tr><td>750 to 2000</td><td colspan="2">3 ft.-0 in. (Paved)</td></tr>
<tr><td>> 2000</td><td colspan="2">6 ft.-0 in. (3 ft.-0 in. Paved)</td></tr>
<tr><td rowspan="2">Multilane (Divided & Undivided)</td><td>Inside (Divided)</td><td>Outside
(Both sides for undivided)</td></tr>
<tr><td>3 ft.-0 in. Paved</td><td>6 ft.-0 in. (3 ft.-0 in. Paved)</td></tr>
<tr><td colspan="3">Refer to Bridge Design Manual Appendix 6.02 for Bridge Widths</td></tr>
<tr><td rowspan="2">Lane Width</td><td>ADT</td><td colspan="2">Lane Width</td></tr>
<tr><td>≤750

>750</td><td colspan="2">10 ft.-0 in.

11 ft.-0 in.

10 ft.-0 in. lanes may be considered in urban areas for multi-lane un-divided (regardless of ADT) and multi-lane divided (ADT < 10,000).

12 ft.-0 in. lanes are required for National Network (also known as the National Truck Network). Refer to 3.08.01G for retention or reduction of existing National Truck Network lane widths.

Refer to the Truck Operator’s Map for the National Truck Network (Gold) classifications.</td></tr>
<tr><td>Design Loading Structural Capacity</td><td colspan="3">Refer to Bridge Design Manual Appendix 6.02. Design loading structural capacities are not evaluated on Construction on Existing Road (3R) projects.</td></tr>
<tr><td>Horizontal Curve Radius</td><td colspan="3">Refer to Standard Plan R-107-Series.</td></tr>
<tr><td>Stopping Sight Distance</td><td colspan="3">Refer to 2018 7th Edition AASHTO Green Book or MDOT Sight Distance Guidelines.</td></tr>
<tr><td>Maximum Grade</td><td colspan="3">Refer to Appendix 3A.</td></tr>
<tr><td>Cross Slopes</td><td colspan="3">Traveled way: 1.5%-2%. Shoulder: 4% (6% allowed per Section 6.05.05)</td></tr>
<tr><td>Superelevation Rate</td><td colspan="3">Standard Plan R-107-Series or reduced maximum (6%) Straight Line Superelevation Chart.</td></tr>
<tr><td>Vertical Clearance</td><td colspan="3">Refer to Bridge Design Manual Chapter 7.</td></tr>
</table>

3.09.02 Design Exceptions / Design Variances

(revised 12-22-2025)

When the geometric controlling criteria are unable to be met or retained for the specific elements requiring improvement, request a Design Exception or Design Variance in accordance with Section 3.08.01E. Additionally, there are some Department-specific criteria that may also require a Design Exception or Design Variance. Refer to Section 3.06 for posted speeds that have changed since the most recent reconstruction.

When requesting exceptions or variances to design elements on Heritage Routes, it is important to address the fact that the requested exception is based on historic, economic, or environmental concerns for the preservation of the natural beauty or historic nature of the facility.

3.10 NEW CONSTRUCTION AND RECONSTRUCTION CONTROLLING CRITERIA (NON-FREEWAY)

(revised 9-22-2025)

3.10.01 Geometric Controlling Criteria

(revised 9-22-2025)

The criteria present in Appendix 3A provides the minimum dimensional requirements for the geometric controlling criteria for both Non-Freeway New Construction and Reconstruction project types.

Some geometric elements may be divided into Urban and Rural areas (Refer to Section 3.02). These definitions are provided as guidance only; specific project context will be established by the Project Manager and project team.

3.10.02 Design Exceptions / Design Variances

(revised 9-22-2025)

Design Exceptions or Design Variances are required for both New Construction and Reconstruction project types whenever the design criteria in Appendix 3A cannot be met for controlling design elements. Refer to Section 3.08.01E.

3.11 ADDITIONAL NON-FREEWAY DESIGN CRITERIA

(revised 9-22-2025)

3.11.01 General

(revised 9-28-2026)

Deviation from the additional design criteria presented in this section does not require Design Exceptions and/or Design Variances, as these are not geometric controlling criteria.

3.11.01A Signing

Contact the Region/TSC Traffic and Safety Engineer to identify desirable enhancements and sign upgrading needs.

3.11.01B Elevation of Guardrail and Bridge Railing

1. Inspect height, length, and overall condition to determine if guardrail should be upgraded.
2. Upgrade existing Type A guardrail to current standards (refer to Chapter 7) at all locations, except that Type A guardrail in good condition may be used at cul-de-sacs, "T" intersections, and in front of the opening between twin overpassing structures.
3. Upgrade blunt ends and turned down endings to current standard terminals.
4. Connect or upgrade to current standards any unconnected guardrail to bridge railing transitions.
5. If existing bridge railing does not meet AASHTO static load requirements or has an unacceptable crash history, upgrade or retrofit the bridge railing with thrie-beam guardrail to current standards. (Refer to Bridge Design Manual Section 6.05 for any new railing or complete railing replacement).
6. Remove all existing Breakaway Cable Terminals (BCT). Refer to Section 7.01.41B for upgrading guardrail terminal guidelines.

3.11.01C Tree Removal

The AASHTO Roadside Design Guide presents ideal clear zone distance criteria; however, these distances are not always practical in Michigan. Consequently, consider removing trees within the clear zone subject to the following criteria:

1. Where there is evidence of vehicle tree crashes either from actual crash reports or scarring of the trees.
2. Trees in target position on the outside of curves with a radius of 3000 feet or less.
3. Trees that are obstructing adequate sight distance or are particularly vulnerable to being hit at intersections or railroads.
4. Trees that break the continuity of a generally established tree line within the clear zone.
5. Refer to Section 7.01.11B for obstacles inside the calculated project clear zone. Review crash history for need of spot or corridor improvements.

3.11.01D Roadside Obstacles

Consider roadside improvements to enhance safety and mobility for all users. Improvements may include removal, relocation, redesign, or shielding of obstacles such as culvert headwalls, utility poles, and bridge supports that are within the clear zone as referenced in Section 7.01.11C.

Review crash history for guidance on possible treatments. Include in the project those obstacles that are specifically related to crashes or can be economically justified to reduce future risk. Consider blending ends of culverts within the clear zone into the slope. Refer to the MDOT Drainage Manual.

3.11.01E Cross Section Elements

1. For thru lanes, consider relocating the pavement crown to the standard location when the amount of resurfacing is four (4) inches or greater.
2. Consider modifying side slopes to be recoverable (1:6 preferred).

3.12 GUIDELINES FOR PASSING RELIEF LANES

(revised 9-28-2026)

3.12.01 General

The construction of Passing Relief Lanes (PRL) is not intended to connect existing multilane sections but to provide a safe opportunity to pass slower vehicles.

Contact the Geometric Design Unit to assist in project selection, location, and design.

3.12.02 Truck Climbing Lanes

The Highway Capacity Manual (HCM) states that the presence of heavy vehicles on two-way, two-lane highway grades can cause a problem because traffic is slowed and platoons form simultaneously as passing restrictions increase.

A. Warranting Criteria (TCL)

(For Information Only)

Use Design Hour Volumes (DHV) to identify candidate locations. Request specific classification counts when requiring more comprehensive analysis. Consider a combination of the following in identifying the need for a TCL:

1. Upgrade traffic flow rate exceeds 200 vph.
2. Upgrade truck flow rate exceeds 20 vph.
3. One of the following conditions exists:
    a) Level of Service E or F exists on the grade.
    b) A reduction of two or more levels of service is experienced when moving from the approach segment to the grade.
    c) A typical heavy truck experiences a speed reduction of 10 mph or greater on the grade.

B. Location Consideration (TCL)

TCLs should be in areas:

1. On the upgrade side of “critical grades”.
2. Along sections relatively free from commercial or residential development (driveways) and away from major intersections.

C. Design Consideration (TCL)

1. A TCL may be introduced beyond the beginning of the upgrade because the truck speed will not be reduced enough to create undesired conditions for following drivers until it has traveled a certain distance up the grade.
2. Extend TCLs beyond the crest to the point where a truck can attain a speed that is within 10 mph of the speed of other traffic and where decision sight distance is available when approaching the transition (taper) area.
3. The taper length L (feet) is approximately W×S, where W is the shift in feet and S is the posted speed in mph.
4. TCLs should be 12 feet wide.
5. TCL shoulders should be as wide as the shoulders on the adjacent two-lane sections but no less than 4 feet (3 feet paved). Limit 4-foot shoulders to areas where wider shoulders are not feasible or environmental concerns prohibit wider shoulders.

3.12.03 Passing Lane Sections (PLS)

Passing Lane Sections (PLS) along two-way, two-lane rural routes can be desirable even in the absence of “critical grades” required for TCLs. PLSs are particularly advantageous where passing opportunities are limited because of traffic volumes with a mix of recreational vehicles and/or roadway alignment. It is preferable to have a four lane cross section for a PLS where right of way or environmental reviews permit.

A. Warranting Criteria (PLS)

(For Information Only)

Use design hour volumes (DHV) in identifying candidate locations. Request specific classification counts when required for comprehensive analysis. Consider a combination of the following in identifying the need for a PLS:

1. Combined recreational and commercial volumes exceed five percent of total traffic.
2. The level of service drops at least one level and is below Level B during seasonal, high-directional splits.
3. The two-way DHV does not exceed 1200 vph. In situations where volumes exceed 1200 vph, investigate other congestion mitigating measures.

B. Location Considerations (PLS)

PLSs should be in areas:

1. That can accommodate four lanes (PLS for each direction of traffic) to minimize the number of three lane sections.
2. With rolling terrain where vertical grades (even though not considered “critical grades”) are present to enhance:
    a) Visibility to readily perceive both a lane addition and lane drop.
    b) Differential in speed between slow and fast traffic. This occurs on upgrade locations and produces increased passing opportunities.
    c) Slower vehicles regaining some speed before merging by continuing the PLS beyond the crest of any grade.
3. Relatively free of commercial and/or residential development (driveways) and away from major intersections.
4. Where radii of horizontal curves are greater than or equal to 1900 feet.
5. With no restrictions in width resulting from bridges or major culverts, unless structure widening is done in conjunction with PLS construction.
6. That are further than 750 feet from a railroad crossing.
7. Where directional spacing of approximately 5 miles can be maintained.

C. Design Considerations (PLS)

1. The beginning and ending transition (tapers) areas of a PLS should be located where adequate decision sight distance is available in advance.
2. The added lanes should continue over the crest of any grade so that slower traffic can regain some speed before merging.
3. The taper length L (feet) is approximately W×S, where W is the shift in feet and S is the posted speed in mph.
4. PLSs should be 12 feet wide.
5. PLS shoulders should be as wide as the shoulders on the adjacent two-lane sections but no less than 4 feet (3 feet paved). Limit 4-foot shoulders to areas where wider shoulders are not feasible or environmental concerns prohibit wider shoulders.
6. The desirable minimum length of any PLS is 1 mile with an upper limit of about 1½ miles.

3.13 CONSTRUCTION ON EXISTING ROAD CONTROLLING CRITERIA (FREEWAY)

(revised 9-22-2025)

3.13.01 Geometric Controlling Criteria

(revised 9-22-2025)

The criteria in Appendix 3A provides the dimensional targets to be used for the geometric controlling criteria if existing geometrics are unable to be retained for Freeway Construction on Existing Road project types (Refer to Section 03.08.01B). Improve the necessary geometric elements; it is possible that projects may require a combination of improvements.

Some geometric elements may be divided into Urban and Rural areas (Refer to Section 3.02) These definitions are provided as guidance only; specific project context will be established by the Project Manager and project team.

3.13.02 Design Exceptions / Design Variances

(revised 12-22-2025)

When the geometric controlling criteria are unable to be met or retained for the specific elements requiring improvement, request a Design Exception or Variance in accordance with Section 3.08.01E. Refer to Section 3.06 for posted speeds that have changed since the most recent reconstruction.

3.14 NEW CONSTRUCTION AND RECONSTRUCTION CONTROLLING CRITERIA (FREEWAY)

(revised 9-22-2025)

3.14.01 Geometric Controlling Criteria

(revised 9-22-2025)

The criteria in Appendix 3A provide the dimensional requirements to be used for the geometric controlling criteria for both Freeway New Construction and Reconstruction project types. Design criteria for freeways are established in the AASHTO publications A Policy on Design Standards Interstate System and A Policy on Geometric Design of Highways and Streets.

Use Standard Plan R-107-Series to upgrade freeway projects as directed by the AASHTO project type. When it is not possible to use Standard Plan R-107-Series, use the straight-line method on a curve-by-curve basis. Refer to Section 3.04.03. A Design Exception or Design Variance is required if neither of these options can be met.

Some geometric elements may be divided into Urban and Rural areas (Refer to Section 3.02) These definitions are provided as guidance only; specific project context will be established by the Project Manager.

3.14.02 Design Exceptions / Design Variances

(revised 12-22-2025)

Design Exceptions or Design Variances are required for both New Construction and Reconstruction project types whenever the design criteria in Appendix 3A cannot be met for controlling design elements. Refer to Section 3.08.01E.

3.15 ADDITIONAL FREEWAY DESIGN CRITERIA

(revised 9-22-2025)

3.15.01 General

(revised 9-22-2025)

Deviation from the additional design criteria presented in this section does not require Design Exceptions or Design Variances, as these are not geometric controlling criteria.

3.15.01A Signing

Contact the Region/TSC Traffic and Safety Engineer to identify desirable enhancements and sign upgrading needs.

3.15.01B Ramp Geometrics, Acceleration/Deceleration Lanes, and Taper Lengths

Analyze the need for additional lanes on the ramp terminals (both off and on) for capacity improvements and associated safety impacts with the additional lanes and with consideration for the existing intersection control method (off ramps). Check radii for adequacy. Flatten gore areas where feasible.

3.15.01C Vertical Curbs

Remove vertical curb on freeway mainlines, high-speed turning roadways, and collector-distributor roads. Additionally, remove vertical curb on other ramps for a minimum distance of 200 feet from the 2-foot point.

3.15.01D Crown Location/Pavement Cross Slope

For thru lanes, consider relocating the pavement crown to the left edge of the outside lane when the amount of resurfacing is four inches or greater. Where less than four inches, retain the crown point but establish or maintain a 2.0% cross slope. Obtain a 2.0% cross slope by reducing thickness on the median lane; however, this may not be feasible when the entire pavement is sloped in one direction. The desirable rollover or algebraic difference between the pavement and shoulder cross slopes is six percent or less. Maximum rollover between lanes is five percent. Refer to Section 6.03.04B(1).

3.15.01E Guardrail and Concrete Barrier

Shield piers and other obstacles near the center of medians that are 70 ft.-0 in. or less in width (edge to edge) from both sides. Refer to Standard Plan R-56-Series. Shield obstacles in the median near the edge of pavements from the near side; the far side will be shielded on a case-by-case basis as determined by the Geometric Design Unit.

When it is not possible to maintain both current guardrail offsets and the required distance from shoulder hinge line to the front face of the guardrail post, the additional offset between the guardrail and pavement edge takes precedence. The shoulder width can be maximized by using longer posts and relocating the guardrail to the shoulder hinge line. Refer to Section 7.01.41D.

Included in Section 7.01.12 are guardrail types for upgrading freeways when replacing entire runs.

The need for median barrier will be reviewed with the Geometric Design Unit.

The elimination of guardrail must be considered when slopes can be economically flattened or where fixed objects can be removed or relocated outside the clear zone.

3.15.01F Attenuation

Where physical conditions prohibit the use of barriers, but shielding is needed, install attenuation devices. Contact the Geometric Design Unit for attenuation design.

3.15.01G Clear Zones & Fixed Objects

Refer to Section 7.01.11 for the current clear zone criteria to be used when upgrading freeways. Shield or remove obstacles within the clear zone. Remove obstacles beyond these limits but within the recovery area as determined by the Geometric Design Unit.

3.15.01H Culvert End Treatments

Replace existing culvert ends within the clear zone on projects with sloped-end sections in accordance with the MDOT Drainage Manual.

3.15.01I Bridges

Contact the Structure Design Section in the Bureau of Bridges and Structures (BOBS) for any additional requirements.

3.16 UNDERCLEARANCES - VERTICAL CLEARANCE ANALYSIS

(revised 9-22-2025)

In addition to a Design Exception, a vertical clearance analysis is required when the minimum underclearance in Section 7.01.08 of the Bridge Design Manual is unable to be obtained for Freeway New Construction and Reconstruction project types.

A vertical clearance analysis includes the following:

- A determination of the most effective means of obtaining the vertical clearance standard that contains:
    - A benefit/cost analysis to achieve the standard, either in full or with incremental progress.
    - The alternatives of obtaining all vertical clearances with the road project, a bridge project, or some combination of road and bridge work to meet the clearance requirements.
    - Preliminary grades for the bridge and approaches, the route under the structure, and ramps if appropriate.
- Location of existing structure foundations related to the proposed grade changes.
- Impact evaluation on existing drainage.
- Evaluation of other deficient geometric features.
- Determination of ROW needs.
- Impacts on the environment.
- Cost estimates for alternatives to meet vertical clearances.
- Proposed time frame when the remainder of vertical clearance will be achieved (rough estimate).
- Crash analysis where appropriate.
- Soils (cut and fill information) and ground water information.
- Impact on local businesses and residences.
- User costs, constructability, maintaining traffic scheme, and maintenance cost.

Complete the vertical clearance analysis as early as possible, preferably during project scoping. This information is also required if a Design Exception is submitted.

3.17 PERFORMANCE BASED-PRACTICAL DESIGN

(revised 9-22-2025)

Performance Based Practical Design (PBPD) is a decision-making approach that uses quantitative analyses to guide decision-making through the project development process. It is the combination of Practical Design and Performance-Based Design encompassing the what (economic efficiency) and the how (performance-based, data-driven methodology), either of which is incomplete without the other.

The general premise of PBPD is that proposed improvements should be targeted and right sized based on project specific goals and needs. This philosophy places less emphasis on strict adherence to standards and more significance on safety and mobility performance. PBPD can be utilized in every step of the project development process from planning/scoping to final design. While applicable to any project and can occur at various phases of the project development process some projects will have limited application while more complex such as a total reconstruction will have more opportunities for PBPD applications.

PBPD is a design up philosophy that makes the necessary improvements to a roadway or structure to address specific performance issues. The goal of PBPD is to fix what is broken and to not unnecessarily spend scarce resources solely for the purpose of meeting published standards when those deficient features defined per standards and guidance are not causing safety, mobility, reliability or similar problems. By scrutinizing each element of a project's scope relative to value, need, and urgency, a PBPD approach seeks a greater return on infrastructure investments.

The building blocks of PBPD will be as follows:

- Safety will not be compromised.
- For most projects, the minimum design will be the existing condition.
- Project scoping should focus on addressing specific problems supported by data.
- Design solutions should focus on adherence to the project's scoping package.
- Solutions should be an optimized combination of mobility, operations, and other modes.
- Designs should be consistent with the context of the corridor.
- Designs should strive to maximize benefit/cost.

Appendix 3A Geometric Design Elements – New Construction / Reconstruction

<table>
<tr><th>Element</th><th></th><th>Urban</th><th colspan="5">Rural</th></tr>
<tr><td rowspan="3">Design Speed</td><td>Freeway</td><td>55 mph minimum but not less than posted speed.</td><td colspan="5">The greater of posted speed, or 70 mph.</td></tr>
<tr><td>Non-Freeway (Arterial)</td><td>30 mph but not less than posted speed.</td><td colspan="5">The greater of posted speed, or 50 mph minimum.</td></tr>
<tr><td>Collector Roads</td><td>Posted speed (minimum).</td><td colspan="5">Posted speed (minimum).</td></tr>
<tr><td rowspan="4">Lane Width</td><td>Freeway</td><td>12 ft.</td><td colspan="5">12 ft.</td></tr>
<tr><td>Non-Freeway (Arterial)</td><td>12 ft. lanes are desirable and should be used where practical, especially on high-speed arterials. Where 12 ft. lanes are not practical, 11 ft. lanes are often used.

Lane widths of 10 ft. may be used in more constrained areas where truck and bus volumes are relatively low, and speeds are less than 35 mph. Auxiliary lanes may be 10 –12 ft.

12 ft. lanes on the National Network (NN). Refer to 3.08.01G for retention or reduction of existing National Network lane widths.</td><td>Design Speed, (mph)</td><td colspan="4">Minimum Lane Width, ft.
ADT, vehicles/day</td></tr>
<tr><td></td><td>Under 400</td><td>400 to 2000</td><td>Over 2000</td></tr>
<tr><td></td><td>40
45
50
55
60
65
70
75</td><td>10
10
11
11
11
11
11
11</td><td>11
11
11
12
12
12
12
12</td><td>12
12
12
12
12
12
12
12</td></tr>
<tr><td rowspan="2">Collector Roads</td><td>Through lanes & Auxiliary lanes, 10-12 ft.

Industrial Areas 12 ft., but where right-of-way is restricted, 11 ft.</td><td>Design Speed, (mph)</td><td colspan="4">Minimum Lane Width, ft.
ADT, vehicles/day</td></tr>
<tr><td>Where shoulders are used, see guidelines for Rural Collectors ☞</td><td></td><td>Under 400</td><td>400 to 2000</td><td>Over 2000</td></tr>
<tr><td></td><td>20
25
30
35
40
45
50
55
60
65</td><td>10
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10
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11</td><td>10
10
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11
11</td><td>11
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11*
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11*</td></tr>
<tr><td colspan="5">*Consider using 12 ft. with substantial truck volumes or frequent agricultural equipment use.</td></tr>
</table>

<table>
<tr><th>Element</th><th></th><th colspan="5">Urban & Rural</th></tr>
<tr><td rowspan="11">Shoulder Width</td><td rowspan="3">Freeway</td><td colspan="2">Mainline</td><td colspan="3">Ramp (one lane and two lanes)</td></tr>
<tr><td>Median</td><td>Outside</td><td>Left</td><td colspan="2">Right</td></tr>
<tr><td>8 ft. (4ft. paved minimum)
(8 ft. paved at bridge and barrier sections)

For 6 or more lane sections (3 or more lanes directional) use 10 ft. paved minimum and consider 12 ft. paved where truck traffic exceeds 250 DDHV.</td><td>10 ft. minimum (paved)

Consider using 12 ft. paved where truck traffic exceeds 250 DDHV.</td><td>6 ft. (4 ft. paved minimum)</td><td colspan="2">8 ft. (7 ft. paved minimum)</td></tr>
<tr><td colspan="5">See Appendix 6-A for shoulder width dimensions in relation to various freeway and ramp cross section elements (edge of lane, hinge point, etc.).</td></tr>
<tr><td rowspan="4">Non-Freeway (Arterial)</td><td colspan="2">Urban</td><td colspan="3">Rural</td></tr>
<tr><td colspan="2" rowspan="3">In those instances where sufficient right-of-way exists to include shoulders, refer to the guidance for non-freeway rural shoulders.*
☞</td><td colspan="3">Minimum paved shoulder, ft. for specified ADT, vehicles/day
Undivided Roadways*</td></tr>
<tr><td>Under 400</td><td>400 to 2000</td><td>Over 2000</td></tr>
<tr><td>4</td><td>6</td><td>8</td></tr>
<tr><td colspan="5">Use 8 ft. right and 4 ft. left for divided arterials.
Use full width (8 ft.) on both sides of divided arterials with 3 lanes in each direction.

For new construction and reconstruction and when feasible on shoulder widening, the paved shoulder is extended with 1 ft. of aggregate to the shoulder hinge for stabilization.</td></tr>
<tr><td colspan="5">A minimum 4 ft. (3 ft. paved) shoulder or curb and gutter is acceptable adjacent to right turn lanes.
* Minimum shoulder widths apply for posted speeds greater than 45 mph. At lower speeds, minimum shoulders are desirable.</td></tr>
<tr><td rowspan="4">Collector Roads</td><td colspan="2" rowspan="4">Where shoulders are used, refer to requirements for rural arterials.
☞</td><td colspan="3">Minimum shoulder, ft. for specified ADT, vehicles/day</td></tr>
<tr><td>Under 400</td><td>400 to 2000</td><td>Over 2000</td></tr>
<tr><td>2</td><td>4</td><td>6</td></tr>
<tr><td colspan="3">The above ranges apply on uncurbed roads and when shoulders are feasible on curbed roads. A minimum paved width of 1 ft. is desirable.</td></tr>
</table>

<table>
<tr><th>Element</th><th></th><th colspan="2">Urban & Rural</th></tr>
<tr><td rowspan="5">Design Loading Structural Capacity
(Also see Bridge Design Manual)</td><td>Freeway</td><td colspan="2">HL93-Mod/ HS-25</td></tr>
<tr><td rowspan="4">Non-Freeway</td><td>State Trunkline</td><td>HL93-Mod/ HS-25</td></tr>
<tr><td>Local Roads Over Freeways and State Trunkline</td><td>HL93-Mod/ HS-25</td></tr>
<tr><td>Local Roads and Streets</td><td>Design according to county or city standards,
HL93-Mod/ HL93/ HS-20 minimum.</td></tr>
<tr><td colspan="2">Use HL93-Mod/ HS-25 for all structures in an interchange regardless of route type</td></tr>
<tr><td rowspan="5">Horizontal Curve Radius</td><td>Freeway</td><td colspan="2" rowspan="5">See Standard Plan R-107-Series and Section 3.04.03</td></tr>
<tr><td>Non-Freeway (Arterial)</td></tr>
<tr><td>Collector Roads</td></tr>
<tr><td>Non-Freeway (Arterial)</td></tr>
<tr><td>Collector Roads</td></tr>
</table>

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Element			Urban & Rural																
Maximum Grade			Maximum Grade (%) for specified design speed (mph)																
	Freeway	Type of Terrain	50		55		60		65		70		75						
		Level	4		4		3		3		3		3						
		Rolling	5		5		4		4		4		4						
			Grades 1% steeper may be provided in urban areas.																
	Non-Freeway (Arterial)	Type of Terrain	Urban							Rural									
			30	35	40	45	50	55	60	40	45	50	55	60					
		Level	7	7	7	6	6	5	5	5	5	4	4	3					
		Rolling	9	8	8	7	7	6	6	6	6	5	5	4					
	Collector Roads	Type of Terrain	Urban									Rural							
			20	25	30	35	40	45	50	55	60	20	25	30	35	40	45	50	55	60
		Level	9	9	9	9	9	8	7	7	6	7	7	7	7	7	7	6	6	5
		Rolling	12	12	11	10	10	9	8	8	7	10	10	9	9	8	8	7	7	6

Stopping Sight Distance	Follow 2018 7th Edition of AASHTO "A Policy on Geometric Design of Highways and Streets" (AKA AASHTO Green Book). The MDOT Sight Distance Guidelines also provide detailed information on sight distance calculation.		
Cross Slope	Traveled way cross slope = 2.0%, Paved shoulder cross slope = 4.0% (Also see Section 6.05.05)		
Superelevation Rate	AASHTO Method 5 "Curvilinear Relation" is used for new construction/reconstruction. Maximum rate of 7%. (See Standard Plan R-107-Series.)		
	AASHTO Method 1 "Straight Line Relation" is allowed when Method 5 is not feasible. Maximum rate of 6%. (See Section 3.04.03)		
	The above methods also apply to urban freeways and urban ramps, except the maximum rate is 5% for 60 mph design speed.		
Vertical Clearance		**NHS**	**Non NHS**
	Freeway	16 ft.-0 in.	14 ft.-6 in.
	Non-Freeway (Arterial)	16 ft.-0 in.	14 ft.-6 in.
	Collectors & "Special Routes"	14 ft.-6 in. (1 ft. greater than Michigan legal vehicle height.)	14 ft.-6 in.
	For pedestrian bridges provide 1 ft. additional clearance over non-freeway and 17 ft. minimum under clearance over freeways. A vertical clearance of 23 ft.-0 in. is required for grade separations over railroads. *(See Bridge Design Manual 7.01.08 and Bridge Design Guides 5.24.03-04.)*		

Appendix 3B National Network – Federally-Designated Routes

Route	From	To
I-75 Conn	US 24BR Pontiac	I-75
US 2	WI State Line Ironwood	WI State Line S. of Crystal Falls
US 2	WI State Line Iron Mountain	I-75 St. Ignace
US 8	US 2 Norway	WI State Line
US 10	Ludington	I-75 Bay City
US 12	IN State Line	I-94 W. Jct. Ypsilanti
US 23	OH State Line	I-75 Mackinaw City
US 24	OH State Line	MI 15 Waterford
US 24BR	US 24 S. of Pontiac	MI 1 Pontiac
US 27	IN State Line	I-75 S. of Grayling
US 31	IN State Line	I-75 Mackinaw City
US 33	IN State Line	US 12 Niles
US 41	WI State Line	Houghton
US 45	WI State Line	MI 26 Rockland
US 127	OH State Line	I-69/US 27 N. of Lansing
US 131	IN State Line	US 31 Petoskey
US 141	WI State Line S. of Crystal Falls	US 41/MI 28
US 223	US 23	US 12/127 Somerset

Route	From	To
MI 10	I-375 Detroit	Orchard Lake Road
MI 13	I-69 Lennon	I-75 Saginaw (via MI 81)
MI 13	I-75 Kawkawlin (via I-75 Conn.)	US 23 Standish
MI 14	I-94 Ann Arbor	I-96/275 Plymouth
MI 15	US 24 Clarkston	MI 25 Bay City
MI 18	US 10	MI 61 Gladwin
MI 20	US 31 New Era	MI 37 White Cloud
MI 20	US 27 Mt. Pleasant	US 10 Midland
MI 21	I-96 near Grand Rapids	I-69 Flint
MI 24	I-75 Auburn Hills (via I-75 Conn.)	I-69 Lapeer
MI 24	MI 46	MI 81 Caro
MI 26	US 45 Rockland	MI 38
MI 27	I-75	US 23 Cheboygan
MI 28	US 2 Wakefield	I-75
MI 32	Hillman	Alpena
MI 33	Mio	Fairview
MI 35	US 2/41 Escanaba	US 2/41 Gladstone
MI 36	US 127 Mason	Dansville

Route	From	To
MI 37	MI 55	US 31/MI 72 Traverse City
MI 37	I-96 Grand Rapids	MI 46 Kent City
MI 38	US 45 Ontonagon	US 41 Baraga
MI 39	I-75 Lincoln Park	MI 10 Southfield
MI 40	MI 89 Allegan	US 31 BR/I-196BL Holland
MI 43	MI 37 Hastings	US 127 Lansing
MI 46	US 131 Howard City	MI 25 Port Sanilac
MI 47	I-675 Saginaw (via MI 58)	US 10
MI 50	MI 43/66 Woodbury	MI 99 Eaton Rapids
MI 50	US 127 S. Jct	I-75 Monroe
MI 51	US 12 Niles	I-94
MI 52	OH State Line	US 12 Clinton
MI 52	I-96 Webberville	MI 46 W. of Saginaw
MI 53	MI 3 Detroit	MI 25 Port Austin
MI 55	US 31 Manistee	I-75
MI 55	MI 65	US 23 Tawas City
MI 57	US 131 N. of Rockford	US 27
MI 57	MI 52 Chesaning	I-75 Clio
MI 59	US 24 BR Pontiac	I-94

Route	From	To
MI 60	MI 62 Cassopolis	I-69/US 27
MI 61	MI 115	US 27 Harrison
MI 61	MI 18 Gladwin	US 23 Standish
MI 63	US 31 Scottdale	I-196
MI 65	US 23 Omer	MI 55
MI 65	MI 72 Curran	MI 32
MI 65	Posen	US 23 N. of Posen
MI 66	IN State Line	US 12 Sturgis
MI 66	Battle Creek	MI 78
MI 66	MI 43/50 Woodbury	MI 46 Edmore
MI 67	US 41 Trenary	MI 94 Chatham
MI 68	US 31/131 Petoskey	US 23 Rogers City
MI 69	US 2/141 Crystal Falls	MI 95 Sagola
MI 72	US 31/MI 37 Traverse City	US 23 Harrisville
MI 77	US 2	MI 28 Seney
MI 78	MI 66	I-69 Olivet
MI 81	MI 24 Caro	MI 53
MI 82	MI 37 S. Jct. Newago	US 131

Route	From	To
MI 83	Frankenmuth	I-75
MI 84	I-75	MI 25 Bay City
MI 89	MI 40 Allegan	US 131
MI 94	US 41	MI 28 Munising
MI 95	US 2 Iron Mountain	US 41/MI 28
MI 104	US 31 Grand Haven	I-96
MI 115	US 27	MI 22 Frankfort
MI 117	US 2 Engadine	MI 28
MI 123	I-75 N. of St. Ignace	MI 28
MI 142	MI 25 Bay Port	MI 53
MI 205	IN State Line	US 12 W. of Union

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CHAPTER 4 • DRAINAGE

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4.01.01 References

4.01.03 General Procedures

4.02 STORM SEWER DESIGN

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4.02.21 Storm Sewer Soil Borings

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4.03.04B Storage Basins

4.03.04C Catch Basin Sumps

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4.05 DESIGN CRITERIA FOR ROADWAY CULVERTS

4.05.02 Culvert Pay Lengths

4.05.08 Estimating Peak Flows for Culverts

4.05.08A EGLE's Soil Conservation Service (SCS) Method

4.05.08B The Rational Method for Estimating Peak Flows for Culverts

4.05.10 Hydraulic Analysis Data and Soil Borings on Plans

4.05.12 Bedding and Filling Around Pipe Culverts

4.05.12A Trench Installation

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4.06 UNDERDRAINS

4.06.01 Purpose of Underdrains

4.06.02 Bank Underdrains

4.06.03 Subgrade and Subbase Underdrains

4.06.04 Open-Graded Underdrains

4.06.05 Underdrain Outlets & Outlet Endings

4.06.06 Stone Baskets

4.06.07 Underdrain in Roundabouts

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Sections in MDOT Drainage Manual

The following list includes sections moved from the Road Design Manual to sections within the MDOT Drainage Manual. Some topics listed, remain in the Road Design Manual but are supplemented by discussions in the MDOT Drainage Manual.

TOPIC	LOCATION IN MDOT DRAINAGE MANUAL
GENERAL INFORMATION	Chapter 2 – Legal Policy and Procedures
Glossary	Glossary
General Procedures	Section 2.5.1
Legal Precedent to Discharge Surface Water	Section 2.5.2
Types of Right-of-Way Easements or Conveyance for Drainage	Section 2.5.3
Drainage Considerations	Section 2.5.4
Drainage Conditions and Participation with Local Agencies/Private Entities	Section 2.5.4.1
Participation Agreements & Costs	Section 2.5.4.2
Intracounty and Intercounty Drainage Systems for State Trunkline Storm Water	Section 2.5.5
Relocation of Existing Drainage Course	Section 2.5.6
Relocation of Field Tile Drains	Section 2.5.7
Design Procedures for Unknown Field Tile Locations	Section 2.5.8
STORM SEWER DESIGN	Chapter 7 – Road Storm Drainage Systems
General	Sections 7.1, 7.3.9, and 7.4.8.3
Storm Sewer Design Criteria and Procedure	
Roadways with Enclosed Drainage	Section 7.4.1
Depressed Roadways	Section 7.4.2
Design Velocity	Section 7.4.8.4
Hydraulic Grade Line	Sections 7.2, 7.4.9.1, and 7.4.8.4
Rational Method	Sections 7.4.9.7, 3.4.3, 3.4.1.4, and Table 3-1
Rainfall-Frequency Zones	Appendix 3-B
Rainfall-Intensity-Duration Tables	Appendix 3-B
Solving Manning's Formula	Section 7.4.8.2 and Table 7-5

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TOPIC	LOCATION IN MDOT DRAINAGE MANUAL
Design Factors for Storm Sewers	Section 7.3.2
Steps in the Design of Storm Sewers using Rational Method	Sections 7.4.9.7 and 7.4.8.2
Tabulation Sheet for Computing Storm Sewers	Table 7-9
Hydraulic Elements of Channel Sections Chart	Section 7.4.8.2
Factors in Locating Catch Basins or Inlets	Section 7.4.5
Factors in Locating Manholes	Section 7.4.7.1
Numbering Drainage Structures	Section 7.4.7.3
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Considerations	Section 7.4.7.3
Measurement and Payment	Section 7.4.7.3
Storm Sewer Pipe Classification and Usage Guidelines	Section 7.4.8.1
Jacked-in-Place Sewers	Section 7.4.8.1
Storm Sewer Soil Borings	Section 7.4.8.1
Storm Sewer Pipe - Curved	Section 7.4.8.5
DRAINAGE OUTLETS	Chapter 2 – Legal Policy and Procedures Chapter 8 – Stormwater Storage Facilities Chapter 9 – Stormwater Best Management Practices (BMP)
Acceptable Drainage Outlets	Sections 8.1.1 and 2.2.1
Unacceptable Drainage Outlets	Section 8.1.1
Retention/Detention Systems	Section 8.3.1
Design Guidelines to Reduce Impacts of Nonpoint Source Pollution on Receiving Waters	Sections 8.3.2 and 9.3.3
Detention Basins	Section 8.4.1
Infiltration Systems	Section 8.4.4
Storm Water Runoff Detention Basin Design Guides	Section 8.4.1
Design Considerations	Section 8.4.1.1
Design Procedures	Section 8.4.3
DITCHES	Chapter 4 – Natural Channels and Roadside Ditches
Roadway Drainage Ditches	Sections 4.4.3.2.1 and 4.4.3.2.3
Standard Ditches	Section 4.4.3.2.2

TOPIC	LOCATION IN MDOT DRAINAGE MANUAL
Round Bottom Ditch	Section 4.4.3.2.2
Berm or Swamp Ditch	Section 4.4.3.2.2
Independent Ditches	Section 4.4.3.2.2
Toe of Slope Ditch	Section 4.4.3.2.2
Valley and No-Ditch Sections	Section 4.4.3.2.2
DESIGN CRITERIA FOR ROADWAY CULVERTS	Chapter 3 – Hydrology Chapter 5 – Culverts
MDOT and FHWA Requirements	Section 5.3.2
Roadway Culvert Size Determination	Sections 5.3.3 and 5.3.4
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CHAPTER 4 • DRAINAGE

4.01 GENERAL INFORMATION

4.01.01 References

(revised 4-22-2019)

A. Computing Flood Discharges for Small Ungaged Watersheds, EGLE, (rev. 2008)

B. Concrete Pipe Design Manual, American Concrete Pipe Association, (June 2000)

C. Concrete Pipe Handbook, American Concrete Pipe Association, (January 1988)

D. Hydrology, Section 4, National Engineering Handbook, Soil Conservation Service

E. MDOT Drainage Manual, Current Edition

4.01.03 General Procedures

(revised 8-26-2019)

See Drainage Manual Section 2.5.1.

At the time the line and grade of new roadways (including pathways and sidewalks) or the extent and limits of a widening or reconstruction project are determined, a careful engineering study and design must be made concurrently for surface and subsurface drainage. Highway drainage design involves two basic operations: estimating peak flows of runoff and designing a conveyance system.

Detailed hydrologic and hydraulic design guidelines are presented in the MDOT Drainage Manual. For specific information contact the Design Engineer - Hydraulics.

4.02 STORM SEWER DESIGN

4.02.15 Sewer Bulkheads Title Sheet

(revised 7-10-2006)

Only sewer bulkheads larger than 12" in diameter will be measured for payment. The cost of placing sewer bulkheads 12" in diameter and less will not be paid for separately but payment for the work will be considered as having been included in the contract unit prices bid for other contract items. The sewer bulkhead location should be shown on the plans.

4.02.18 Storm Sewer Under Structures

(revised 11-28-2011)

Storm sewers within the stress influence of the footings shall be protected by concrete encasement or other approved methods. If the designer has any question about which the stress influence lines in a particular structure, he should contact the Geotechnical Services Unit of Construction Field Services Division.

4.02.20 Jacked-in-Place Sewers

(revised 4-20-2015)

See Drainage Manual Section 7.4.8.1.

At times it may be necessary to install sewer pipe by jacking or tunneling methods. A sewer installed by jacking or tunneling may be considered a special design, therefore a request to determine the design of the pipe should be made to the Design Engineer - Municipal Utilities. However, some general jacking information for designers is listed below.

1. The smallest practical pipe size that can be jacked is 36" in diameter. However, a smaller size pipe may be inserted inside a jacked casing and the void outside the sewer filled with a flowable fill.
2. Concrete pipe is to be specified when jacking a storm sewer.
3. If circumstances require jacking a pipe smaller than 36", a C76 Wall Class 5 pipe shall be specified.
4. Jacking a storm sewer will normally be more economical than an open trench installation when either the fill height exceeds approximately 16' or maintaining traffic is beneficial. The situation should be reviewed at The Plan Review Meeting and a recommendation provided to the designer.
5. Jacking will usually continue on a 24-hour-per-day operation due to the pipe's tendency to set up if the jacking operation is interrupted for more than a few hours
6. Jacking is usually done from the low side up grade to allow water to drain out during the jacking operation. However, it may also be done by jacking down grade, which allows for better control of the pipe grade due to the weight of the pipe.

7. Pipe that is being jacked is subjected to vertical loads from the weight of earth and horizontal loads from the jacking pressure. The resultant vertical earth load on a horizontal plane at the top of the bore is a function of the weight of earth above the bore minus the upward friction forces, minus the cohesion of the soil along the limits of the prism above the bore.

    a. The vertical load from the weight of earth and possible live load will determine the class of pipe to be specified.

    b. The cross-sectional area of the concrete pipe is adequate to resist axial compression from jacking, and unless unusual circumstances exist, little or no gain is accomplished in increasing crushing resistance by specifying a higher class of concrete pipe than required for vertical loads.

    c. Soil borings are required when storm or culvert pipe is installed by jacking or tunneling. Contact, coordination, and follow up with the Region/TSC Soils Engineer as described in the following section is important in reducing potential risks to the operation.

4.02.21 Storm Sewer Soil Borings

(revised 11-28-2011)

The plans and specifications do not automatically provide for the additional work required to install sewers through areas of unstable soils. Therefore, soil borings must be obtained and shown on the plans to identify where remedial treatment is necessary. Corrective treatment usually means undercutting and backfilling. Also, in areas having a high water table, a well point system may sometimes be considered. The designer should use the following procedures.

1. The need for soil borings should be discussed at the scope verification meeting. The Project Manager should provide the Region/TSC Soils Engineer with any necessary information for locating proposed sewer lines. The Region/TSC Soils Engineer will then provide the Project Manager with pertinent soils data and recommendations.

2. Follow up requests to be sure soil borings are received. The complete boring data shall be made part of the plans and proposal. The data report will include the log of borings, the complete shear report, the weight and moisture report, as well as a plot of the shear strength. The report by the Geotechnical Services Unit, Construction Field Services Division can be reproduced on a plan sheet.

3. When unstable soils are encountered, the Designer and the Geotechnical Services Unit, Construction Field Service Division engineers should confer to determine the best method of correction.

4. Estimated quantities for the correction should be included in the plans.

5. Where unstable soil conditions, or obstructions other than rock, require excavation of the sewer trench below the elevation shown on the plans, such excavation shall be made to the dimensions authorized by the Engineer. The pay item "Trench Undercut and Backfill" is used to pay for this excavating and backfilling of the trench with a specified aggregate up to the bottom of the trench elevation on the plans. Many jobs will include short runs of relatively shallow depth sewers where undercutting is unnecessary, therefore, the designer will have to make some judgement when requesting soil borings.

4.02.22 Storm Sewer Pipe - Curved

(revised 7-10-2006)

See Drainage Manual Section 7.4.8.5.

Curved pipe, if necessary, needs to be reviewed and approved by the Design Engineer - Municipal Utilities.

4.03 DRAINAGE OUTFALLS

4.03.04 Design Guidelines to Reduce Impacts of Nonpoint Source Pollution on Receiving Waters

(revised 4-28-2025)

See the MDOT Drainage Manual and MDOT Stormwater Treatment Manual for additional information and requirements.

MDOT is regulated and permitted as a municipal separate storm sewer system (MS4) under the National Pollutant Discharge Elimination System (NPDES) program. The permit requires inclusion of stormwater control measures (SCMs) that provide water quality treatment and volume control to address the long-term impacts of stormwater discharges from state highways to waters of the state. As such, any project that meets the following criteria requires SCMs:

- Has an acre or more earth disturbance, discharges to a water of the state, and modifies the drainage system

Or

- Falls within a watershed with an established total maximum daily load (TMDL) for a pollutant

Volume control SCMs are required when the above conditions are met and the project increases imperviousness, either by the addition of new pavement or the conversion of land to a more impervious condition. Some receiving waterbodies are exempt from volume control requirements. See the Stormwater Treatment Manual for additional information.

Site constraints may preclude the inclusion of SCMs on a project. In these cases, the project must follow the maximum extent practicable (MEP) process that documents what treatment was provided and why the total treatment is less than what is required by the MS4 permit. Use Form 2650 when proceeding with the MEP process. Additionally, the Designer must work with the Environmental Services Section to obtain environmental clearance on stormwater as part of the projects NEPA review.

The following general guidelines for controlling stormwater runoff are applicable to virtually all highway situations. There are many drainage design practices that have significant potential for reducing pollutant loads from highway stormwater runoff. The principal concepts to be considered when designing highway systems include:

1. ***Eliminate direct discharges*** – Prioritize eliminating direct discharges of untreated highway stormwater runoff to receiving waters (including groundwater). Route highway stormwater runoff through one or a combination of SCMs including: vegetated ditches, detention basins, infiltration systems, or hydrodynamic separators prior to discharge to receiving waters.

   Eliminate drains along bridge decks over water and unstabilized soil.

2. ***Keep runoff velocity at a non-erosive level*** - Reduce the runoff velocity to a non-erosive level to decrease the transport of sediment. The methods for reducing the runoff velocity include reducing gradients, installing velocity reduction devices (such as: permanent check dams, drop structures, baffles, basins and diversions), and by using vegetative controls (vegetated ditches and swales).

3. ***Maintain existing discharge rates and volumes*** – Projects that add imperviousness, by adding lanes, paving shoulders, or change drainage routing can increase the rate of stormwater runoff or the discharge volume to the receiving waterbody. Include SCMs to maintain the existing (pre-project) discharge rate and volume over a range of flows to the MEP. Applicable SCMs include detention and infiltration basins. Permanent check dams may be used when there is only a small increase in the discharge rate or volume.
4. ***Meet MS4 treatment criteria*** – Projects that disturb more than 1 acre, have a discharge to a water of the state, and work is being done on the drainage system are required to provide post construction SCMs to treat the long-term stormwater runoff impacts of the project on water quality and water quantity. Projects may use the established MEP process when site constraints preclude the inclusion of SCMs. See the Stormwater Treatment Manual for additional information on how project type affects water quality and channel protection treatment requirements as well as information on the MEP process.
5. ***Label outfalls*** – Follow the provisions in the Standard Specifications for Construction and label all MDOT stormwater outfalls with a direct discharge to a water of the state. Any new, not reconstructed, outfalls included as part of the project must be authorized by EGLE. Contact the Stormwater Program Manager for assistance.

Sediment is transported along the pavement, curbs, and shoulders as suspended solids. The following water quality treatment SCMs are intended to reduce the volume of suspended solids available for transport by runoff.

4.03.04A Vegetative Controls

Vegetative controls that include grassed channels, filter strips, and shallow overland flow, work by reducing the velocity of the surface flow or channel flow allowing sediment and suspended solids to settle out. Since sediments can contain attached pollutants, these pollutants may be reduced prior to entering the receiving waterbody if the velocity of runoff is slowed over an adequate length of vegetation.

Vegetated controls can be applied wherever suitable land area is available. Vegetative controls are adaptable to a variety of site conditions, are flexible in design and layout, and are the least costly management procedure. Vegetative controls can be used as sole management measures or in conjunction with other measures.

Maximize the use of vegetative controls where possible. A vegetated ditch with a length of at least 200 feet has been shown to be very effective in removing suspended sediment. Sediment removal may be increased on vegetated ditches that are less than 200 feet in length by adding permanent check dams. Sediment removal using vegetative control is consistently effective.

4.03.04B Storage Basins

Storage basins are constructed to either temporarily store stormwater runoff and release it at a rate consistent with conditions prior to construction (detention basin) or remove the stored water from the system (infiltration basins). Storage basins provide volume control and water quality treatment.

Detention basins are utilized in areas where:

1. Suitable depressions occur or can be constructed, and where acceptable inflow and outflow conditions can be achieved.
2. Soils are able to provide a stable embankment.
3. Storage to detain the runoff volume from a specified storm event of the contributing drainage area is available.

Infiltration basins are utilized in areas where:

1. Soil/subsoils have acceptable permeability. Review criteria in the Geotechnical Manual and contact the Region/TSC Soils Engineer for assistance for obtaining a percolation test and soil gradation.
2. The seasonal high groundwater table is the appropriate depth below the bottom of the basin. See the Drainage Manual and Stormwater Treatment Manual for additional guidance.
3. Pretreatment will be used to minimize the amount of sediment entering the basin.
4. There is sufficient storage for the runoff volume to be stored and drained from the basin within the acceptable draw down time.

4.03.04C Catch Basin Sumps

Catch basins are a main point of stormwater entry into enclosed storm sewer systems. Catch basins with sumps, as shown in Standard Plan R-1-Series, allow for collection of coarse sediments and space for some suspended solids to settle out before reaching the outfall. They are primarily used on enclosed systems and provide a small amount of sediment removal. In heavily urbanized corridors, they may be the only opportunity for water quality treatment.

Catch basin sumps need frequent maintenance to remove accumulated sediments. Failure to maintain the sumps will result in sediment resuspension and impacts to receiving waterbodies.

4.03.04D Hydrodynamic Separators

A hydrodynamic separator (HDS) is a proprietary manufactured treatment device that creates a vortex within the unit to separate suspended solids from stormwater. They are typically used in urban areas where opportunities for vegetated stormwater treatment are limited.

Flow rates through HDSs are limited by the manufacturers to obtain the required sediment removal, typically 80%, so these devices must include a bypass piping configuration to allow flows higher than the treatment flow to bypass the system. See the Stormwater Treatment Manual for more information.

HDSs need frequent maintenance to remove accumulated sediments. Failure to maintain a HDS will result in sediment resuspension and impacts to receiving waterbodies.

4.05 DESIGN CRITERIA FOR ROADWAY CULVERTS

4.05.02 Culvert Pay Lengths

(revised 7-10-2006)

Concrete pipe 24" diameter and above is available in commercial lengths of 8'. When installing new culverts or extending existing culverts, the length quantities should be based on available commercial lengths.

4.05.08 Estimating Peak Flows for Culverts

(revised 4-22-2019)

The hydrologic analysis required for culverts can use either the method described in the Michigan Department of Environment, Great Lakes, and Energy paper entitled ***Computing Flood Discharges For Small Ungaged Watersheds***, (Drainage Manual Appendix 3-C) referred to as the EGLE SCS Method, or the Rational Method. All cross culverts must be designed for the 50-year flow and checked against the 100-year flood flow.

4.05.08A EGLE's Soil Conservation Service (SCS) Method

Reference Drainage Manual Section 3.4.4 and Appendix 3-C.

The EGLE SCS Method is based on Section 4, ***Hydrology***, from the SCS National Engineering Handbook. It is an acceptable method to be used for drainage areas of less than 20 square miles. Assistance on determining estimated peak flows can be obtained from the Design Engineer - Hydraulics.

4.05.08B The Rational Method for Estimating Peak Flows for Culverts

Reference Drainage Manual Section 3.4.1 and Table 3-1.

If the area is less than 20 acres and the flow to the culvert crossing is low or intermittent, the more simplified Rational Method may be used for design.

4.05.10 Hydraulic Analysis Data and Soil Borings on Plans

(revised 6-27-2022)

See Drainage Manual Appendix 6-B.

If either the size or location of the culvert are changed, the Road Design Unit must obtain new approval from the Design Engineer - Hydraulics. A plan sheet should be included in all projects showing the project drainage (see Section 1.02.04). All drainage structures should be accompanied by a tabulation of drainage data shown on the Drainage Map. For culverts, the tabular form illustrated below is required and can be obtained from the Design Engineer – Hydraulics. The tabulation must include the design flood frequency discharge and the drainage area.

Soil borings must be requested from the Geotechnical Services Unit for any new or extended culverts that have the following sizes **or equivalent area:**

- Pipe culverts equal to or greater than 60” diameter
- Box and slab culverts equal to or greater than 4’ x 4’

For culverts smaller than these sizes, the soil borings must be requested from the Region/TSC Soils and Materials Engineer (see Section 14.25). All soil borings and related information must be shown on the plans.

See Section 8.05F of the Bridge Design Manual for bridge hydraulic analysis table and scour analysis table.

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CULVERT TABLES

LOCATION	
STRUCTURE NUMBER	
CONTROL SECTION	
JOB NUMBER	
LOCATION	
WATERCOURSE	
TOWNSHIP	
COUNTY	
DISCHARGE	
10-YEAR	
50-YEAR	
100- YEAR	
ADDITIONAL INFORMATION	
DRAINAGE AREA	
METHOD OF ANALYSIS	

Stream: **County:**	**EXISTING (ft)**	**PROPOSED (ft)**	**CHANGE**
CULVERT TYPE			
SPAN			
RISE			
LENGTH			
ENTRANCE TYPE			
U/S INVERT ELEV			
D/S INVERT ELEV			
U/S FLOWLINE			
D/S FLOWLINE			
K_e:			
50-YEAR			
VELOCITY AT OUTLET			
HEADWATER			
100-YEAR			
VELOCITY AT OUTLET			
HEADWATER			

50-YEAR AND 100-YEAR FLOOD ELEVATIONS ARE FOR COMARISON ONLY
Note:

4.05.12 Bedding and Filling Around Pipe Culverts

(revised 7-10-2006)

Reference Drainage Manual Section 5.3.7.

The bedding and filling around pipe culverts is done according to Standard Plan R-82-Series upon which the Culvert Class-Depth-Usage Table is based. This type of installation is referred to as a “Positive Projecting Embankment Conduit” for a concrete pipe. The following information describes other types of installations for concrete pipe. However, when special designs or installations are required, a design request should be made to the Bridge Design Section.

4.05.12A Trench Installation

When the culvert pipe is placed in a narrow trench and covered with earth, the backfill will tend to settle downward. This downward movement or tendency for movement of the backfill within the trench above the conduit is retarded by frictional forces along the sides of the trench that act upward and help support the backfill. As this type of installation applies normally to a sewer-type installation and our standard plans and specifications do not restrict the trench width for a culvert, this type of installation is not normally considered in design.

4.05.12B Positive Projecting Conduits

Positive projecting pipes are installed in shallow bedding with the top of the conduit projecting above the surface of the natural ground or compacted fill at the time of installation and then covered with earth fill. Culverts placed in wide trenches also are included with this classification. This classification is the basis for our Standard Plan R-82-Series.

4.05.12C Negative Projecting Embankment Conduit

Negative projecting embankment culvert pipes are installed in relatively shallow trenches of such depth that the top of the pipe is below the level of the natural ground surface or compacted fill at the time of installation and then covered by earth fill, the height of fill being greater than the depth of trench. As with a trench installation, the load on the pipe is reduced by frictional forces along the sides of the trench. This may reduce the ASTM class of concrete pipe required; however, a request to Bridge Design for a design will be required before reducing pipe class.

4.05.12D Induced Trench Conduit

The induced or imperfect trench installation is used when it is necessary to relieve or reduce the load on a concrete pipe under a high fill. The culvert is initially installed as a positive projecting pipe. When the embankment fill has been placed to an elevation of two to three times the diameter of the culvert above natural ground, a trench is excavated over the culvert and backfilled with compressible material simulating a negative projecting installation. As this is a special design, the design and details for this type of construction are to be requested from Bridge Design.

4.05.19 Precast Concrete Box Culverts

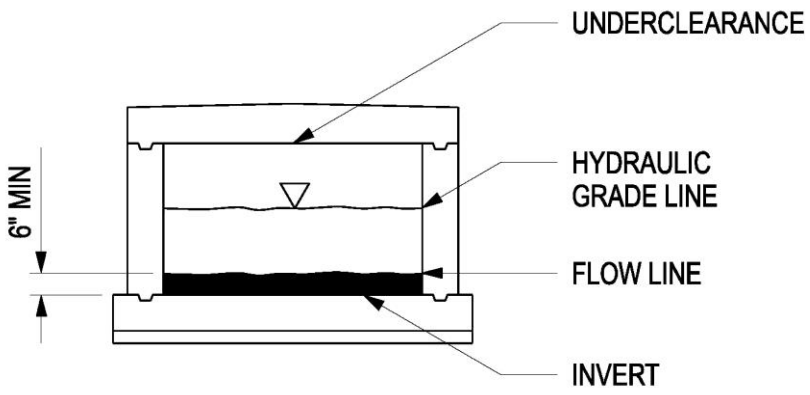
(revised 4-26-2021)

Precast box culverts are available in numerous sizes state-wide. The designer should contact a local supplier to verify that a particular size is available. The supplier, in some instances, may be willing to furnish a larger size if his available forms do not match the required size. Precast box culverts offer the advantage of rapid installation and are competitively priced with cast-in-place box culverts for new construction or culvert extensions.

Precast concrete box culverts are called for by size, as specified in the Standard Specifications for Construction. It should be noted on the plans that the box culvert shall meet the specified AASHTO and ASTM requirements for HS25 loading. If the culvert is located under a railroad crossing, consult the Railroad Grade Separations Engineer of the Railroad Coordination Unit – Office of Rail and specify American Railway Engineering and Maintenance of Way Association (AREMA) Loading. When the culvert requires headwalls, details must be obtained from the Bureau of Bridges & Structures, Structure Design Section, Special Structures Unit.

When extending box culverts, adhesive anchored bolts shall be used to tie the new construction to the existing.

The invert of a box culvert is to be set 6” below the normal flow line. This elevation is to be referred to as the invert elevation on the details to avoid confusion with the flow line of the waterway that appears on the profile.



4.05.20 Lining Culverts

(revised 7-10-2006)

Reference Drainage Manual Section 5.5.3.

When a culvert has structural deterioration, it may be possible to line the culvert instead of replacing it. Caution must be used by the designer and a hydraulic analysis should be done to determine the potential hydraulic impacts of inserting the liner. The analysis should cover the range of flows passed by the culvert.

Lining may be in the form of inserting plastic pipe and grouting the annulus or insertion of a resin-impregnated flexible liner. Installation is covered by appropriate Special Provision, e.g. “In Place Culvert Rehabilitation, Liner.” The installation of a liner may be allowed for the following conditions:

1. The culvert is a cross culvert that acts as an equalizer between two bodies of water (e.g. between two wetlands).
2. A driveway culvert that is only carrying ditch flow generated from MDOT ROW. For the range of design flows, the water surface elevation upstream of the culvert is contained within the ROW.
3. The culvert is a CMP that will not experience inlet control over the range of design flows.

Any questions regarding the hydraulic analysis or potential impacts should be directed to the Design Engineer – Hydraulics.

4.05.21 Drainage Marker Posts

(revised 4-26-2021)

Drainage marker posts are installed to help maintenance personnel locate end sections or headwalls of transverse culverts 36” diameter or less and on all underdrain outlet endings. Drainage marker posts are to be placed outside the shoulder hinge lines and should not be used in medians except on spread roadways (medians 150’ wide or greater). Drainage marker posts shall be at least 6’ long and shall conform to the delineator or steel line posts that are specified in the current standard specifications.

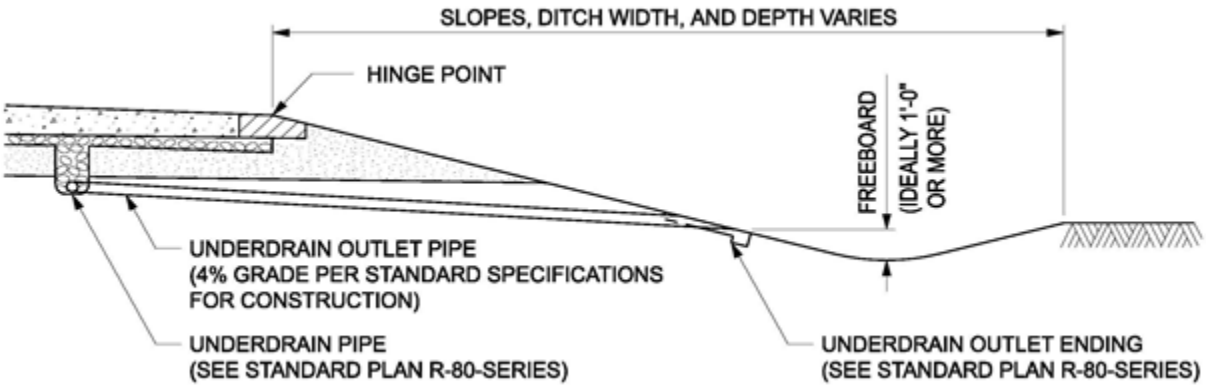
4.06 UNDERDRAINS

4.06.01 Purpose of Underdrains

(revised 4-27-2026)

Current methods of installing underdrains are shown on Standard Plan R-80-Series. In order to protect a roadway surface from early deterioration, a stable base must be built for the roadway. Water in subbase materials weakens the foundation soils, therefore a good roadway requires good drainage. Underdrains intercept and remove seepage from the subbase, eliminating springy or bad subsoil conditions. Underdrains are used on both enclosed and daylighted drainage systems.

The various underdrains either capture and drain the water trapped below the pavement surface or intercept seepage water before it enters the space below the pavement and then convey the seepage to either an outlet ditch or a storm sewer system. The designer should design the depth of ditch or storm sewer to accommodate the underdrain depth below the pavement section and the fall of the outlet pipe to ideally provide 1’ (or more) of freeboard from the bottom of the outlet to the ditch bottom.



Where underdrain is required to facilitate subbase or open graded aggregate base drainage, there should be a minimum of two underdrains per roadway located per Standard Plan R-80-Series and not under wheel loads. Additional underdrains should be placed to ensure lateral spacing does not exceed 30 feet center-to-center.

4.06.02 Bank Underdrains

Bank underdrains are sometimes placed in the back slopes to intercept seepage planes before they reach the roadway to minimize erosion or sloughing. Two basic methods of installing bank underdrains are shown on the standard plan. One method backfills the trench with a granular material and wraps the underdrain pipe with a geotextile. The other method envelopes both the open-graded material and the underdrain pipe by lining the trench with a geotextile.

4.06.03 Subgrade and Subbase Underdrains

Subgrade underdrains are meant to drain both the subbase and subgrade under the pavement. Currently, two methods of constructing subgrade underdrains are shown on the standard plan. One method lines the trench with a geotextile that envelopes both the open-graded material and the underdrain pipe. The other method uses granular material and wraps the underdrain pipe with a geotextile.

The subbase underdrain is meant to drain only the subbase. The flow line of the underdrain is normally a maximum of 10” below the top of the subgrade. The underdrain pipe is wrapped with a geotextile.

4.06.04 Open-Graded Underdrains

(revised 3-8-1999)

Four methods of installing open-graded underdrains are shown on the standard plan. All four have an open-graded material immediately below the pavement surfacing. Their purpose is to drain quickly any water that enters through joints or cracks in the pavement and to minimize the amount of water entering the subbase material. Two of the methods use underdrain pipe and two use the Prefabricated Drainage System (PDS).

4.06.05 Underdrain Outlets & Outlet Endings

(revised 4-27-2026)

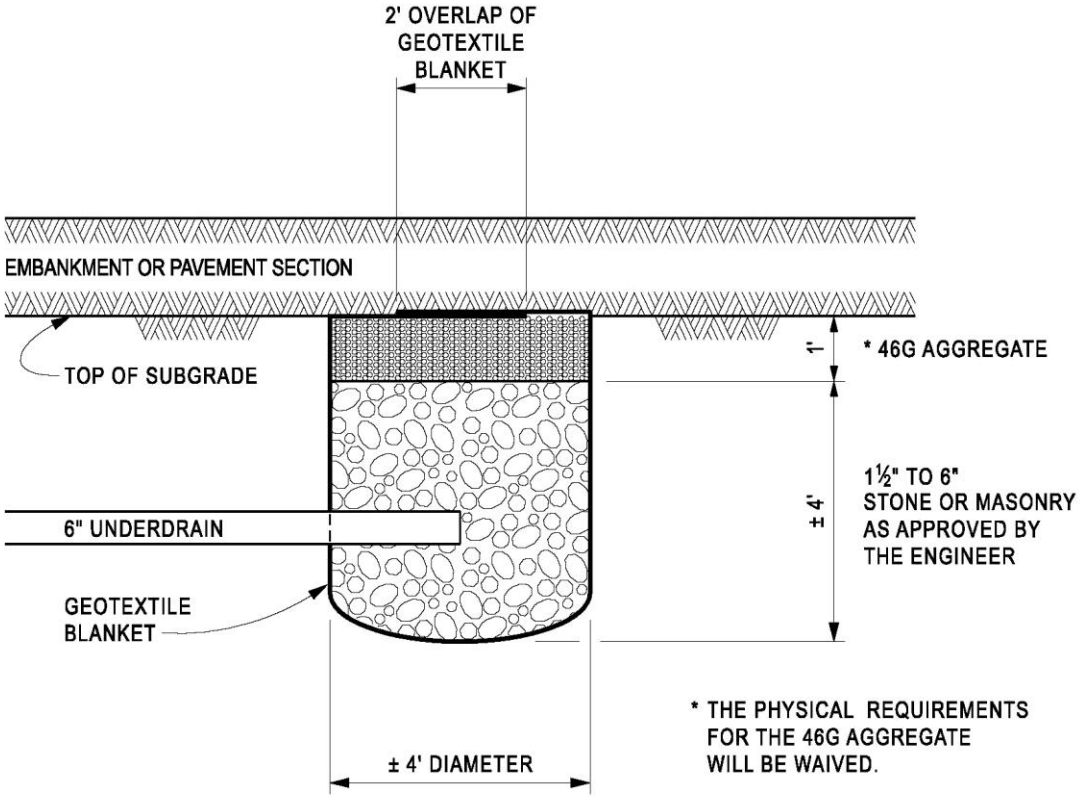
Underdrain outlets are used to connect underdrains to the outlet endings. To resist crushing from heavy construction and maintenance vehicles and to ensure positive flow, use rigid PVC or corrugated steel pipe shall be used for underdrain outlets.

Currently four approved outlet endings are shown on Standard Plan R-80-Series. Use the Underdrain Outlet Ending (CIP) option when site conditions allow proper placement. When site conditions do not allow proper placement, the other options are available for use. Other designs may be used when approved by the Engineer.

4.06.06 Stone Baskets

(revised 2-23-2026)

Use stone baskets to drain springs that occur below the roadway. Construct the stone basket by making an excavation at the spring head 4’ in diameter and approximately 5’ below the bottom of embankment or pavement section. Place geotextile blanket in the excavated hole and backfill with 1½” to 6” stone or masonry, and a 1’ thick layer of 46G open graded aggregate. Use a 6” diameter underdrain to dissipate water from the stone basket. Show the location of the stone basket on the typical cross section and detail the following sketch on the plans.



TYPICAL STONE BASKET SECTION

4.06.07 Underdrain in Roundabouts

(added 9-23-2024)

Underdrain in roundabouts follows the same design principles as typical roadways but with additional attention paid to drainage of the center island. Regardless of the permeability of the center island surface, underdrain should be installed at the inside of the circulating lane in accordance with Standard Plan R-80-Series. Alternatively, a separate drainage system can be installed solely for the center island.

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CHAPTER 5

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5.24 R.O.W. SKETCHES

MICHIGAN DESIGN MANUAL
ROAD DESIGN

CHAPTER 5

RIGHT OF WAY

5.01 (revised 6-28-2021)

REFERENCES

Deleted

5.02 (revised 8-23-2021)

GLOSSARY OF TERMS

Abandonment - Legally, cessation of use of R.O.W. or activity thereon with no intention to reclaim or use again. Sometimes erroneously called "vacation". Divisional usage: relinquishment of control to a subordinate governmental unit, e.g., county.

Acquisition or Taking - The process of obtaining R.O.W.

Appraisal - A professional estimate or opinion of value.

Award - The determination rendered by a judge, jury, or commission upon a controversy submitted to them, such as value of real property or damage thereto.

Clear Vision Corner - A corner of an at grade intersection from which all obstructions have been removed and on which no construction or growth is allowed that will interfere with a line of sight established according to principles of safety. Generally, requires property beyond the normal R.O.W., triangular in shape with the longer leg along the major highway. Clear vision corner R.O.W. is generally limited access.

5.02 (continued)

Condemnation - The process by which property is acquired for transportation and public purposes through legal proceedings under power of eminent domain.

Condemnation Trial - A step in the condemnation procedure, conducted by a judge in a court of law, in which MDOT is represented by the Attorney General, where the amount of just compensation to be paid to a property owner is determined.

Consent(s) - The right to enter upon a specific area of land for a temporary time frame for a specific purpose. The Consent will expire at the completion of the project or upon a specified date. Consents may be granted for the following purposes:

- Grading
- Grading Drive
- Closing Drive
- Relocating Drive
- Constructing Sidewalk
- Temporary Drives

If the Consent is to construct a temporary drive, the temporary drive is to be removed before the end of construction and the underlying lands returned as nearly as possible to their former condition.

Control of Access - The condition where the right of owners or occupants of abutting land or other persons to access, light, air, or view in connection with a highway is fully or partially controlled by public authority.

5.02 (continued)

GLOSSARY OF TERMS

Deed - A duly attested written instrument, conveying real property or an interest therein.

Deed, Quitclaim - A deed conveying, without warranty, any title, interest, or claim that the grantor may have in the estate conveyed.

Deed, Warranty - A deed containing covenants by the grantor, for himself/herself and his/her heirs, to the grantee and his/her heirs, to warrant and defend the title and possession of the estate conveyed.

Drainage Easement - An easement for directing the flow of water and to allow construction and maintenance of sewers, ditches, and such.

Easement - An interest or right held by one person in land owned by another person whereby the first person is accorded partial use of such land for a specific purpose. An easement restricts but does not abridge the rights of the fee owner to the use and enjoyment of the easement holder's rights.

Eminent Domain - The power to take private property for public use. Eminent domain gives the government the right to take possession of private property in the manner directed by the Constitution and the laws whenever the public interest requires it.

Encroachment - Any structure illegally erected within or overhanging the R.O.W. and attached to the land, such as a fence, building, or gasoline pump. Has been expanded to include occupation of the R.O.W., e.g., parking vehicles offered for sale.

5.02 (continued)

Fair Market Value (Eminent Domain Definition) - Market value as defined in Standard Jury Instruction 90.06 considers the following:

1. The highest price estimated in terms of money that the property will bring if exposed for sale in the open market with a reasonable time allowed to find a purchaser buying with knowledge of all of the uses and purposes to which it is adapted and for which it is capable of being used
2. The amount which the property would bring if it were offered for sale by one who desired, but was not obliged, to sell, and was bought by one who was willing, but not obliged, to buy
3. What the property would bring in the hands of a prudent seller, at liberty to fix the time and conditions of sale
4. What the property would sell for on negotiations resulting in sale between an owner willing, but not obliged, to sell and a willing buyer not obliged to buy (e)what the property would be reasonably worth on the market for a cash price, allowing a reasonable time within which to effect a sale.

Fee Simple, also Fee and Fee Simple Absolute - Full, complete ownership of land. It is free from liens, judgments, easements, and in fact, all encumbrances.

5.02 (continued)

GLOSSARY OF TERMS

Government Corner - Also called a Public Land Survey System (PLSS) corner, means the corners established in the original government survey of the state. The original surveys in Michigan first established the Township boundaries. Then, in an orderly sequence, subdivided the townships into sections NOMINALLY one mile square. The PLSS corners marking the four corners of a section are more specifically termed Section Corners. The sections are nominally divided into four parts by Quarter Corners approximately half way between the section corners. Nearly all land in Michigan, including state highways, is described by reference from one or more government corners. There are generally four section corners (Northeast, Southeast, Southwest and Northwest) for each section, one defining each corner of this section. Often a section corner is a common point for one to three other sections. Section lines are the lines from section corner to quarter corner around the outside of each section. There are often "Double" corners along township lines. Preservation of the monuments marking the location of PLSS corners is required by Michigan Act 74, P.A. 1970, as amended. Michigan Act 345 of 1990 is an act to re-monument all the corners of the state over a 20 year period.

Highest and Best Use - The most profitable use, reasonable, but not speculative or conjectural to which property may be put in the future.

5.02 (continued)

Just Compensation - A full and fair equivalent for the loss sustained by the owner as a result of taking or damaging of private property for transportation purposes.

Legal Description - A description of real property by government survey, metes and bounds, or lot numbers of a recorded plat including a description of any portion thereof subject to an easement of reservation, if any.

Market Value - The highest price for which property can be sold in the open market by a willing seller to a willing purchaser, neither acting under compulsion and both exercising reasonable judgement.

Necessity Hearing - A step in the condemnation procedure, conducted by a judge in a court of law, in which MDOT is represented by the Attorney General, wherein the desirability of the project and the need for the particular parcel is determined.

Negotiation - The process by which property is sought to be acquired for transportation purposes through discussion, conference, and final agreement upon the terms of a voluntary transfer of such property.

Partial Taking - Acquisition of a portion of a parcel of property.

5.02 (continued)

GLOSSARY OF TERMS

Plats

Subdivision - An official map showing the division of a tract or area into lots for use or occupancy. Plat development is regulated under Act 288, P.A. 1968 and local ordinance. Plats are recorded in the office of the Register of Deeds in the counties and filed with the Subdivision Control Unit of the Department of Commerce. Most plats identify and dedicate R.O.W. within and bordering the subdivision. Subdivisions are identified with a unique title or name and the name of the owner or developer.

Assessor's Plats and/or Supervisor's Plats are established for the convenience of a local authority for tax or assessment purposes. The assessing officer will certify that the local governmental authority has acquired title to the highways, streets, alleys, and public places shown on said assessor's plat by reason of purchase, dedication, condemnation, or adverse possession for public use; and if there are any to which the local governmental authority has not acquired title for public use, the extent of their use shall be plainly stated. (The language of the statute pertains to the use of roads, streets, etc., to which title has not been acquired and not to the character and the rights of lot owners or others or the ownership of the land itself. In other words, such plats cannot dedicate R.O.W. for public use; they can only certify R.O.W. as it actually is or the use to which it is being put.)

5.02 (continued)

Possession and Use Agreement (P&U) - A form used when negotiations cannot be completed by the Real Estate Acquisition Agent and the owner has no objection to the State's taking possession of the land and commencing construction prior to determination of just compensation.

Private Claim - A parcel of land which was in private ownership at the time United States sovereignty was established. Private claims are numbered and almost always abut navigable waters. These claims were surveyed prior the General Land Office survey in Michigan is not a part of the rectangular Public Land Survey System.

Property Controlling Corner - A public land survey corner or any property corner which does not lie on a property line of the property in question, but which controls the location of one or more property corners of the property in question.

Property Corner - A geographic point on the surface of the earth, which is on, is a part of, and controls a property line.

Remainder - Real property that is located outside of the approved R.O.W. but been reviewed and approved for disposal.

Right of Entry - The lawful right to enter upon a parcel of land, which is in the process of being acquired, for the purpose of beginning the construction, or processes related to construction (drilling, testing, etc.) of a public project.

5.02 (continued)

GLOSSARY OF TERMS

Right of Way - (R.O.W.) - The entire area reserved for the construction, operation, and maintenance of the roadway and the improvement of the roadside such as landscaping, sidewalks, pathways or transit stops. R.O.W will either be free access or limited access. Limited access R.O.W. is when the inherent right of access to a public highway by the abutting owner or occupant is acquired along with the title to the R.O.W.

Right of Way (R.O.W.) Marker - A signpost of wood, concrete, or metal construction which served as an indicator of the approximate location of R.O.W. along public ways. The signpost was painted or otherwise labeled with "R/W". The signpost extended well above the surface of the ground in order to be readily visible to the public and the abutting landowners. R.O.W. markers were used to mark section line intersections, changes in R.O.W. widths, the beginning and ending of curved R.O.W. lines, and other locations that would benefit landowners and the public. R.O.W. markers were not usually set along limited access roadways. R.O.W. markers and fencing were not placed by professional surveyors and were not intended to define the limits of roadway R.O.W.

Right of Way (R.O.W.) Monument - A R.O.W. monument is placed by a professional surveyor to identify a corner or a point-on-line of right-of-way. R.O.W. monuments are set flush with the ground surface or slightly below to increase their stability and survivability. Monuments are stamped with a monument number and the license number of the professional surveyor responsible for setting the monument. R.O.W. monuments are set in locations where fee title has been acquired and are intended to define the boundaries of such lands.

5.02 (continued)

Riparian Rights - The property and other rights of an owner of waterfront property in the bed, banks and water of a lake or stream. Riparian rights cannot be severed from the upland parcel to which they accrue.

Roadside Control - The public regulation of the roadside to improve highway safety, expedite the free flow of traffic, safeguard present and future highway investment, conserve abutting property values, or to preserve the attractiveness of the landscape.

Roadway - The part of the R.O.W. required for construction, limited by the outside edges of slopes and including ditches, channels and all structures pertaining to the work. In short, the area between slope stake lines.

Scenic Easement - An easement for conservation and development of roadside views and natural features.

Setback Lines - A line established by zoning ordinance, deed restriction or custom regulating the distance from the R.O.W. line of a street or highway to the point where improvements may be constructed.

Sight Line Easement - An easement for maintaining or improving the sight distance.

Slope Stake Line - The limits of the designed roadway cross section where the finished side slope of an excavation or embankment meets the surface of the existing ground. It is detailed on the plans as a dashed line and marked in the field by marked stakes (slope stakes).

5.02 (continued)

GLOSSARY OF TERMS

Statutory Right of Way (R.O.W.) - The R.O.W. of roads established by "use", where no other R.O.W. was established by dedication or purchase. This R.O.W. is defined by statutes and generally accepted to be 66', 33' either side of the centerline of the traveled way, or where the road is along section or quarter section lines, the R.O.W. is measured 33' either side of those lines.

Step-1 Authority - Authority from the FHWA to secure title information.

Step-2 Authority - Authority from the FHWA to proceed with appraisals, negotiations, and actual acquisition.

Stipulated Settlement - An agreement in an active court case under court jurisdiction which settles an issue or the entire case between contending parties without a judge's or jury's decision. It further must be approved by the court and made a matter of record.

Title - The evidence of a person's right to the property or the right itself.

5.02 (continued)

Title Commitment - A document issued to a prospective land purchaser by a title insurance company by which the company agrees to issue a title insurance policy on that parcel of land. The commitment contains the recorded legal description of the land, the name and address of the present owner, the title search findings, such as, chain of title information, title encumbrances, liens, easements, tax payment information, and the terms and conditions by which the insurance company is willing to guarantee title.

Title Search - An investigation of public records and documents to ascertain the history and present status of title to property, including ownership, liens, charges, encumbrances, and other interests.

Uneconomic Remainder - A remnant piece of property having little or no use. In the case of a partial acquisition requiring removal of all or most of the improvements (either residential or commercial), the remaining property (remainder) may be declared as uneconomic at the owner's request.

5.03 (revised 9-28-2020)

GENERAL

Right of Way studies of a preliminary nature are nearly always made before the final survey is started. R.O.W. is decidedly a prominent part of a set of plans and should be carefully reviewed for the entire project before preliminary plans are started. Acquisition of R.O.W. is often difficult, expensive, and time consuming, and it is the responsibility of the Design Engineer to expedite all plan work pertaining to R.O.W. matters.

5.03.01 (revised 9-28-2020)

Right of Way Parcel Overlay (ROWPO)

The purpose of ROWPO is to furnish the Region Real Estate staff with plans that have the requirements outlined in sufficient detail so that proper descriptions can be prepared and the land acquired for construction purposes. The information on the plans is used in preparing various conveyance instruments such as deeds, easements, consents, etc., and in legally describing and locating the various parcels of land referred to in these instruments. The R.O.W. information provided in the plans are used by real estate staff to prepare appraisal/valuation reports, acquire property, and for record purposes.

5.04 (revised 8-23-2021)

R.O.W. WIDTHS

The proposed R.O.W. width should be sufficient to accommodate the planned project. Federal regulations specify "The State shall acquire rights-of-way of such nature and extent as are adequate for the construction, operation, and maintenance of a project." AASHTO guidelines specify that "right-of-way widths should not be less than that required for all elements of the highway cross section and appropriate border areas."

Anticipated traffic volume, stage construction, real estate values, winter snow removal and storage difficulties, flat or rolling country, etc., should be considered in the selection of R.O.W. widths. It is essential that the R.O.W. width selected will meet all the requirements of ultimate construction as determined by careful highway planning. As a rule, proposed R.O.W. or a Consent are based on slope stake lines. A general rule of thumb is to provide 7' to 10' from the slope stake line to the proposed R.O.W. or Consent limits, although proposed R.O.W. should not be jogged too often to follow the slope stake line. Some engineering judgement is required.

The methods of acquisition are not explained in detail, however, it is the intent that R.O.W. be available for the maintenance of the total width including such drainage as may be necessary.

It is desirable, whenever local conditions will permit, to call for a uniform width of R.O.W. through a specific property, rather than to break it into a series of varying widths. Logical breaks or points of change are at fence lines or property lines that intersect the project. In the majority of cases, the property owner will prefer this method of R.O.W. acquisition. If the road can be built on less than the standard width, in order to avoid costly building relocation, the R.O.W. is frequently "jogged". However, care should be exercised in this practice because many times when the R.O.W. is jogged to miss the buildings they still suffer substantial damage, thus the jogging may not be justified.

5.05 (revised 8-23-2021)

URBAN R.O.W.

Where all or portions of a project are located in urban areas, R.O.W. may be limited to the width determined by municipal planning or to existing R.O.W. Portions within urban boundaries that have never been developed should be set up the same as for rural projects. Occasionally, because of the increased width of the proposed surface, additional R.O.W. is needed. In this case the new width is determined by MDOT, and the designer should become familiar with whatever agreements or decisions are made.

5.05.01 (revised 9-28-2020)

Urban Expressways

R.O.W is of primary importance in urban expressway design. Modern expressways are designed to provide roadways of sufficient width to carry large volumes of traffic frequently including frontage roads and access ramps, requiring R.O.W. widths of 300' to 400'. Obviously, a strip of land of this width cutting across a city is very costly and disruptive, and the work involved in securing the necessary properties requires a lot of time. Construction that is slowed by R.O.W. acquisition may further be delayed by the moving and razing of many buildings. Base Plans (Preliminary R.O.W.), although not exact and thus subject to revision, should be placed on file in the city's offices and used as a criterion for the issuing of building permits in areas where construction is planned in the near future.

5.05.02 (revised 8-23-2021)

Constructing Sidewalks

Whenever feasible, new or reconstructed sidewalk should be placed 1 foot minimum inside the existing or proposed R.O.W. line (as determined by a Professional Surveyor). When the proposed sidewalk grading limits extend outside the R.O.W., a Consent (Form 0640C) is requested. The Consent obtains permission from the adjacent property owner to temporarily utilize their property to construct new and/or to replace existing sidewalks within the existing or proposed R.O.W. See application #3 on the following page for proposed sidewalk remaining outside the R.O.W. Show slope stake lines to determine the impact to the property.

The Real Estate Services Section of the Development Services Division or Region Real Estate will determine just compensation for the Consent which is offered to the property owner. Consent is noted at each applicable location as:

Consent

Listed below are several applications for use of the Consent and options in the event of failure to obtain Consent or fee/easement. Gapping out sidewalk construction in areas with Consent or fee/easement conflicts is not an acceptable option. Sidewalk accessibility must be provided for persons with disabilities according to the Americans with Disability Act (ADA) of 1990. When constructing sidewalk, MDOT is responsible for meeting ADA accessibility requirements for the public sidewalk. The area outside these limits may require restoration of existing private connection to the sidewalk. Regardless of whether the Consent is granted, accessibility impact should be discussed with the property owner during negotiations.

5.05.02 (continued)

Constructing Sidewalks

If ROW is not in the scope of the road/bridge project, then it would not be required for the project solely for ADA compliance and a Consent will be needed to transition to the existing sidewalk. If the scope of the road/bridge project does include ROW and/or there is planned accessible path where constructing sidewalks are within the scope (more than just ramps), then ROW would need to be purchased for the sidewalk ramp transitions, including condemnation, if necessary.

See Section 6.08.06 for information on accessibility requirements for private connections to sidewalks.

1. **Existing sidewalk extends to the face of buildings** - In the downtown business districts, many businesses are on the R.O.W. line or just beyond the R.O.W. line. If the existing sidewalk is being reconstructed to the face of a building, obtain the Consent. No fee/easement would be required if the pedestrian travel zone of the sidewalk is within the existing R.O.W. The Consent requested would include construction of the sidewalk frontage zone located outside the existing R.O.W. to add aesthetic value to the business property. If the Consent is not granted, MDOT may elect to delete the parcel and construct the sidewalk to the R.O.W. line leaving the remaining portion of old sidewalk to the face of the building with consideration for accessibility as previously stated.

5.05.02 (continued)

2. **Existing sidewalk to be replaced in existing R.O.W., but grading is needed outside existing R.O.W**.- Many communities have the existing sidewalks constructed one foot inside the R.O.W. line. If the proposed sidewalk requires a slope stake line outside the existing R.O.W., obtain the Consent. This Consent allows for reconstructing the sidewalk within the existing R.O.W. and placing fill material and/or excavating the back slope on the private property to construct the sidewalk to the proper line and grade. If the Consent is refused during negotiations, MDOT may elect to delete the parcel and build retaining walls with possible fencing or guardrail to keep the sidewalk and associated grading within the R.O.W. with consideration for accessibility as previously stated. If construction of the sidewalk cannot be accommodated within the existing R.O.W. or by Consent, MDOT may be required to condemn for either the Consent or a fee/easement in order to construct the new sidewalk.

5.05.02 (continued)

Constructing Sidewalks

3. **Sidewalk Partially Outside R.O.W.** - When a slope stake line falls within any portion of an existing sidewalk that is either outside or partially outside the R.O.W., obtain a Consent. The Consent allows for reconstructing a new sidewalk within the existing R.O.W. and removing that portion of existing sidewalk outside the existing R.O.W.

   If a proposed new or reconstructed continuous sidewalk is to remain partially outside the R.O.W., MDOT shall determine ownership prior to proceeding. If the property is within the municipality owned R.O.W., MDOT should obtain permission via Consent from the municipality. The Consent should be included in the R.O.W. Certification. If the property is not owned by the municipality, MDOT should acquire permanent fee/easement R.O.W. for the sidewalk remaining outside the existing R.O.W. Although MDOT is not responsible for the future maintenance or repair of the sidewalk, the fee/easement acquisition ensures the preservation of a sidewalk width compliant with ADA requirements. If MDOT is not able to acquire permanent fee/easement R.O.W., a Consent can be acquired.

   For tying in short intermittent alterations to existing sidewalk outside the R.O.W. *see #5.*

   If the fee/easement or Consent is refused by the property owner, MDOT may elect to delete the parcel, remove and replace that portion of the sidewalk within the R.O.W. and build retaining walls with possible fencing or guardrail to keep the sidewalk and associated grading within the R.O.W. As previously stated, accessibility impacts should be addressed during negotiations with the property owner.

5.05.02 (continued)

   If construction of the sidewalk cannot be accommodated within the existing R.O.W., MDOT may be required to condemn for either the Consent or fee/easement in order to construct the new sidewalk.

4. **Constructing Sidewalk Outside Existing R.O.W.** - When sidewalk is constructed or reconstructed outside the existing R.O.W. MDOT shall determine ownership prior to proceeding. If the property is within the municipality owned R.O.W., MDOT should obtain permission either via Permit or Consent from the municipality. The Consent should be included in the R.O.W. Certification. If the property is not owned by the municipality, MDOT should acquire permanent fee/easement R.O.W. to construct the sidewalk outside the existing R.O.W. If MDOT is not able to acquire permanent fee/easement R.O.W., a Consent can be acquired. Failure to obtain the permanent R.OW. or a Consent during negotiations may require MDOT to condemn for permanent R.O.W. to replace the sidewalk. Whenever feasible, sidewalk should be constructed or reconstructed one foot minimum inside the existing/proposed R.O.W. (as determined by a Professional Surveyor).

   See Section 6.08.01 for the MDOT's position on sidewalk liability and maintenance agreements.

   When the adjacent property is subject to Section 4(f) of the U. S. Department of Transportation Act of 1966, permanent easement or fee R.O.W. is usually not feasible. Consent should be pursued under these conditions.

5.05.02 (continued)

Constructing Sidewalks

5. **Tying to Existing Sidewalk** – When intermittent sidewalk construction such as sidewalk ramp upgrading or driveway construction is not done in conjunction with construction or reconstruction of the continuous sidewalk, the instrument used to access private property will depend on the proposed placement of the altered section of sidewalk. Consent can be used to tie in to existing sidewalk outside the right of way if the sidewalk is not realigned or widened outside the right of way. In other words, there is no further increase to existing encroachment. If the sidewalk alignment or width is altered causing further encroachment outside the right of way, a permanent easement is required.

   The Project Manager should seek local government support for the project, utilizing Context Sensitive Design concepts. Local agencies can provide valuable assistance by holding public meetings to seek input from the community, of which, impacted property owners are primary stakeholders. This "input" process may help alleviate many disagreements and allow all stakeholders to reach consensus prior to any acquisition. If local officials are very supportive of the project, many times they talk directly with the affected owners to secure agreement for a certain design of the sidewalks. It is required that MDOT obtain an agreement for the local agency's acceptance of responsibility for maintenance of the sidewalk.

5.05.02 (continued)

Any property needed outside the existing R.O.W. should be acquired by MDOT for timely acquisition of the R.O.W. needs. If the property owner fails to sign a Consent the plans should be revised according to the different scenarios above or Region Real Estate and Real Estate Services Section initiates the condemnation process prior to letting the plans.

5.06

LIMITED ACCESS R.O.W. AT RAMP INTERSECTIONS

In order to control access in the interchange area along crossroads adjacent to and within the influence of ramp intersections, limited access R.O.W. should be extended along the crossroad. ***See Section 5.24, Figures 5.24.01 and 5.24.02.***

5.07 (revised 8-23-2021)

TURNBACK PROJECTS

Generally, MDOT will not acquire additional R.O.W. on turnback projects. If additional R.O.W. is required, it must be obtained by the local agency. See Section 12.03.05 for additional information on R.O.W. on turnback projects.

5.08 (revised 9-28-2020)

TYPES OF R.O.W. EASEMENTS OR CONVEYANCE FOR DRAINAGE

1. R.O.W. will be required when an outlet ditch is to be constructed in a location where there was no previous ditch.

2. Existing ditches flowing across the R.O.W. that will require cleaning and deepening will require consent from the affected property owner(s) to clean the outlet ditch.

5.08.01

Special Ditch

Any additional R.O.W. required for intercepting ditches through tillable areas or for swamp ditches, where permanent control is needed for clean-out or other maintenance, should be shown as proposed permanent R.O.W. ***See Section 5.24, Figures 5.24.04, 5.24.05, and 5.24.06***.

5.08.02 (revised 1-29-2018)

County Drains

See the Road Sample Plans for proper labeling. ***See Section 5.24, Figure 5.24.06.***

5.08.03

Drainage Structures

Wherever catch basins, sewers, drainage tile, cobble gutters, riprap, etc., are extended or placed beyond the proposed R.O.W. limits, they should be noted like this:

R.O.W. to Construct and Maintain Drainage Structure

5.08.04 (revised 2-14-2002)

Retention/Detention Basins

R.O.W. for detention basins should be acquired in fee so that it can be fenced. ***See Sections 7.06.10 and 5.24, Figure 5.24.06.*** R.O.W. for detention basins should be noted as:

Prop. R.O.W. for Retention Basin

or

Prop. R.O.W. for Detention Basin

5.09 (revised 8-23-2021)

DRIVEWAYS

MDOT may need to close or relocate a drive. If the drive cannot be closed or relocated within the existing Right-of-Way, MDOT must obtain a Consent from the property owner and follow the normal acquisition process. The plans should reflect one of the following:

- Consent to Close Drive
- Consent to Grade Drive
- Consent to Relocate Drive

If the drive can be closed or relocated within the existing Right-of-Way, MDOT does not need to obtain a Consent from the property owner. The plans should reflect one of the following:

- Close Drive
- Grade Drive
- Relocate Drive

Do not use:

Permit to Construct "Hot Mix Asphalt." (or "Conc.") Drive

Permit to “Widen” Drive

If a driveway or driveway approach is to be combined which requires work outside the Right-of-Way, a Consent must be obtained from each affected property owner. A Consent is not needed if the work can be completed within the existing Right-of-Way. ***See Section 5.24, Figures 5.24.04 and 5.24.06.***

5.09 (continued)

It is important to show the limits of the driveway work by outlining the proposed driveway, ***not*** using dimensions. Slope stake lines, driveway profiles and/or grade information (Example: 2% for 15' then 7% to existing) is also useful to Real Estate personnel when contacting the property owner. When changes occur to a driveway outside MDOT R.O.W., after Preliminary Plans (Final R.O.W.) are submitted, a R.O.W. revision must be submitted to the Region Real Estate Agent and the Region Real Estate Technician. See Section 5.21.

5.10 (revised 1-29-2018)

R.O.W. AT RAILROAD CROSSINGS

When determining the clear vision R.O.W. requirements of an at-grade trunkline crossing with a railroad, a plan sheet of the area in question should be submitted by the Design Engineer to the Railroad Coordination Unit – Office of Rail. This should be done as early as possible, so that the needed R.O.W. may be shown on the Preliminary Plans (Final R.O.W.). ***See Section 5.24, Figure 5.24.03.***

5.11 (revised 8-23-2021)

CONSENT(S)

In cases where minor grading extends a short distance beyond the existing R.O.W., a Consent may be required. When it is anticipated that more than 500 cyd of earth excavation is to be removed from a Consent area, the R.O.W. plans should show the location and estimated quantities. Drainage structures, culverts, and ditches should not be placed within areas with a Consent but require permanent (fee/easement) R.O.W. Consents shall be dimensioned from the proposed or existing R.O.W. lines. ***See Section 5.24, Figure 5.24.04.***

When the adjacent property is subject to Section 4(f) of the U. S. Department of Transportation Act of 1966, permanent easement, or fee R.O.W. is usually not feasible. A Consent (Form 0640C) should be pursued under these conditions.

5.12

POTENTIALLY CONTAMINATED SITES

The identification of potentially contaminated sites is important on all projects, whether proposed R.O.W. is required or the project will be built within existing R.O.W. The Design Engineer should refer to the procedure outlined in Chapter 14.

5.13

TEMPORARY FENCE

It may be necessary to provide temporary fencing in stock grazing land where extra R.O.W. for grading and disposal of muck is required. A miscellaneous quantity of woven wire fence (for temporary fencing) should be shown on the note sheet.

5.14 (revised 1-29-2018)

PRESERVING R.O.W. LOCATION

Knowledge of the physical location of the R.O.W. is important to the Department when future improvements or expansions are planned. It is immediately important to owners of remainder properties abutting our fee ownership. Unless monuments are placed to mark the alignment on which the R.O.W. was purchased, confusion may result over the location of the R.O.W. In urban trunklines and rural expressway projects, where use of alignment monuments by surveyors would be so dangerous as to be impractical, the R.O.W. lines are monumented. In both cases, state law requires that all Government Corners used in the design survey or affected by construction activities be preserved and a record filed with the Register of Deeds.

5.14.01 (revised 1-29-2018)

Government Corners

A description, witnesses and alignment ties to Government Corners are contained in the survey notes. The Design Survey Section or Region Surveyors must be consulted when questions arise. All Government Corners and property control corners that fall within the construction area must be identified on the plans and marked "PRESERVE". If MDOT professional staff are not available, the contractor will be required to retain a Michigan licensed professional surveyor to accomplish this work as described in the current Specification.

Activities under this section must conform to the requirements of the Land Corner Recordation Act, Act 74, P.A. 1970, as amended. This act requires that corners of the Public Land Survey System be monumented in place or by reference monument, and that if any such monument be located in a hard surfaced roadway, it shall be placed in a monument box.

5.14.02 (revised 1-29-2018)

Alignment Monuments

On MDOT trunklines wherever their future use is deemed practicable, survey markers should be set at all points defining the road alignment. Alignment points include PC, PI, PT, etc. The Region Project Development Engineer should consult with the Region Surveyor to determine, during scoping, if the alignment on a project should be monumented. If the Region determines that the alignment be monumented, and has programed sufficient funding to do so ,the Design Unit adds the appropriate pay items to the plans and notes proposed locations to be monumented on the construction plans as follows:

Place Alignment Control Marker – PRESERVE

Survey marks shall consist of rebar not less than ⅝” in diameter and 18" in length. All alignment points in the road surface should be placed in a monument box. Since alignment is a component of our boundary, Act 299, P.A. 1980, as amended, requires that this work be performed by a Michigan licensed professional land surveyor. If MDOT professional staff are not available, the contractor will be required to retain a professional surveyor to monument alignment points.

5.14.03 (revised 9-28-2020)

R.O.W. Monuments

In cases where setting monuments to preserve the alignment is not possible or practical, the actual limits of the R.O.W. should be established.

R.O.W. lines should be monumented:

at the intersection of all section lines and private claim lines (Along the Detroit and St. Clair rivers long narrow plats of land were established. These are known as French Claims and there are no section lines in this area);

at the intersection of all subdivision block lines;

at all changes in direction of the line;

at the P.C. and P.T. of curved sections of the line;

at intervals not greater than 2000'.

In determining the location of monuments placed at the 2000' spacing, the intersection of the R.O.W. with section subdivision lines or other property lines identified in the design survey should be used whenever possible.

When service roads are involved, monumentation will be along the outside R.O.W. of the service road. If the service road R.O.W. is not contiguous with the freeway R.O.W., both lines must be monumented.

The Design Unit notes proposed locations to be monumented on the construction plans as follows:

Place Monument with MDOT ROW cap stamped with the license number of the Professional Surveyor in charge - PRESERVE

5.14.03 (continued)

After the Design Unit has noted the locations of the monuments, it will send the digital data to the Survey Unit for review. The Survey Unit will mark any proposed changes and return the digital data to the Design Unit.

If additional R.O.W. is acquired, Region Real Estate or the Real Estate Services Section will notify the Survey Unit, who will determine when the placement of the R.O.W. monuments will be completed. Therefore, when R.O.W. monumenting is called for, the following note should be placed on the plans:

R.O.W. monuments and marker posts are not a part of this contract

The placement of R.O.W. monuments is boundary surveying and shall be performed by the Survey Unit or a consultant survey firm based on Act 299, P.A. 1980, as amended.

Monumenting of R.O.W. will apply on all projects requiring the acquisition of R.O.W.

When acquiring easement and fee R.O.W., MDOT must comply with Public Act 132 of 1970, as amended as part of the survey process. See the MDOT Wiki Page for additional information - http://mdotwiki.state.mi.us/design/index.php/Chapter_4_-_Surveys_-_Types#4.6_Certified_Surveys_for_Real_Estate_Acquisition

5.15

REST AREAS AND WEIGH STATIONS

When a rest area or weigh station is recommended, R.O.W. requirements are to be shown on the plans and secured along with the road R.O.W.

5.16 (revised 8-23-2021)

RIGHT OF WAY (R.O.W.) PLAN SUBMITTAL

R.O.W. requirements are submitted in two phases, preliminary and final. These phases have been incorporated into the Base Plan and the Plan Review milestone submittals. ProjectWise workflows have been created as noted in Chapter_1_-_ProjectWise_Pre-Bid_Processes of the Design Submittal Requirements to provide further guidance.

Base Plans (Preliminary R.O.W. Plans) is for title search, project R.O.W. cost estimates assigning parcel numbers, preparation of the ownership sheet and creation of the Parcel.dgn file. The Parcel.dgn file is a reference file that is attached to the Alignment/ROW plan sheets prior to the Preliminary Plan submittal. The Parcel.dgn file contains the legal property lines of properties affected by proposed R.O.W. along with parcel numbers and other parcel report information. (See http://mdotwiki.state.mi.us/design/index.php/Chapter_3_-_Standard_Naming_Conventions for more detail) The Parcel.dgn file is created by the Region Surveyor, Region Real Estate Technician, or Consultant, if contracted to perform this work task.

After Preliminary Plans (Final R.O.W.) have been submitted as part of the Plan Review milestone, any changes required to the R.O.W. plans are submitted as a R.O.W. revision. This R.O.W. revisions represent a snapshot in time. Changes to the design that would impact a property owner and any proposed R.O.W. items should only be considered if time permits prior to letting. These changes should be discussed with the Region Real Estate Agent and Acquisition Agent to determine the impact of the Proposed Acquisition and minimize the potential for a delay due to changes in R.O.W.

The Designer prepares the plans by laying out the R.O.W. requirements of a highway. The plans used for R.O.W. purposes are drawn utilizing MDOT's current CADD format.

5.16 (continued)

At least one month prior to the submittal of Base Plans (Preliminary R.O.W.), the Project Manager or the Design Engineer should verify that a ROW phase is set up on the Phase Initiator (P.I.) system. The ROW phase does not need to be chargeable, but it must be on the P.I. system. If the ROW phase is not on P.I., the Project Manager or Design Engineer should submit a change request in JobNet. When the Base Plans (Preliminary R.O.W.) are submitted to the Region Real Estate Technician, the Project Manager will complete the process to obtain a chargeable ROW phase.

The design plans should be at a point where the final Slope Stake Lines and construction limits have been identified. Roughly 50% complete before Final R.O.W. is submitted. The project must have an Environmental Clearance (and Public Hearing Certification, if needed). The Project Manager has the responsibility for verifying that Environmental Clearance and Public Hearing Certification has been obtained

In the R.O.W. Overlay (ROWPO) Phase the Region Real Estate Technician, or consultant if contracted for this phase, adds the ownership sheet. Not required but if requested by the Region Real Estate Agent or Acquisition Agent, the Legal Property Lines, parcel number and other parcel report information can be attached to the Removal and Construction Plan Sheets by attaching the Parcel.dgn file as a reference file for making individual Property parcel sketches.

5.16.01 (revised 9-28-2020)

Environmental Clearance

All projects are required to be classified environmentally prior to MDOT making the Good Faith Offer to the property owner. If the project has not been cleared, the Environmental Section, Project Planning Division (PPD), Bureau of Transportation Planning, will need a set of plans for their review and subsequent classification of the project.

5.16.02 (revised 2-18-2010)

Public Hearing Certification and Public Meetings

Projects which require an Environmental Impact Statement (EIS) require a formal Public Hearing. For other projects that require the acquisition of several (approximately 25 or more) parcels of R.O.W. a public information meeting should be considered prior to the R.O.W. acquisition. The Public Involvement Unit, Statewide Transportation Planning, Bureau of Transportation Planning will schedule a Public Hearing if required and can assist in scheduling a public information meeting prior to the R.O.W. acquisition. Such a meeting is held in a location and at a time convenient to the individuals directly affected.

5.16.03 (revised 9-28-2020)

Transmittal of Plans and Materials

Any transmission of plotted plans, section maps, and other material, as well as the Final R.O.W., are made through the Project Manager, who keeps the necessary records and distributes prints as required. Any revision of the R.O.W., must follow this same channel. The current method of transmittal is electronic via MDOT's project management system (ProjectWise). Transmittal includes the submission of CADD files and prints plotted in PDF format.

A. ProjectWise Procedure

Upon submittal of the various R.O.W. transmittals the project manager shall place the R.O.W. files into ProjectWise.

There are two parts to the ProjectWise transmittal. Submission of the CADD files and the submission of PDF files.

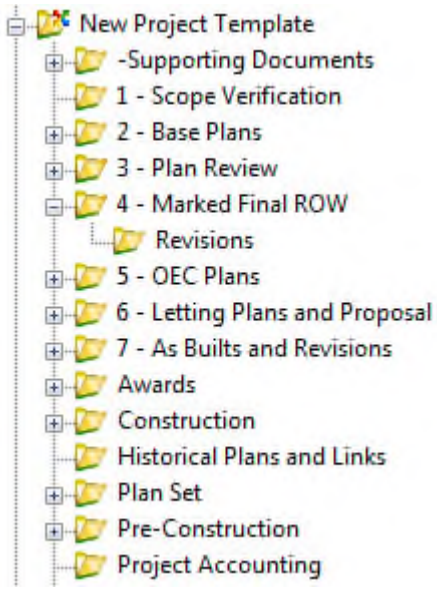
The PDF files are the documents of record and as such are located in locked folders.

The ProjectWise location of the CADD files will be provided by the designer as part of the CADD transmittal. This will include the location of the design base files and sheet files. See Standard_Naming_Conventions for information that is included in each file. The Region Real Estate Technician can utilize the sheet CADD files created by design as a template for developing R.O.W. exhibits. It is the designer's responsibility to notify Real Estate of any changes to the appropriate design base files that are included in the R.O.W. CADD transmittal.

A snap shot of CADD files used to create the Plan Review files will be submitted in the RID_Preliminary folder as part of the RID Review process. The D-XXXXXX_ROW_20YY-MM-DD.dgn can not be modified without a subsequent submittal.

5.16.03 (continued)

B. ProjectWise Template



5.16.04 (revised 1-29-2018)

R.O.W. Forms

The form needed to submit R.O.W. plans is in PDF fillable format. The 0303 form should be used at each submittal. The 0303 form should be completed and signed by the Project Manager.

5.16.05 (added 8-28-2023)

Temporary Breach in Limited Access Right of Way

Occasionally, a designer may propose to temporarily breach limited access R.O.W. Such reasons may include work occurring around wetlands or other environmental constraints, providing access to the site, equipment and material storage, haul routes, portable plants, etc. In this scenario, an Engineering Review is not required, and no property rights are conveyed within MDOT R.O.W.

Interstate requests for temporary breaches will be submitted by the Associate Region Development Engineer to the FHWA Area Engineer containing all reasons and supporting documentation pertinent to this request. FHWA must grant written approval before the project is advertised.

Non-interstate requests can be coordinated directly between the Associate Region Development Engineer and the Development Services Division Administrator.

All breaches in limited access R.O.W. require inclusion in the environmental classification/certification process and approval by the Environmental Services Section (ESS) is required prior to submitting the request. The designer is responsible for accumulating all justification and supporting documentation as may be required by ESS staff. The proposed breach must not negatively impact environmentally sensitive resources such as threatened and endangered species, cultural resources, or public recreational properties. Additionally, the proposed breach must not negatively modify roadway drainage or storm water features. An analysis of present and future drainage is required if the request modifies or crosses a drainage feature or storm water management feature.

5.16.05 (continued)

Conditions requested by FHWA, the Development Services Division, or the Environmental Services Section must be adhered to and included in the design and proposal, as required. Conditions could involve the replacement of the R.O.W. fencing, restoration requirements, temporary road work items, temporary paving, traffic control modifications, etc. Conditions may require the addition or modification of project quantities and the designer is responsible for including those quantities in the project. All conditions must be met or the request for the limited access R.O.W breach will not be approved.

All temporary access through limited access R.O.W. will expire at the conclusion of the project construction and the right of way must be fully restored, including replacement of all fencing as applicable and as outlined in any approval or real estate documents.

5.17 (revised 1-25-2021)

BASE PLANS (PRELIMINARY R.O.W.)

The Base Plans (Preliminary R.O.W.) submittal should be submitted based upon the approved dates established by the Planisware network for the project. Project Managers must meet this date and are encouraged to submit the Preliminary R.O.W. earlier if possible.

The Project Manager will notify the appropriate review groups via ProjectWise email notification of the Base Plan Review meeting with ProjectWise links to the signed 0303 Design form and submitted Base Plans (Preliminary R.O.W. Plans). The review groups will review the Base Plans (Preliminary R.O.W. Plans) and all review comments are collected by the Project Manager. After the Base Plan Review meeting has occurred, any review comments that require changes to the Base Plans (Preliminary R.O.W. Plans) will be incorporated into the development of the Preliminary Plans (Final R.O.W. Plans). Any R.O.W. or Design revisions that occur after the Plan Review meeting and submission of the Preliminary (Final R.O.W. Plans) will be documented by using the 0303 Design Form and follow the Revision process.

The Design Plan Submittal memorandum (0303 Design Form) contains Design and Real Estate information. The 0303 contains the following information along with additional information:

A. Control section and job number

B. Location

C. Environmental Classification (and date of determination), if available.

D. Anticipated R.O.W. Certification date

E. A general description of the R.O.W. needed to construct the project, i.e., proposed R.O.W. consists of limited access R.O.W. for relocated interchange ramp.

5.18 (revised 1-29-2018)

REQUIREMENTS FOR BASE PLANS (PRELIMINARY R.O.W.)

The Base Plans (Preliminary R.O.W.) should include the following:

1. See Chapter 1 and the Road Sample Plans for guidance regarding plan sheet creation.

2. Design Plan Submittal Form 0303.
   - Distribute plans and memos as per the distribution list.

3. Consultants are also required to submit both the CADD and PDF files to the Project Manager through ProjectWise utilizing MDOT's standard system format.

The following items are not required but if available should be sent as part of the Base Plans (Preliminary R.O.W.) submittal:

Survey notes with property ties and government corners, vicinity map depicting the location of the various proposed R.O.W., and existing and proposed typical cross sections.

5.19 (revised 1-25-2021)

PRELIMINARY PLANS (FINAL R.O.W.)

When the design plans are at a point where the final slope stake and construction limits have been identified (roughly 50% complete), Preliminary Plans (Final R.O.W.) should be submitted showing final R.O.W. requirements. On large projects it may be desirable to have an informal plan review with representatives from the Environmental Section, Real Estate Services Section, Region Real Estate Agent and the Design R.O.W. Engineer prior to the Plan Review meeting. This may help to avoid future R.O.W. revisions and ensure that Real Estate is receiving all of the information it needs. The R.O.W. necessary for the proposed project is outlined on Form 0303.

The Project Manager will notify the appropriate review groups via ProjectWise email notification of the Plan Review meeting with ProjectWise links to the signed Form 0303 and submitted Preliminary Plans (Final R.O.W.). The review groups will review the Preliminary Plans (Final R.O.W.) and all review comments are collected by the Project Manager. After the Plan Review meeting has occurred, any review comments that require changes to the Preliminary Plans (Final R.O.W.) will be incorporated into the development of the Final Plans (Plan Completion). Any R.O.W. or Design revision after the submittal of the Preliminary Plans (Final R.O.W.) will follow the process in Section 5.21.

5.20 (revised 1-29-2018)

REQUIREMENTS FOR PRELIMINARY PLANS (FINAL R.O.W.)

In addition to the requirements for Base Plans (Preliminary R.O.W.), the following information is needed for Preliminary Plans (Final R.O.W.):

1. See Chapter 1 and the Road Sample Plans for guidance regarding plan sheet creation.

R.O.W. revisions can be used to modify the Final R.O.W. submittal as requested by the Designer or Region Real Estate. Designers should make determining R.O.W. needs a priority in the Design Process.

5.21 (revised 9-28-2020)

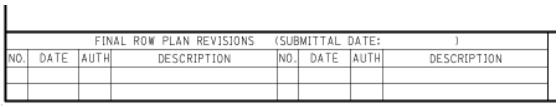
R.O.W. REVISIONS

R.O.W. Revisions are processed by the Project Manager. The Project Manager must complete the "R.O.W." box on each revised plan sheet summarizing the revisions. Should there be more than one revision on a given plan sheet each subsequent revision shall be added to the individual sheet that is revised (see figure 5.21A) The Project Manager completes and signs the Design Plan Submittal Form 0303 attaching the revised plan sheet(s) with the revisions circled in red. The 0303 Form should include a detailed description of and reason for the revisions. The requesting unit or division should also be included on the memorandum.

Revisions, unless originated by Region Real Estate, are not normally accepted within six months of the letting date. If a revision is necessary within six months of letting, consult with the Region Real Estate Agent, or the Design R.O.W. Engineer to determine the best method for processing the Revision.

If a R.O.W. Revision includes a majority (more than 50%) of the plan sheets included in the Preliminary Plan (Final R.O.W.) plan submittal, it is advisable to re-submit the entire set of Preliminary Plan (Final R.O.W.) plans instead of issuing a R.O.W. Revision. The Design R.O.W. Engineer should be consulted in making this determination.

Figure 5.21A



5.22 (revised 9-28-2020)

MINOR CONSTRUCTION CHANGES FORM

During the negotiations between the property owner and MDOT Real Estate, the property owner may request some construction change or note be made on the plans. For example, the property owner may want the driveway relocated 60 feet west of its existing location because of improvements planned for the property, or a property owner may request the timber from removed trees to be stockpiled for the property owner's use. The Real Estate Acquisition Agent will describe the change on Minor Construction Changes Form (form 728). Any requested change involving design issues are to be presented to the designers by the Region Real Estate Agent or Region Project Development Engineer for their approval or denial before the negotiation is complete. The designer is encouraged to work with the Region Real Estate Agent in reaching an agreement that satisfies the property owner while providing a safe and constructible road.

When the Design Unit receives signed, approved 728 forms, every effort should be made to place the information on the plans. This will aid the construction field office and the contractor. The cost for the change should be included in the estimate. The changes shown on Form 728 should not require the submittal of R.O.W. revision, because they should not change the limits of the proposed R.O.W.

5.22.01 (revised 9-28-2020)

Showing MDOT Remainder Property on Plans

Many times MDOT has remainder property in the project vicinity. Quite often this property could be used by the contractor for locating various batch plants, equipment and materials storage, or disposing of excess excavations. The designer should consult with the Real Estate Region Agent and Construction Field Services Division to determine if the remainder property locations should be shown on the plans. If it is determined that the project area contains remainder property that could be used by the contractor, the construction plans will require a special provision informing the contractor of any restrictions for the use of the property and/or items required for authorization of its use (by the Resident Engineer) and that a rental agreement between the contractor and MDOT (Real Estate Services Section – Property Management Unit) may be required.

5.22.02 (revised 9-28-2020)

Site Clearance

Occasionally Region Real Estate or the Real Estate Services Section will request the Design Division to include the removal or demolition of a building in the design plans. Real Estate will provide all the necessary information to be included in the proposal package, including the Building Removal Specifications (Form 665).

5.23 (revised 9-28-2020)

R.O.W. SUMMARY

The preceding commentary on the processing of R.O.W. should be considered as a general guideline only. Each project will have to be examined for special or unique features that might require further study. These should be discussed with the Design R.O.W. Engineer (liaison between Design and Region Real Estate or the Real Estate Services Section).

Preliminary reviews will help to reduce the number of R.O.W. revisions. Changes in R.O.W. design, after it has been submitted, must be held to a minimum. In some cases the R.O.W. may already have been acquired, as detailed on previously submitted plans. Changes usually dictate that additional time may be needed to clear R.O.W. and additional expenses charged to the project. To avoid interference or delay during construction, Region Real Estate or the Real Estate Services Section must be satisfied that all requirements are met. Revisions in R.O.W. can be avoided by making certain concessions in the form of ditch changes, steeper slopes, etc., to stay inside the R.O.W. as previously submitted. These practices should be encouraged insofar as they do not materially detract from the concepts of a good design and/or safety.

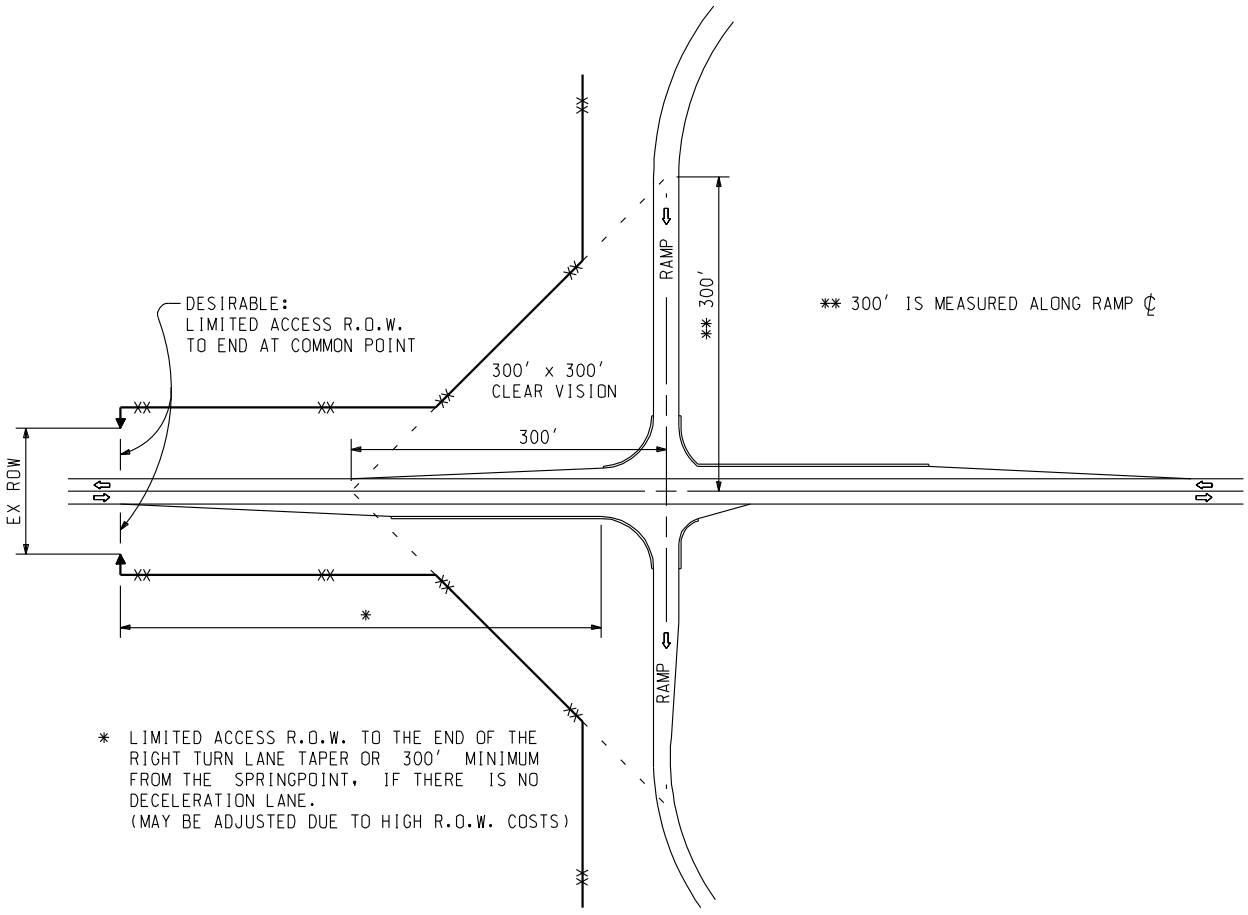
5.24 (revised 9-22-2014)

R.O.W. SKETCHES

The R.O.W. sketches included in this section should be considered general guidelines for depicting certain situations only. The sketches are not intended to show complete R.O.W. dimensioning for every situation.

5.24

R.O.W. SKETCHES

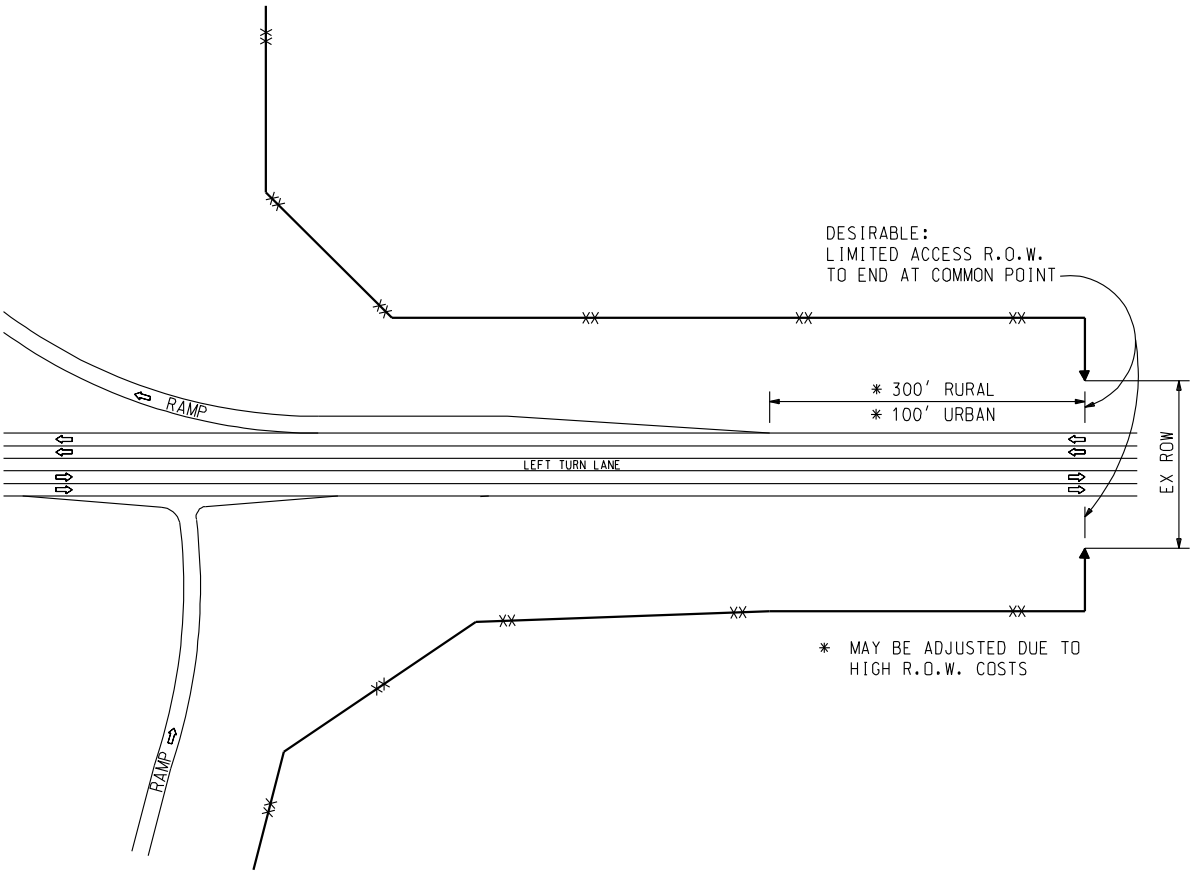


GUIDE FOR THE PURCHASE OF
LIMITED ACCESS R.O.W. AT RAMP TERMINAL (RURAL)

Figure 5.24.01

5.24

R.O.W. SKETCHES

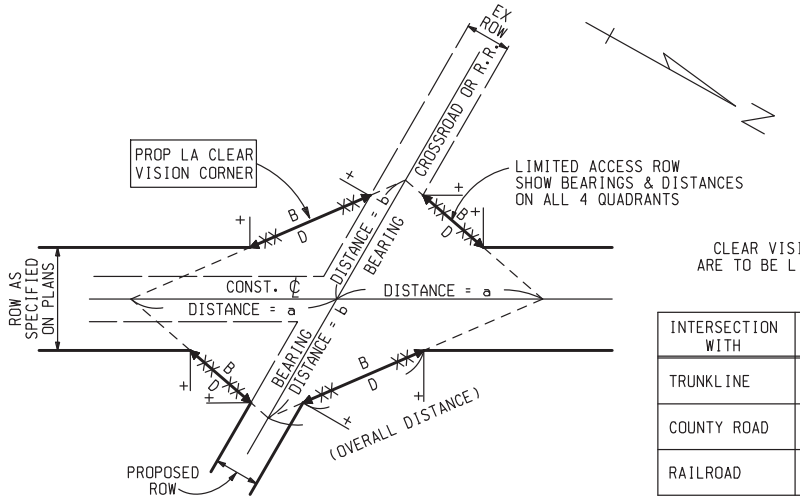


GUIDE FOR THE PURCHASE OF
LIMITED ACCESS R.O.W. AT RAMP TERMINAL

Figure 5.24.02

5.24

R.O.W. SKETCHES



FOR SINGLE ROADWAY

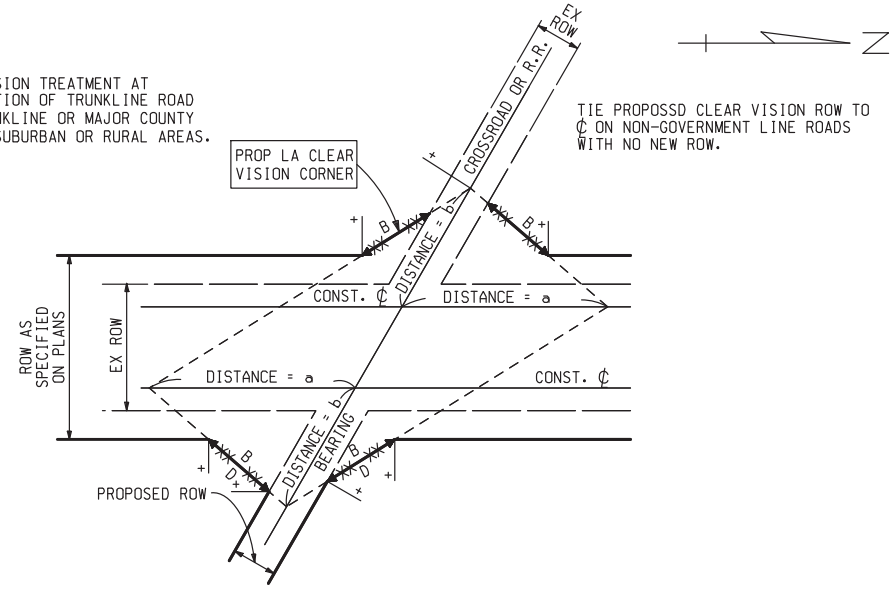
CLEAR VISION CORNERS ARE TO BE LIMITED ACCESS

INTERSECTION WITH	LOCATION	a	b
TRUNKLINE	RURAL	300′	300′
COUNTY ROAD	RURAL	300′	200′
RAILROAD	RURAL	*	*

* REFER TO THE TRUNKLINE RAILROAD CROSSING UNIT OF THE OFFICE OF RAIL

CLEAR VISION TREATMENT AT INTERSECTION OF TRUNKLINE ROAD WITH TRUNKLINE OR MAJOR COUNTY ROAD IN SUBURBAN OR RURAL AREAS.

TIE PROPOSSD CLEAR VISION ROW TO ℄ ON NON-GOVERNMENT LINE ROADS WITH NO NEW ROW.



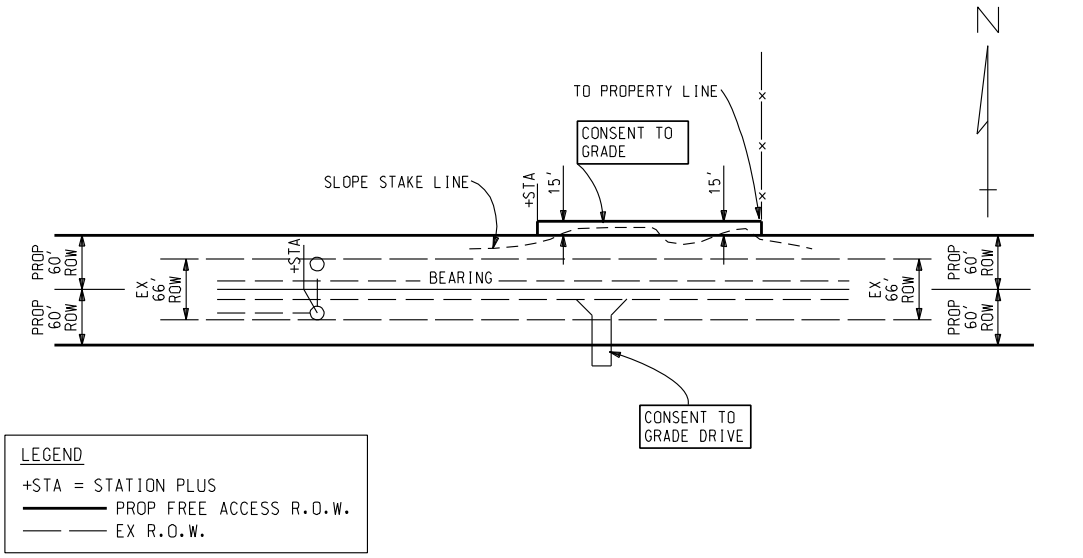
FOR DUAL ROADWAY

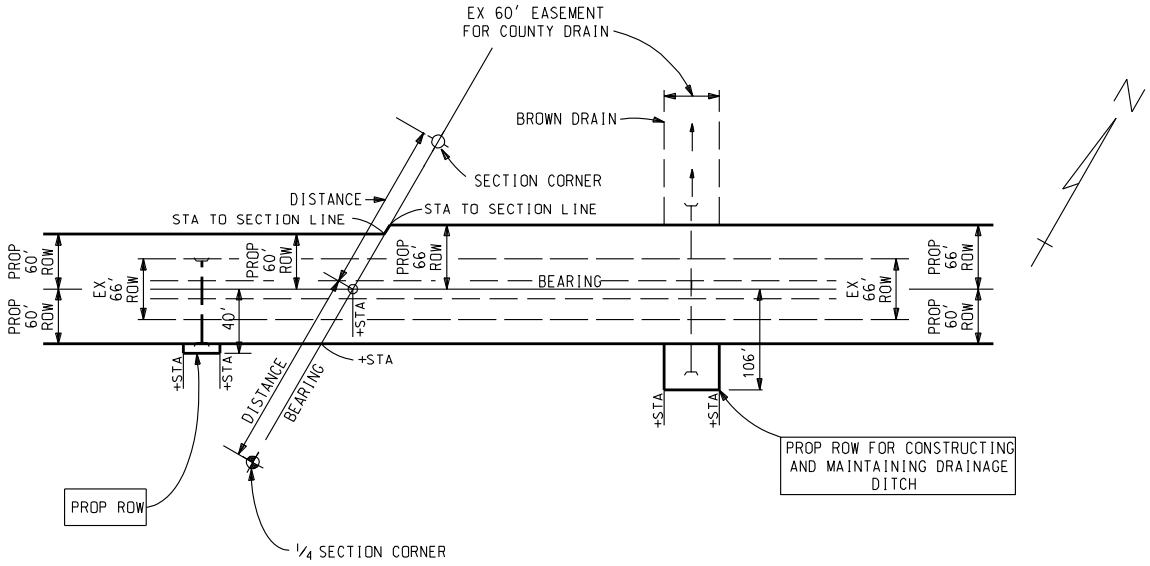
SKETCHES SHOWING DIMENSIONS FOR CLEAR VISION AREAS

Figure 5.24.03

5.24

R.O.W. SKETCHES



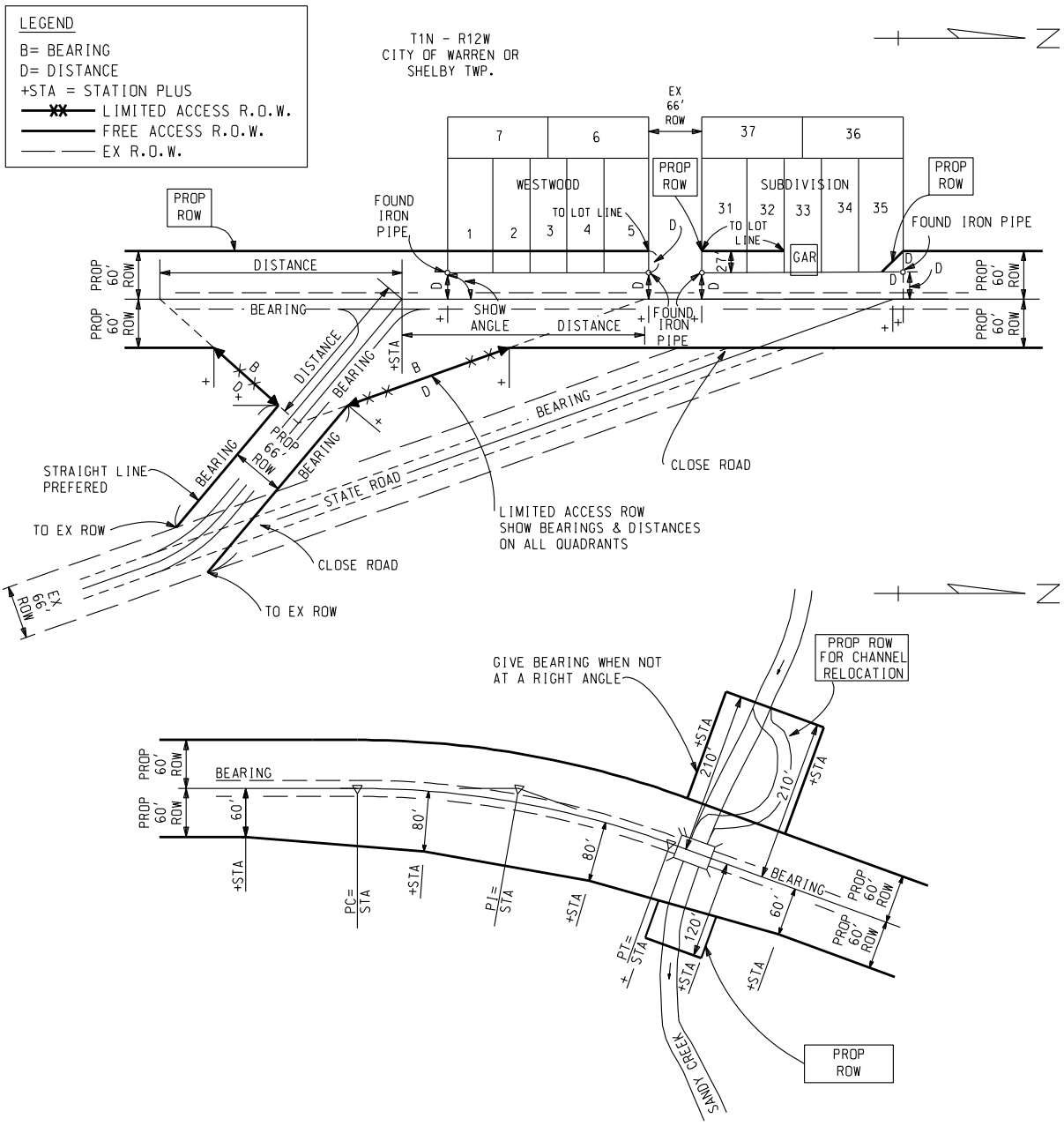


METHOD OF INDICATING
EXISTING OR ACQUIRED AND PROPOSED RIGHT OF WAY ON PLANS

Figure 5.24.04

5.24

R.O.W. SKETCHES

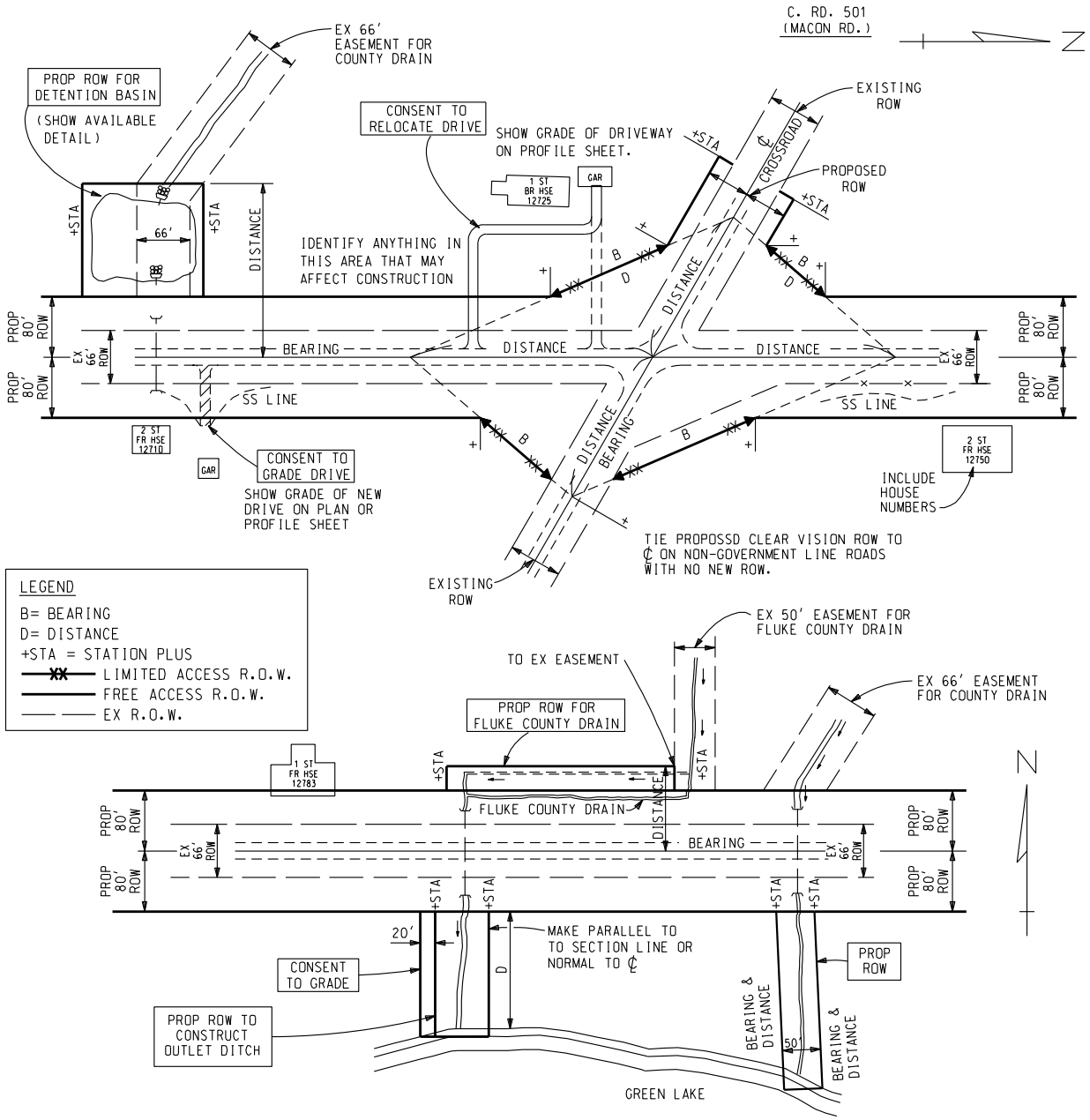


METHOD OF INDICATING
EXISTING OR ACQUIRED AND PROPOSED RIGHT OF WAY ON PLANS

Figure 5.24.05

5.24

R.O.W. SKETCHES

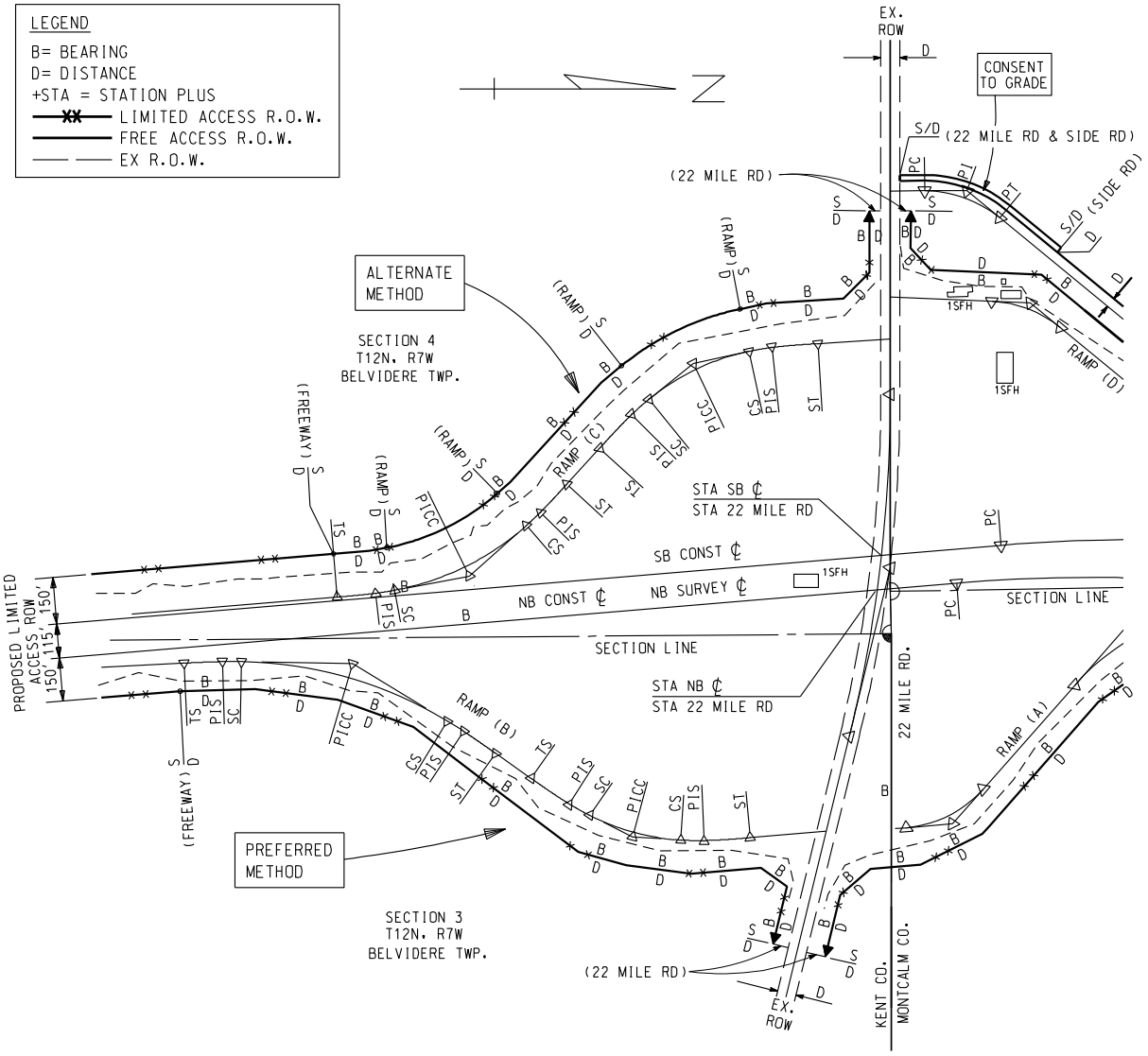


METHOD OF INDICATING
EXISTING OR ACQUIRED AND PROPOSED RIGHT OF WAY ON PLANS

Figure 5.24.06

5.24

R.O.W. SKETCHES

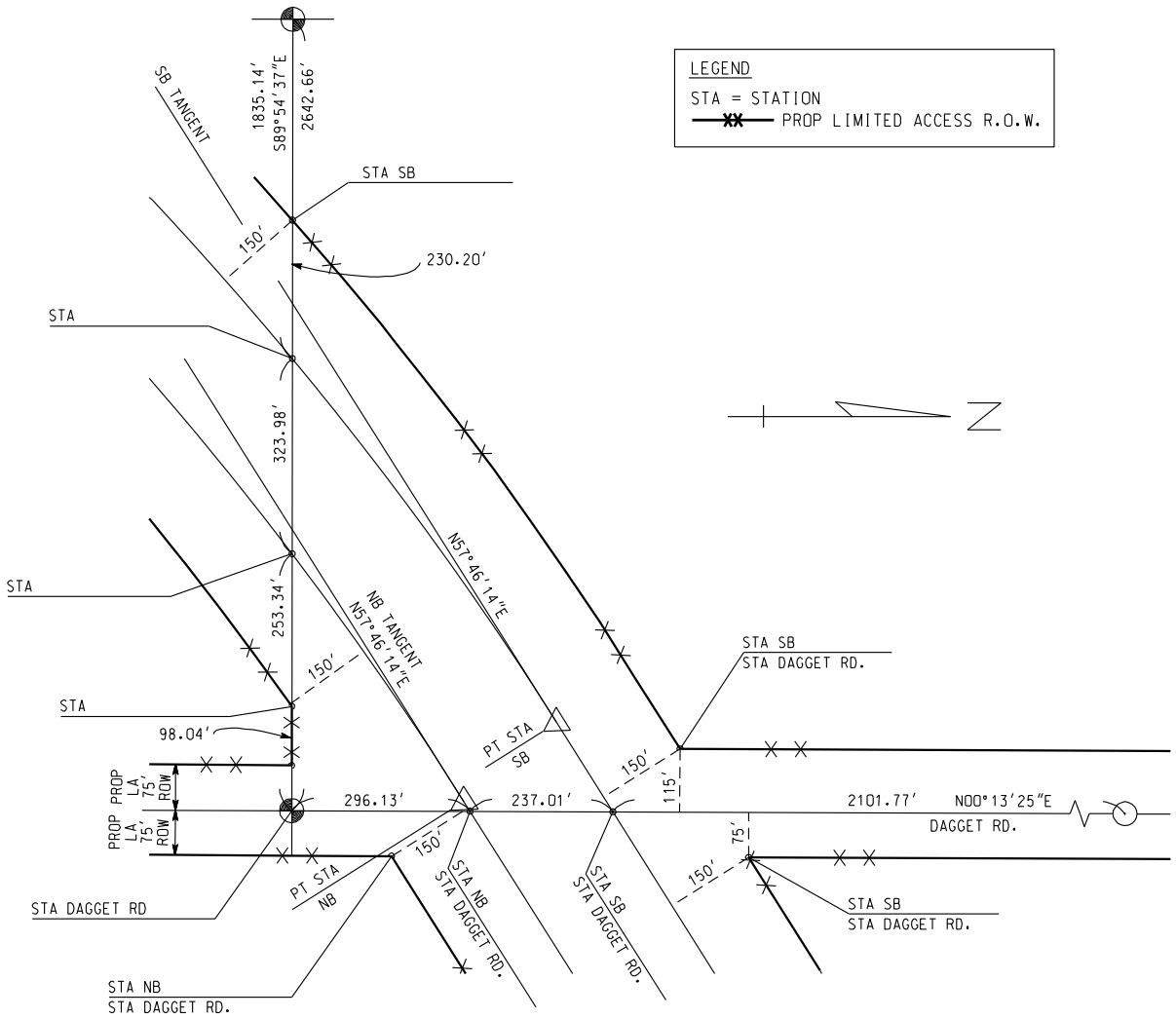


SAMPLE OF R.O.W. DIMENSIONS FOR RAMPS

Figure 5.24.07

5.24

R.O.W. SKETCHES

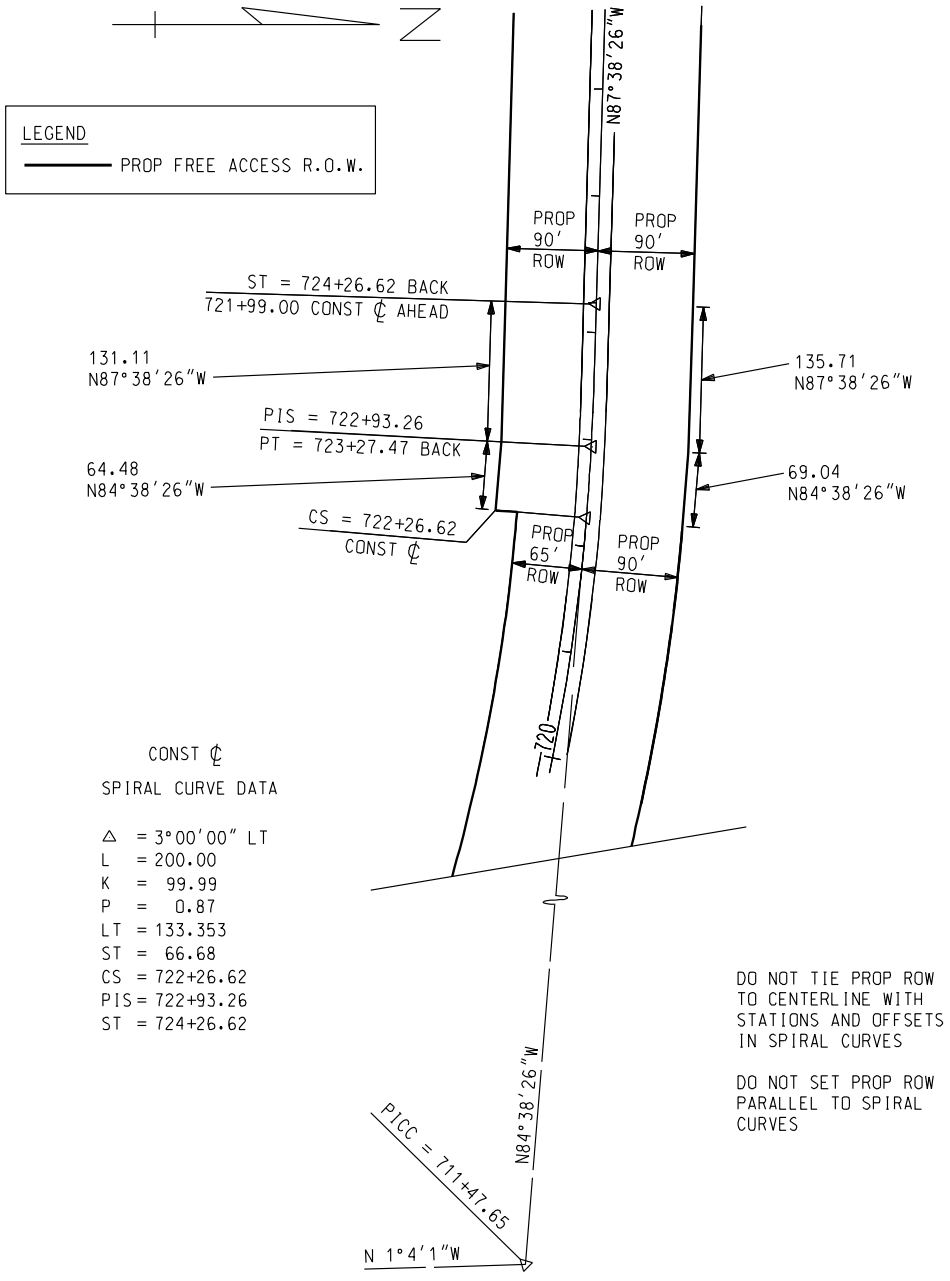


SAMPLE OF R.O.W. TIES
(NOT TO SCALE)

Figure 5.24.08

5.24

R.O.W. SKETCHES



R.O.W. DIMENSIONING FOR SPIRAL CURVES

Figure 5.24.09

5.24

R.O.W. SKETCHES

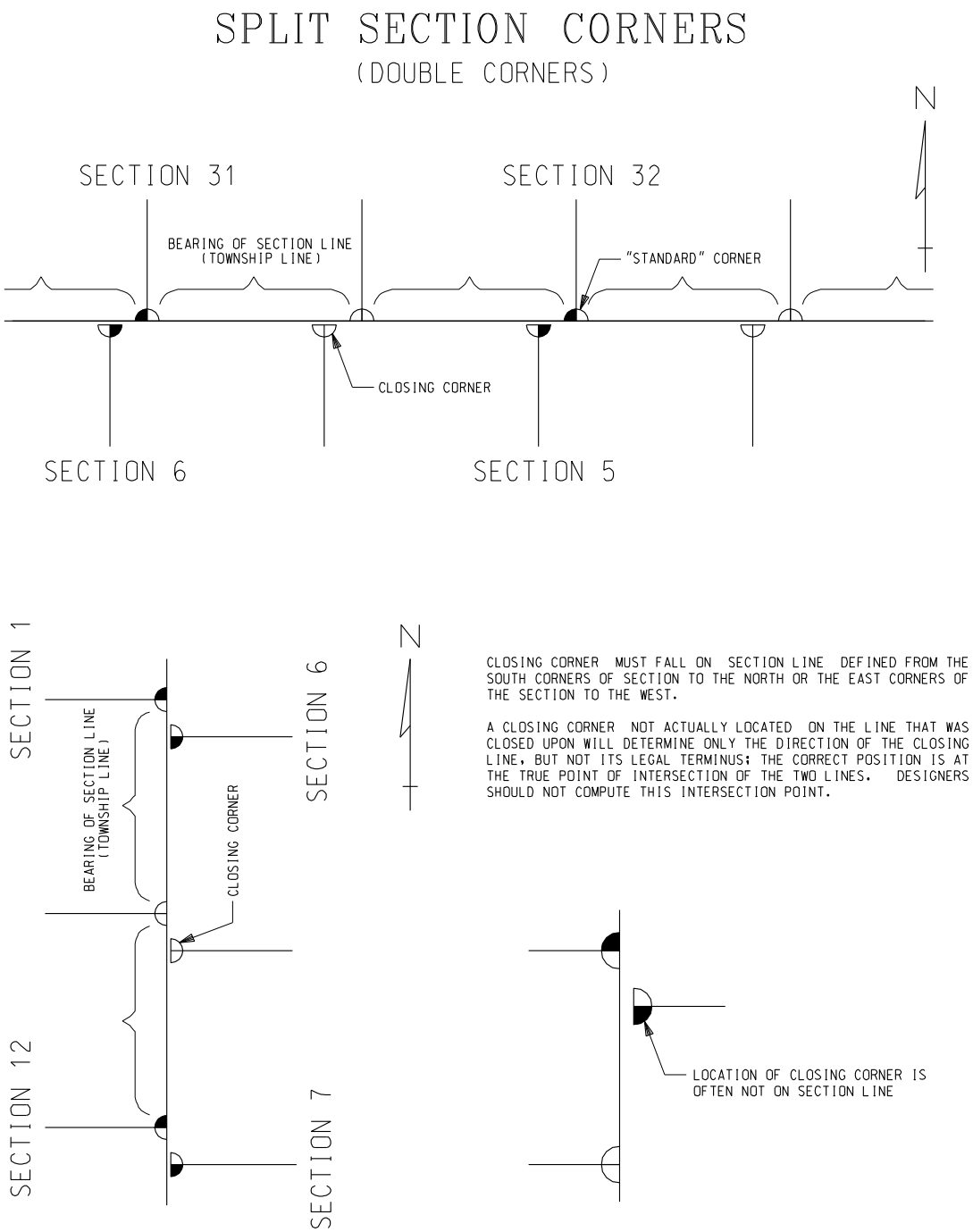
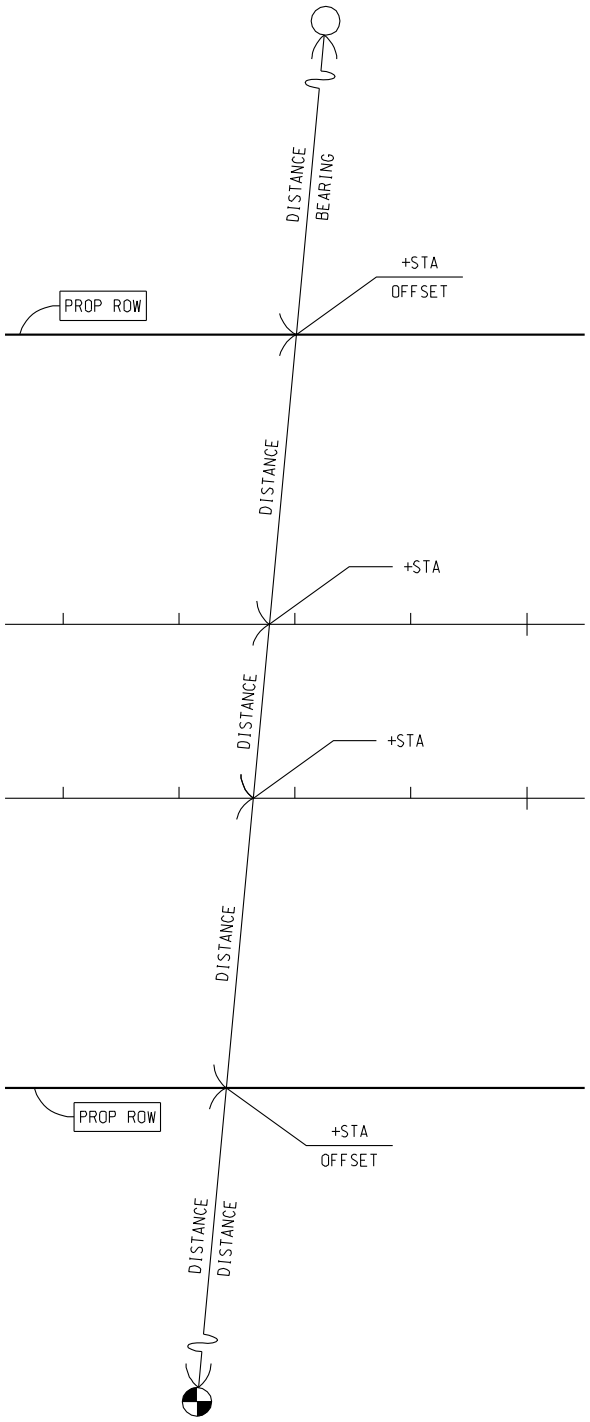


Figure 5.24.10

5.24

R.O.W. SKETCHES

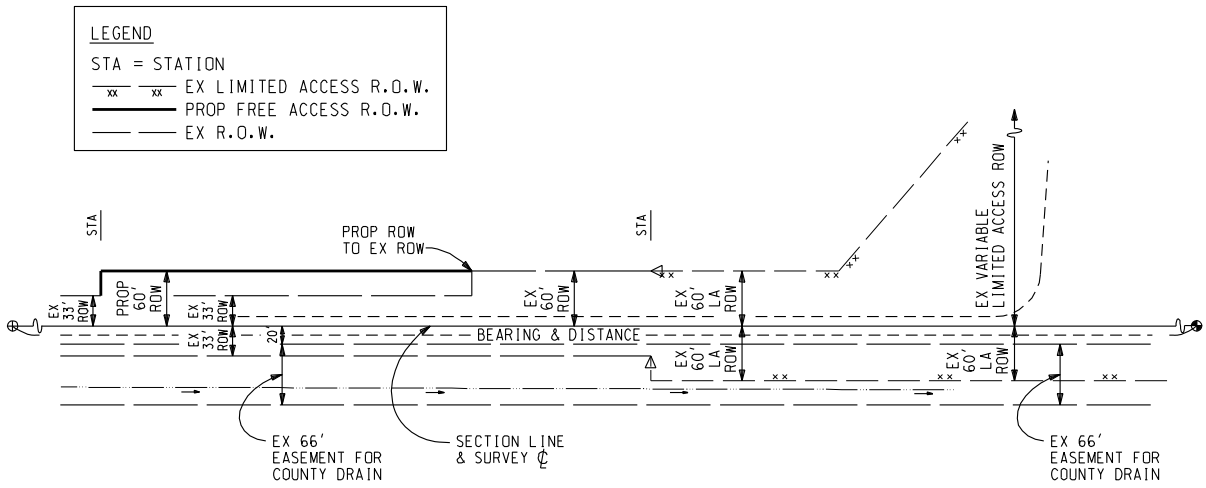


METHOD OF SHOWING TIES
TO GOVERNMENT CORNERS

Figure 5.24.11

5.24

R.O.W. SKETCHES



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CHAPTER 6 • SURFACING AND SHOULDERS

6.01 PAVEMENT SELECTION PROCESS

6.01.01 References

(revised 6-28-2021)

A. Truck Operators' Map, MDOT, issued annually (available from the Utility Coordination and Permits Section of the Development Services Division)

B. Pavement Selection Manual, MDOT, Current Edition

C. Standard Specifications for Construction, MDOT, Current Edition

D. Michigan DOT User Guide for Mechanistic-Empirical Pavement Design, MDOT Current Edition

6.01.02 Equivalent Single Axle Load (ESAL)

Recognizing that automobile traffic has little deleterious effect on the load carrying capacity of a pavement, the Department has adopted the concept of 18 kip (18,000 lbs.) axle load repetitions or ESAL as a meaningful unit of traffic measurement. (While there is no hard data available, some consider that it requires something on the order of 5,000 passenger cars to equal one 18 kip axle load. A General Accounting Office study has estimated that one 80,000 lb. truck causes wear equal to 9,600 cars.) The Bureau of Transportation Planning, in determining future traffic volumes for design purposes, is able to convert average daily commercial vehicles counts into ESAL repetitions. ESALs are available from the Project Planning Division.

6.01.03 Survey and Mapping Methods

Legal truck weights in Michigan, for vehicles exceeding 80,000 lbs. gross weight, are 18,000 lbs. per single axle and 13,000 lbs. per axle in tandem groups, with one 32,000 lbs. tandem pair permitted, provided certain minimum axle spacings are met. For vehicles less than 80,000 lbs. gross weight, maximum weights of 20,000 lbs. per single axle and 34,000 lbs. per tandem axle are permitted. Routes where these loads are permitted, regardless of the season, are shown in green on the Truck Operators' Map, published by the Department.

The maximum gross load is 164,000 lbs. on 11 axles legally spaced. Overweight vehicles may be issued a permit for a specified trip or move.

6.01.04 AASHTO Interim Guide

In the middle 1950's, AASHO conducted the most extensive road test ever on a specially constructed track near Ottawa, Illinois. Utilizing a part of what is now I-80 and military personnel driving loaded trucks 24 hours per day for two years, this provided the data that led to the publication of the “AASHTO Interim Guide for Design of Pavement Structures 1972". The AASHTO design method is an empirically developed method which is used across the country by many public agencies.

6.01.05 Choice between Aggregate, Hot Mix Asphalt and Concrete

(revised 10-23-2017)

It is the general practice of the Department to not leave aggregate as a driving surface on a roadway. Therefore, at minimum, a new or existing aggregate road will generally be paved with a single course of hot mix asphalt material, regardless of how little traffic it serves.

Michigan differs from many of the states in having a wide range of soil types, varying from well drained sands to heavy clays, to rock outcroppings. Concrete has the advantage of rigidity and high strength relative to thickness and requires less elaborate mixing facilities at the plant. Hot mix asphalt is flexible, easier to repair, and it requires less time to open to traffic, needing only to cool. The Department tries to utilize the advantages of each material when selecting a pavement type.

Ramps will usually have the same type of surfacing as is used on the freeway. One exception would be when the mainline is overlaid utilizing a different wearing surface material than the existing ramp. In this case, the new mainline surface material may extend up the ramps part way depending on the condition of the ramps.

Similarly, utility trench replacement is typically the same type of pavement material as surrounds it. Refer to Section 9.04.01 for design of pavement cross-section replacement due to utility trench work.

6.01.06 Pavement Design and Selection Policy

(Approved by EOC 2-9-2012)

(revised 9-22-2025)

6.01.06A Design

Pavement design is performed using a combination of the AASHTO 1993 and Mechanistic-Empirical (ME) design methods. The AASHTO 1993 design method is conducted using the "AASHTO Guide for Design of Pavement Structures", 1993 and the software “DARWin Version 3.1”. The ME design method is conducted using the AASHTO “Mechanistic-Empirical Pavement Design Guide” and the software “Pavement ME Design.” Further details can be found in the Michigan DOT User Guide for Mechanistic-Empirical Pavement Design.

6.01.06B Selection

Pavement selection will be determined using the life cycle cost analysis method when the project pavement costs exceed the $1.5 million threshold as described in the Pavement Selection Manual. Pavement costs are determined by separately calculating the cost of paving with both HMA and concrete. When the cost of either the HMA or concrete exceeds $1.5 million, a life cycle cost analysis is required. For such projects, Pavement Operations of the Construction Field Services Division will conduct the pavement design and life cycle cost analysis in accordance with the Pavement Selection Manual. MDOT staff and industry organizations will be provided an opportunity for review and comment, with final approvals by the Engineering Operations Committee. In accordance with state law, the low cost alternative will be selected.

Pavement designs and the life cycle cost analysis will be done by Pavement Operations for the following project categories.

- All New Construction or Reconstruction projects with pavement costs greater than $1.5 million.
- Major Construction on Existing Road projects (unbonded concrete overlays, rubblized concrete with HMA surfacing, HMA over crush & shaped HMA, multi-course HMA overlays, thin concrete overlays, and multi-course HMA over an Asphalt Stabilized Crack Relief Layer) with pavement costs greater than $1.5 million.

Certain fixes known under a different name (e.g. ‘inlay’) may still require a life cycle cost analysis, regardless of project type. Questions should be directed to Pavement Operations. Assistance will be given to the Regions for other projects on an as-needed basis

Life cycle cost analysis will include the cost of initial pavement construction costs as well as maintenance costs over the service life. It will also include calculation of user costs for both initial construction and all future maintenance shown in the maintenance schedules. User costs will be calculated using the software titled “Construction Congestion Cost.”

Informational life cycle cost analyses may be conducted for a variety of reasons prior to processing of an official analysis. In addition, some circumstances will require re-analysis, such as scope changes or scheduling delays. Projects must be monitored during project development to ensure that a valid life cycle cost analysis is in place prior to advertisement, and that the correct pavement type has been specified in the plans. The Pavement Selection Manual contains details of these and many other aspects of the process.

6.01.07 Alternate Pavement Bidding

(revised 7-29-2024)

At times during pavement selection, the life-cycle cost between the two alternatives may be relatively close and all other design considerations relatively equal. Under these circumstances, bidding the project with alternate pavement options can allow market competition to determine best value.

On September 1, 2011 the Engineering Operations Committee approved a process for the identification and development of alternate pavement bid (APB) candidate projects.

Candidate selection criteria includes;

1. Only freeway projects will be eligible.
2. The project fix type must be either a complete reconstruction or a major rehabilitation (separated concrete overlay or HMA over rubblized concrete).
3. Estimated construction costs must exceed $10,000,000 dollars.
4. Each pavement alternate must be expected to have similar environmental, Right-of-Way, drainage, and utility impacts.
5. Maintaining traffic concepts must be similar for both pavement alternates.
6. Paving must be the controlling operation for the construction schedule.
7. If the project meets all the above criteria, the TSC will request an informational LCCA. The proposed pavement designs will be developed using the MDOT Pavement Selection Manual. The life cycle costs of the two pavement design alternates must be15% to be considered for alternate bid on Design-Bid-Build projects. A Design-Build project will be identified as APB if the project meets the above Selection Criteria, regardless of the LCCA EUAC percentage differential.

MDOT leadership may recommend other projects not meeting the above criteria.

The detailed selection and plan development process for Alternate Pavement Bidding is available on the Plan Development Services website (MDOT only).

6.02 AGGREGATE CONSTRUCTION

6.02.01 General

There are principally two types of natural aggregate produced commercially:

- Gravel and sand that is excavated and possibly washed and screened.
- Crushed aggregates that may be made from gravel or quarried rock, but which are run through a crusher, then perhaps washed and screened for a given gradation.

In recent decades, other types in the form of artificial aggregates have appeared on the road building scene. Two examples are slag and recycled concrete. Both can be crushed and screened to meet most of the specification aggregate gradation requirements.

6.02.02 Glossary of Terms

Bank run - An aggregate excavated from a bank or pit without any subsequent processing.

Chert - An extremely fine-grained, hard rock composed mainly of silica and occurring commonly in limestone beds. It is considered an undesirable particle because of its susceptibility to fracture under freeze-thaw conditions.

Choking - Adding fines to an open-graded aggregate or rock to make it more densely graded.

CIP - Compacted in place.

Daylighted - Usually used when speaking of the drainage plane between the top of subgrade and the bottom of subbase. To daylight this drainage plane is to extend it to the roadway front slope where it can drain.

Dense graded - An aggregate having a range of particle gradation such that most of the voids between larger particles are filled by other smaller particles.

Fines - A silt and/or clay size material which will pass through the 0.075 mm sieve (ASTM No. 200.)

Fly ash - A by-product of the coal combustion process in electrical generating plants. It is a very fine light dust recovered from stack gases, composed primarily of silica, alumina, and various other oxides and alkalies. In the presence of lime and moisture, it has pozzuolanic (cementing) properties.

Foundry sand - The waste core sand from the steel casting process. Usually black or dark brown in color and likely to contain metal fragments and oil. The Department tests for permeability, in addition to the other usual tests. Environmental interests object to foundry sand because of the excessive leaching of the hydrocarbons or other additives, and it has been declared toxic. If used, it requires extensive testing for inertness or encapsulation. A permit is usually required for use.

Freeze-thaw durability - A measure of dilation percentage per 100 freeze-thaw cycles (Michigan Test Method 113 and 115). It is an aggregate's resistance to failure when incorporated in portland cement concrete and subjected to alternating cycles of freezing and thawing.

HMA – Hot Mix Asphalt (formerly referred to as “bituminous”). Also see Section 6.03.02.

Heavy media - A process used in coarse aggregate gravel production to separate low-gravity particles from the product. The aggregates are passed through a tank containing an agitated liquid composed of water, magnetite, and ferrosilicon. The specific gravity of the liquid is adjusted to that of the low-gravity fraction of the coarse aggregate, which contains the majority of the deleterious particles.

LM - Loose measure.

Loss by washing - After an aggregate or soil sample is dried and weighed, it is washed. The fine components (smaller silt sizes and clay) carried off by the water through a 0.075 mm sieve (ASTM No. 200) is the loss by washing.

Metal - A somewhat archaic term, dating back to the days of gravel roads, referring to the road surface structure whether it is aggregate, aggregate and HMA, or concrete. "Edge of Metal" would today be synonymous with **"Edge of Pavement"**.

OGDC - Open-graded drainage course.

Open-graded - An aggregate gradation lacking sufficient fines to fill the voids between the larger aggregate particles. Material, other than fine aggregate, consisting of mostly one-size particles would be open-graded.

Passing 200 - The loss by washing plus the dried portion of the sample that passes the 0.075 mm sieve (ASTM No. 200). Usually about 0.5 to 1.0% more than the loss-by-washing figure.

Pea gravel - A natural gravel, essentially rounded. Usually a by-product of aggregate production for which there may be limited demand.

Processed aggregate - Material that has been mechanically processed in some way either by screening, washing, or crushing, to enhance its usability.

Select Subbase - An obsolete term, no longer proper terminology, but still used conversationally, that refers to a layer of dense graded processed aggregate placed on subbase to stabilize it, thus facilitating the operation of construction equipment. Comparable to what is now called **"Aggregate Base"**.

Separation Course - An HMA or granular course between an old pavement and new pavement that is intended to eliminate or minimize reflective cracking in the new pavement.

Shrinkage - The reduction in volume of a soil or aggregate when compacted, as compared to its natural, in-place state. Sometimes used when referring to the ***additional*** material required to maintain the same volume in the compacted state as existed in the natural, in-place state.

Slag - An artificial aggregate produced as a by-product of the steel (blast furnace slag) and copper (reverberatory furnace slag) refining process, composed of the solidified remnant of the coke, limestone, and mineral impurities that float to the top of the molten metal. Of several different types, it is crushed and screened to specification aggregate gradation.

Stabilization - The process of adding a material to an aggregate to increase its stability and load-supporting capability. Typical stabilizing agents are water, soils high in fines, lime, HMA materials, and portland cement.

Top size - In a given aggregate gradation, the largest size aggregate particle.

Windrow - Aggregate or earth that has been graded into a longitudinal pile, usually parallel with the center of the road.

The following terms are defined in the Standard Specifications for Construction:

- **Earth grade**
- **Subbase**
- **Subgrade**

6.02.03 Method of Measurement

Aggregates are measured in any of the following ways:

- **Ton (t)** - requires scales and an inspector for weighing; applicable where thickness or area is not uniform.
- **Square Yard (Syd)** - (of a given thickness) - requires field measurement for area, plus depth checks.
- **Cubic Yard, LM (Cyd)** - requires "truck count" and measurement of each hauling unit in the field or computation of volume in the stockpile.
- **Cubic Yard, CIP (Cyd)** (of a given thickness) - requires field measurement of area, plus depth checks.

In order for the method of measurement for aggregate bases and surface courses to be related to the nature of the work involved, aggregate measurement should be set up as follows:

6.02.03A Ton

Use where traffic will use the proposed aggregate surface such as:

- Reconstruction - through traffic maintained on an aggregate base.
- Reconstruction where some grade raises are gravel raises only.
- Shoulders on resurfacing projects.

6.02.03B Square Yard

Use where there will be no traffic on the proposed aggregate surface such as:

- New (relocation) construction
- Total reconstruction - through traffic detoured.
- Total reconstruction - part-width, traffic maintained on existing surface and reconstructed surface (not base).
- Widenings - one lane or more requiring new aggregate base.

6.02.03C Cubic Yard, LM

Use where small amounts of aggregate are involved such as:

- Gravel bases and surfaces for temporary roads.
- Gravel-surfaced crossovers.
- Driveway approaches (base or surface)
- Crossroad approaches less than 200 feet long (base or surface).
- Total aggregate in the contract is less than 5,000 cubic yards.

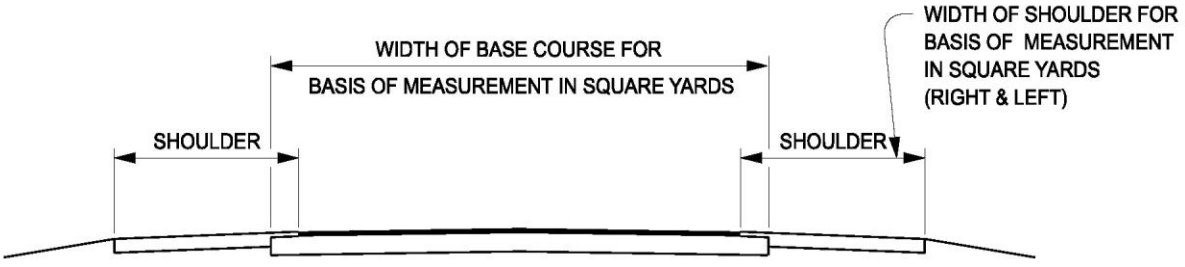
Any combination of these three methods of measurement may be utilized on any one project.

6.02.03D Cubic Yard, CIP

This method is similar in application to the square yard unit of measurement, and is more commonly used with small quantities. Use only when recommended at The Plan Review Meeting.

The ton as a method of measurement for aggregates should not be used in the Detroit Metropolitan area. Use square yard whenever possible and cubic yard, LM or CIP when recommended at The Plan Review Meeting.

When aggregates are measured and paid for by the square yard, the total width of the aggregate should be used for the basis of measurement even though there is overlap, as shown in the example below:



6.02.04 Weight of Aggregates

While different materials in a compacted state weigh more or less than others, for general purposes compacted aggregates are considered as weighing 4,000 lbs/cyd. An exception is slag aggregate. See Section 6.02.08.

6.02.05 Subbase Stabilization

While different materials in a compacted state weigh more or less than others, for general purposes compacted aggregates are considered as weighing 4,000 lbs/cyd. An exception is slag aggregate. See Section 6.02.08.

6.02.05A Purpose

A non-cohesive granular material may be practically impassable to wheeled equipment, and it may be difficult to compact, especially if the sand particles are rounded and one sized. In order to build a project, it is often necessary to stabilize the sand just to enable construction equipment to get on it. By contrast, a clay subgrade, unless it is moisture saturated, can be compacted, and it is quite traversable.

6.02.05B History

The practice of constructing a base with specification gravel on the top of subbase was instituted by the Department in 1955 on all concrete pavement projects. Its purpose was two-fold:

1. To prevent rutting of the subbase (and subsequent contamination with subgrade material) by the contractor's equipment.
2. To provide a stable foundation for placing the paving forms.

The practice was later extended to subbases under flexible surfaces, the material then being changed to the same as the aggregate base course. As the use of paving forms faded from general practice, one of the reasons for placing stabilizing material vanished. Also, about this time, evidence began to show that the compacted aggregate impeded the free drainage below the pavement, defeating to some extent the purpose of the subbase. Currently the Department generally uses this material under HMA. For new concrete pavements, an open graded material with improved drainage characteristics (Open Graded Drainage Course = OGDC) is typically used. See Section 6.02.06.

6.02.05C Thickness (typical)

Aggregate Base, 4 inch

6.02.05D Width

- Under rigid pavements
    - 3 feet (underdrain pipe) or 2 feet (PDS) outside each edge
    - See Standard Plan R-80-Series
- Under flexible pavements
    - Full width of paved surface including paved shoulders.

The additional width beyond the outside edge of concrete pavement is to facilitate the use of slip-form equipment. If curb and gutter is proposed, the width of stabilization should not be increased because of the curb and gutter, unless the plans specify that integral curb and gutter is to be placed (in which case the stabilization should extend 3 feet beyond the back of curb). If the contractor chooses to use integral curb and gutter, then the additional width must be paid for by the contractor. See Pavement Design Engineer for latest details.

When valley gutter or urban freeway curb is used, the Aggregate Base should be extended to include the width of valley gutter or urban freeway curb in order to avoid a marked change in type of base material under the valley gutter or urban freeway curb.

6.02.05E Criteria for Use

Aggregate base is typically used under all HMA and some concrete pavements placed on subbase material. Aggregate base may also be used as a construction platform directly on subgrade when recommended at The Plan Review Meeting.

6.02.06 Open Graded Drainage Course

(revised 6-28-2021)

6.02.06A Purpose

Research has concluded that open graded bases provided the most suitable method for removing water from the roadway section. Materials for OGDC are specifically designed to allow water to drain freely and still provide a suitable paving platform. The OGDC is drained by an open graded underdrain that is located under the shoulder in a geotextile wrapped trench. The trench is backfilled with an open graded material.

OGDC gradations initially required 0-15% passing the 4.75 mm sieve (ASTM No. 4) and 100% passing the 37.5 mm sieve (1½ inches). In some instances contractors reported difficulty paving over this material because of lesser stability than traditional dense graded bases. For this reason this gradation is no longer used. Current OGDC gradations provide improved drainability and stability.

The department has revised the specified gradation several times since the early 1980's. The perceived instability of OGDC continues to be an issue. National studies continue to show the benefits of open graded bases. However, gradations continue to be studied that will maintain drainability and increase stability. Drainability of OGDC is on the order of 300 to 500 feet horizontally per day. The lateral drainage path, to the nearest underdrain, should be no more than 30 feet

6.02.06B Typical Cross Section

The OGDC is usually shown on the typical cross-section extending 1 foot beyond the edge of shoulder. Typically, its thickness is 6 inches or 16 inches in the Metro Region with either a geotextile separator or a dense aggregate separator course placed between the OGDC and the subbase.

6.02.06C Usage

The Engineering Operations Committee, on September 9, 1987, decided that OGDC should be used under all full lane width concrete pavements that are one-half mile or more in length. Exceptions may be made. Contractor equipment, other than spreading and trimming equipment, should not drive directly on the Open Graded Drainage Course. These traffic loadings, directly on the OGDC, cause infiltration of the subbase material into the OGDC layer. This inhibits the drainability of the OGDC.

The designer should review the project with the Construction Field Services Division to determine if construction equipment may run on the open graded base. The designer should check with the Pavement Design Engineer (Construction Field Service Division) for recommendations, if a different base is required.

6.02.07 Crushed Concrete Aggregate

With the development of equipment that can crush concrete on a large scale, it is now feasible to recycle crushed concrete aggregates. Its usage is defined in the Standard Specifications for Construction.

Experience has shown that crushed concrete fines, i.e., crushed concrete sand, causes a very harsh mix, difficult to place and finish, as well as being difficult to consolidate in the field, leading to low compressive strength. For this reason, crushed concrete sand is now prohibited in new concrete. In addition, concrete fines contain chlorides from previous use which causes accelerated rusting of steel in the concrete. MDOT experience has also shown that concrete fines have erratic absorption rates which prevent a consistent water/cement ratio during construction. This can result in less durable concrete.

Crushed concrete aggregates have a tendency to leach out a precipitate that clogs the pores of geotextiles. They are not permitted as OGDC underdrain backfill.

6.02.08 Slag

6.02.08A General

Slag is an artificial aggregate produced as a waste by-product of the iron, steel, and copper industries. Until the downturn in American steel production it was abundant in Michigan, but rather localized. Slag associated with iron and steel making is basically located in the Detroit metropolitan area; in Sault Ste. Marie, Ontario; and in the Burns Harbor-East Chicago area of Indiana. Slag aggregates are available on Great Lakes docks by boat shipment from the Indiana and Ontario sources. The only working copper smelting facility is at White Pine in Ontonagon County. Slag is produced to Department aggregate specifications. When the word "slag" is used alone in the specifications it is understood to mean either blast furnace slag or reverberatory furnace slag.

Blast furnace slag is lighter in weight than natural aggregates, whereas steel furnace slag is heavier. Approximate weights are:

- Blast furnace slag - 144 lbs/cubic foot
- Natural aggregate - 148 lbs/cubic foot
- Steel furnace slag - 184 lbs/cubic foot

6.02.08B Blast Furnace Slag

Blast furnace slag is acceptable for any aggregate use provided it meets the material requirements for that particular use. It is normally blended with other softer aggregates in order to meet AWI requirements.

6.02.08C Reverberatory Furnace Slag

Reverberatory furnace slag is acceptable for all aggregate uses except as fine aggregate for concrete (because it is a manufactured sand.) While it is somewhat heavier than natural aggregate, no weight factor has been applied. It is available in the copper mining area of the Upper Peninsula but is seldom used on trunkline projects.

6.02.08D Steel Furnace Slag

Steel furnace slag often contains ingredients that are still chemically active, causing it to expand, or gases to be released, on contact with water. Its use is therefore restricted; at the present time it can only be used in Hot Mix Asphalt (HMA).

Because of a calcium carbonate leachate, steel furnace slag should not be used as an OGDC in combination with a pavement drainage system. The leachate tends to clog the geotextile wrap, effectively negating the pavement drainage system.

6.02.09 Aggregate Base and Surface Courses

6.02.09A General

By policy, the Department does not construct permanent aggregate-surfaced roadways; i.e., an HMA surface is our minimum. Discussion of Aggregate Surface Course, even though it is included in the Standard Specifications for Construction, is therefore almost a moot subject. It is only used occasionally for surfacing a park and ride lot, county road relocation, or on a lengthy local road approach.

6.02.09B Difference between Base and Surface Courses

When an aggregate is intended for surface use, soil binder (clay) will be added to make it more dense and the surface more stable, i.e., less loose, under traffic. Binder does not materially add to its load supporting capability. On the other hand, binder in a base course is undesirable because it impedes the free drainage of water and is susceptible to frost heave.

6.02.09C Substitution

Occasionally, a project will have a rather large quantity of one type of aggregate and a small quantity of another; e.g., a substantial amount of base course and a little surface course, perhaps for driveways. To avoid a high contract price for the small-quantity material, the designer is encouraged to use the large-quantity type of aggregate for everything. Generally, base course can be substituted for surface course since, if it is too loose, it can be made acceptable by adding soil binder.

Conversely, it is less desirable to substitute surface course for base course.

6.02.09D Conditioning Aggregate Base

Conditioning Aggregate Base is shaping the aggregate surface to the required grade or cross-section as specified in the Standard Specifications for Construction preparatory to HMA resurfacing. It does not apply to the shaping of aggregate base stabilization preparatory to concrete paving.

6.02.10 Aggregate Approaches

It is the practice of the Department to construct an HMA surface on all existing gravel approaches to the trunkline (see Section 12.02.03). The purpose is primarily to keep loose gravel off the through pavement.

6.02.11 Aggregate Additives

(revised 11-28-2011)

6.02.11A General

Calcium chloride and water used to facilitate shaping and compaction are not paid for separately, but are included in other contract items.

6.02.11B Dust Palliative Pay Item

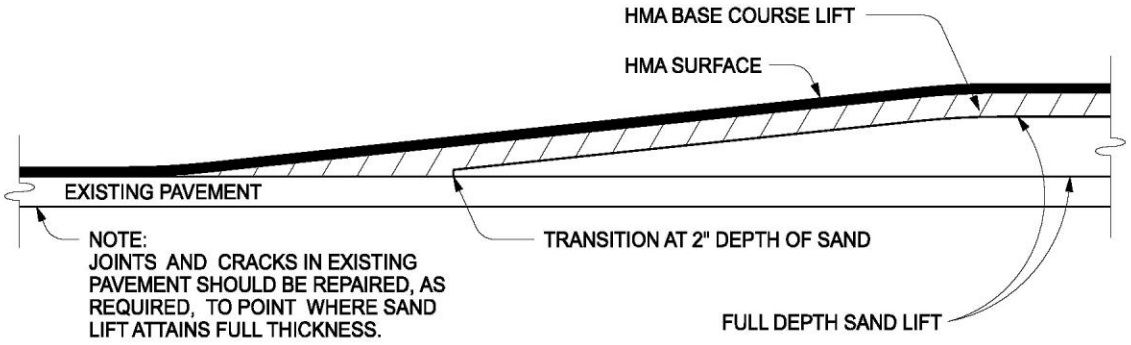
Calcium chloride used as a dust palliative, as when maintaining traffic, should be estimated at the rate of 7.5 tons per mile of two-lane width (or two-shoulder width). The pay item is "Dust Palliative, Applied."

6.02.12 Sand Lift (Grade Lift)

(revised 5-28-2013)

Sometimes, rather than surfacing a road surface or removing it for replacement, a sand lift is used above the old pavement. Use of this method of construction has declined as recycling techniques have been improved thereby increasing the value of old pavement surfaces. A sand and gravel cushion of less than 18 inches should not be used, because there is evidence that reflective cracking is not significantly prevented in a flexible pavement. Experience has also shown that when a **gravel** lift is compacted, the percentage of fines increases, resulting in a dense-graded mixture which tends to trap water. An HMA base course should be used instead. An added advantage to using an HMA base course is the ease of maintaining traffic during construction.

When a sand lift is used and a transition is necessary to meet the existing pavement surface, the transition should be as illustrated below.



LENGTH OF TRANSITION TO BE ADJUSTED
TO SECURE GOOD VERTICAL ALIGNMENT.

SAND LIFT TRANSITION OVER OLD PAVEMENT
To be used when old pavement is not removed.

6.02.13 Pavement Geotextile Separators (Geosynthetics for Base)

(added 6-23-2025)

6.02.13A Purpose

Geotextiles provide separation between pavement cross-section layers, preventing intermixing of materials and mitigating the propagation of underlying distress into new pavement. Specifically, these fabrics are used to separate gap-graded, unbound aggregate layers from sublayers with high fine content or concrete pavements from underlying existing concrete. Geotextiles also aid in drainage by facilitating water movement toward outer underdrains, as the fabric will connect to these drainage systems. Geotextiles can be used as an alternative to other separators such as dense graded aggregate separator layers for unbound aggregate base layers or hot-mix asphalt (HMA) separator layers for unbonded concrete overlays. There are two primary types of geotextiles: non-woven and woven. These are further described in the following subsections.

Note that while the type of geotextile may vary depending on the project and its configuration, always ensure unimpeded drainage from the pavement cross-section. Therefore, when placing geotextiles below an OGDC, use an open-graded underdrain pipe configuration to ensure that water is not impeded from escaping the cross-section, regardless of geotextile type.

During construction, geotextiles are securely tacked to the subsurface layer to prevent excessive bunching and are sufficiently overlapped with adjacent sheeting so that gaps do not occur. To reduce the risk of displacement from construction activity or environmental factors such as wind, placement is often carried out in smaller sections shortly before the surfacing layer is applied.

For further information, see the MDOT Standard Specifications for Construction for construction and material requirements.

6.02.13B Non-woven Geotextile

Non-woven geotextiles are manufactured by bonding synthetic fibers (e.g., polyester or polypropylene) into a felt-like material. This fabric is permeable (roughly ten-times more permeable than a woven), so it is most suitable for configurations that require separation, filtration, and drainage.

For concrete overlays, a non-woven geotextile may be used instead of an HMA separator layer when the existing pavement is in at least fair condition and areas with severe distress have been addressed by pre-overlay repairs. Note that the non-woven geotextile used for concrete overlays should be a heavier type that is 15 oz/syd, whereas the separator for unbound material is typically 8 to 10 oz/syd.

Typically, this fabric type is used between the following layers:

- Cement stabilized open-graded base and OGDC
- OGDC and sand subbase (when pavement is above the OGDC)
- Concrete over existing concrete pavement (if used instead of HMA separator layer)

The pay item for this type is “Geotextile, Separator, Non-Woven”.

6.02.13C Woven Geotextile

Woven geotextiles are manufactured by weaving individual polypropylene yarns into a uniform length of material. This geotextile type has lower permeability than a non-woven, so it is most suitable for configurations that require separation and resistance to water infiltration into sublayers.

Typically, this fabric type is used between the following layers:

- OGDC and subgrade (any subgrade type)
- OGDC and sand subbase (when cement stabilized open-graded base is above the OGDC)

The pay item for this type is “Geotextile, Separator”. It is important to note that since this pay item is generic and does not distinguish between woven and non-woven types, specify the woven type in the project plans when its use is intended.

6.03 HOT MIX ASPHALT (HMA) CONSTRUCTION

6.03.01 General

Asphalt, a refined product of crude petroleum, is a cementing agent in much the same way that portland cement is a cementing agent in concrete. Portland cement forms a cohesive mortar layer around aggregate particles of various sizes, as asphalt cement also does. A fundamental difference between the two is that portland cement concrete is rigid. An HMA mixture, on the other hand, is "flexible" in the sense that, depending on the unique properties of the mixture, it can flow. It is thermoplastic, becoming more pliable as heat is applied. It can be specified so that its temperature, viscosity, and durability characteristics can be matched to specific traffic and climatic conditions.

6.03.02 Glossary of Terms

Aggregate - Mineral substances (natural or "manufactured"), such as gravel, crushed stone, slag, cinders, sand, crushed concrete or combinations thereof.

Aggregate Wear Index (AWI) - A numerical value, derived by the Department, for measuring the resistance to polishing of the coarse aggregate in a given HMA pavement mixture. The higher the number, the greater the friction property. The number is determined by measuring the wet friction of a coarse aggregate concrete sample after it has been subjected to 4 million passes of a weighted, rubber-tired wheel on a circular test track. More recently, AWI numbers are being computed based on the weighted percentages from a petrographic rock analysis of a particular aggregate sample.

Alligator cracking - failure of an HMA surface, usually caused by inadequate base in combination with excess soil moisture, evidenced by closely spaced irregular and interconnected cracks. As deterioration progresses, traffic dislodges the loosened pieces of asphalt and complete failure will occur.

Asphalt cement - An asphalt that is refined to meet specifications for paving, industrial, or a special purpose, in a semi-solid state at ambient temperature. It is a product of the crude oil distillation process.

Asphalt emulsion - Minute globules of asphalt cement that have been mixed with water and an emulsifying agent to form a heterogeneous system. Emulsions are classified as slow-, medium-, or rapid-setting depending on the time it takes for them to break or separate into asphalt and water on application. Each type is available in several grades for particular application requirements.

Asphalt rejuvenator - An additive, somewhat in the nature of a light oil that, when added to an existing HMA surface or to reclaimed asphalt, softens it and increases its penetration. Usually used in conjunction with heater-planing but sometimes in hot-mix recycling. The Department rarely calls for it.

Asphalt Stabilized Crack Relief Layer (ASCRL) - An HMA mixture primarily used as a base course in a multi-course overlay of a concrete pavement to delay reflective cracking. It typically contains less asphalt cement and aggregate fines than standard HMA base course.

Bitumen - A term used synonymously with "asphalt," but more encompassing since it includes materials such as tars. Bitumens are soluble in carbon disulfide.

Black base - A conversational term used synonymously with HMA base course.

Blotter - An application of clean sand, to absorb and soak up an excess of asphalt on a pavement surface.

Blotter course - The first course of a two-course HMA surfacing in which the mix is modified to absorb the excess bitumen from asphalt-rich patches. Used to avoid removal of the patches prior to resurfacing.

Bond coat - See "tack coat."

Break(ing) - The stage during the curing of an asphalt emulsion coating when the asphalt droplets separate from the water and coalesce to form a continuous film of asphalt.

Breakdown rolling - The initial rolling operation after an HMA course has been laid down.

Butt joint - A construction joint, frequently used at the end of a days paving where a vertical saw cut face is provided for ease of resuming paving the next day. It can also be used for tying in to existing pavement. An alternative to a butt joint is a feathered joint.

Cationic emulsion - An asphalt emulsion, generally acidic in nature, prepared with an emulsifier that produces asphalt globules which are electro-positively charged.

Cold milling - The process of removing an existing surface by grinding particles away, usually by means of a machine-driven rotating drum containing a large number of carbide steel-tipped teeth.

Coulter wheel - A sharpened disc that, when brought to bear under pressure on an HMA surface, is capable of cutting through the surface. Sometimes used for trimming, it does the work of a saw faster and more economically, but with less precision.

Cracking stone - A non-technical term, relating to what happens when the thickness of the HMA course being laid is so thin that the paver screed or roller actually breaks some of the larger stone in the mix. This often occurs during feathering, but it is not considered a good construction practice for top course.

Crushing - The process by which an existing HMA surface, on a gravel base, is crushed and broken up in place by equipment such as a milling machine or a hammermill. Resulting particles, which become part of an aggregate base for resurfacing, are no larger than about 2 inches in diameter. Artificial heat is not used.

Cutback Asphalt - Synonymous with "liquid asphalt," the more preferred term used in Michigan specifications.

Drainable HMA base - A mixture composed of mostly one-size coarse aggregate that has an interconnected air void structure that will allow surface water to drain through it.

Drum mixer - A type of HMA plant that combines the drying of aggregates and the mixing of aggregates, asphalt, and mineral filler in a single rotating drum.

Emulsion - See Asphalt Emulsion.

Extraction - A laboratory test that separates the asphalt from the mineral aggregates in an asphalt paving mixture. Once separated, the components of the mix can be measured and tested.

Feathered joint - A construction method whereby the thickness of an HMA course is gradually thinned to "zero" as at the springline of a crossroad approach. While it cannot be thinned to nothing, raking out the large aggregate after paving allows a thin course.

Flow - A test in the Marshall Method of Design that measures the amount of movement or strain (in 0.01-inches) occurring in a prepared specimen during the application of the load in the stability test. It gives an indication of the resistance to deformation (shoving/rutting) that a compacted pavement will have under traffic. See Marshall Test.

Flushing - A phenomenon that occurs when there is more asphalt cement in a mix than is required to coat the aggregate particles and fill the voids. Under traffic and hot sun, the excess asphalt rises to the surface, filling the voids in the surface and being visibly shiny and perhaps slippery. It can also occur, even without an asphalt excess, if traffic is allowed on the mat before it has cooled sufficiently after paving. Moisture in the mix will also cause flushing immediately after paving.

Fog coat - A thin coating of asphalt bond coat, approximately 0.05 gal/syd sometimes used to seal areas that have been milled.

Hot Mix Asphalt (HMA) – (formally referred to as “bituminous” or “hot-mix”) A mixture of asphalt cement and aggregates, usually plant produced, used as a flexible pavement in road construction.

HMA aggregate - The HMA surfacing mixture composed of coarse and fine aggregates, mineral filler (when required), and asphalt. Differentiated from HMA concrete, the aggregate used is a gravel; the percentage of crushed (retained on the 4.75 mm sieve) is less, the aggregates are unwashed, and it is dense graded. This is now an obsolete term within the Department but designers may occasionally encounter it.

HMA base course – An HMA mixture of generally lesser strength and quality than HMA leveling or top courses and incorporating a reduced percentage of asphalt, used as a base for surfacing mixtures. Sometimes called "black base.”

HMA binder course – An HMA concrete mixture incorporating relatively large crushed aggregate particles (100% passing 37 mm). Used as a stable base for surfacing mixtures. Usually more stable than HMA base course because of the aggregate interlock of the crushed particles and the higher asphalt content. While HMA Binder Course was a major pay item a few years ago, the term is now obsolete and is included here principally to aid in understanding old plans.

HMA leveling course - The HMA course under the top course. Besides adding strength and bulk to the total surfacing, it can be used to fill in slight irregularities in the underlying surface.

Lift - A term referring to the layer of HMA mixture laid down in one pass of the paver. A surface paved in two courses is constructed of two lifts.

Liquid Asphalt - An asphalt cement that has been made liquid by blending with petroleum solvents (diluents) of various degrees of volatility. Upon exposure to the atmosphere, the diluents evaporate, leaving the asphalt cement. These materials are devised according to their use. Liquid asphalts fall into three classes:

1. ***Rapid-curing liquid asphalt (RC)*** - Composed of asphalt cement and various amounts of naphtha or gasoline type diluents to make up the different grades of fluidity.
2. ***Medium-curing liquid asphalt (MC)*** - Made similar to the rapid-curing except that the diluent is a kerosene.
3. ***Slow-curing liquid asphalt (SC)*** - Made with a heavy distillate or low-volatile oils.

Used sometimes for blending, it is so liquid that its penetration cannot be measured. Sometimes spoken of in contrast to “penetration asphalt” (the penetration of which can be measured)

Log (log job) - A written narrative that explains to the contractor, and to our own construction forces, the nature and scope of the work to be done. A log job is used for simple projects when the work can, for the most part, be described verbally.

Marshall Test - A laboratory procedure used to design or determine the properties of HMA paving mixtures. It can be used to determine the optimum proportions of aggregates, mineral filler, and asphalt cement needed to provide desired properties in a mix. Generally, thought of as a test for stability.

Mat - A term for the asphalt pavement; likely to be heard during construction.

Mineral filler - A fine mineral aggregate (usually fly ash or crusher dust), at least 70% of which passes the 0.075 mm sieve (ASTM No. 200) used to fill the voids in the mix, increasing the stability. Added in the plant, it tends to stiffen the mix.

Mix design - The laboratory process whereby the proportions of ingredients are determined for an HMA mix having certain predetermined qualities of stability and durability.

Open-Graded Friction Course (OGFC) – An HMA mixture used as a surface course, using predominantly a single size aggregate to form a porous layer. This allows rapid surface drainage and inhibits hydroplaning.

Penetration - The property of asphalt cement that is determined by a laboratory test measuring viscosity semi-solid asphalts, enabling the material to be classified into standard grades. A 1.00 mm diameter needle, with a truncated tip, is weighted to 100 g and allowed to bear on the surface of asphalt, at 25°C for 5 seconds. The penetration, in units of 0.1 mm, is then measured. The results are classified into standard penetration ranges of 85-100, 120-150, 200-250, and 250-300 for HMA mixtures used in Michigan. The lower the number, the harder the asphalt. No longer specified, Performance Grade asphalts are now specified instead.

Performance Grade (PG) - Asphalt binder specification based on climate and attendant pavement temperatures at which the binder is expected to serve.

Plant-mix – An HMA mix produced in a stationary plant, as opposed to road-mix or a stabilized-in-place mixture.

Precoated sand - Sand that has been coated with asphalt. Has been used to impart a more skid-resistant texture, to a new HMA surface having low skid resistance, by uniformly spreading it at up to 2 lbs/syd on the pavement surface, then rolling. No longer used in Michigan.

Prime coat - A sprayed-on application of liquid asphalt, tar, or an asphalt emulsion on an untreated surface, such as gravel, prior to the placement of an HMA mat or seal coat. Its purpose is to close off the aggregate openings, preventing further penetration of succeeding asphalt treatments, and to aid in maintaining the shape of the final grading during paving operations. Not used by the Department.

Raveling - The progressive separation of aggregate particles in a pavement surface under the action of traffic and natural forces. Raveling occurs either from the top down or from the edges inward. A typical failure will occur at the pavement edge where there may be inadequate base support.

Reclaimed asphalt pavement (RAP) - An existing HMA surface, or portion of same, that has been removed, crushed, and may be used for recycling. Proprietary RAP is material owned by a contractor that may have been obtained from an unknown source, e.g., a commercial parking lot, local street, or state trunkline.

Residual - An old term that describes a road oil which has had somewhat limited refining so that it exhibits the properties of a heavier liquid asphalt, such as an SC (slow-cure).

Rubblizing - The process by which a portland cement concrete pavement is broken up into small pieces, ranging from sand size to a maximum of 6 inches, with the majority of pieces in the 1-inch to 2-inch size range. A resonant pavement breaker or multi-headed breaker is specified. Projecting pieces of steel reinforcement are cut off below the surface, the pavement is rolled with a (minimum) 10 ton steel wheeled roller, and depressions of 1-inch or more are filled with coarse aggregate.

Rutting - The formation of longitudinal depressions in the wheel paths that result when an HMA pavement or underlying base has insufficient stability to support traffic. It is usually evidenced as two continuous wheel "tracks" in the traveled lane, sometimes only visible during a rain or when measured with a straightedge.

Scratch coat - A thin course, e.g., ¾ inch of HMA surfacing sometimes used when there is considerable joint and surface deterioration of an underlying concrete pavement after HMA surfacing has been milled off, or to fill ruts. Applied directly to the pavement to be resurfaced, it gets its name from the appearance of the HMA material after it is laid down. The paver screed is set so low that the thickness of the mat may actually be less than the largest dimension of some of the aggregate particles, causing the particles to be pushed ahead of the screed, creating a scratchy appearance.

Screed - The part of the paving machine that levels and compacts the HMA mixture prior to rolling and densification.

Seal coat - The sequence of laying up a thin HMA surface consisting of a prime coat and alternate layers of an asphalt emulsion and stone chips. The terms, single, double, and triple seal, refer to the number of applications of asphalt emulsion and chips. Also known as prime and seal.

Segregation - A separating of the larger from the smaller aggregate particles in an aggregate or HMA mixture. The larger particles, being heavier, have a tendency to roll to the outside of a pile when dropped. The larger particles also have a tendency to rise to the top of a mixture when vibrated because they are unable to sink to the bottom as do the finer, smaller particles. Segregation is objectionable in an HMA mix because the mix will be non-uniform, possess less than design strength, and will have an uneven texture, allowing moisture to enter especially in the areas of the larger particles. This likely will cause raveling of the HMA surface.

Separation course - A layer to prevent bonding of an upper pavement course to a lower pavement course. It may be sand, gravel, or a low asphalt-content HMA mix.

Sheet asphalt - A sandy HMA mixture where the maximum size aggregate is that passing a 4.75 mm sieve (ASTM No. 4) or smaller. (Also called a sand asphalt HMA mixture.)

Shoving - The action of an HMA mixture, lacking stability, moving forward as a result of braking traffic. Most commonly observed as a series of bumps at the approaches to signalized or stop-control intersections.

Slurry seal - A rather liquid mixture consisting of asphalt emulsion and sand used as a thin crack and joint sealer. It is usually applied by a special machine. A variation is a tar emulsion protective coating used in parking lots as protection against deterioration caused by fuel drippings.

Stability - One of the tests used in the Marshall Method of Design to determine the maximum load in pounds, applied at 140°F, which can be applied to a prepared bituminous mixture specimen (4 in. x 2½ in. high cylinder) before it fails. This test, along with the flow test, provides an indication of the ability of the pavement to carry traffic loads. Also see Marshall Test and Flow.

Stabilization – The process of increasing the load-carrying capacity of underlying layers or layers underlying the pavement by adding a stabilizing agent. Asphalt cement is most commonly used as a stabilizing agent, but asphalt emulsions, portland cement or lime have also been used. Other terms of stabilization are stabilization-in-place and in situ recycling.

Stage construction – In HMA construction, delaying placement of the top course until some time after placing the lower courses. Usually requires adding more asphalt cement to the leveling course mix so that it can carry traffic. While sometimes done for economic reasons, it also can occur when the advent of winter brings an end to the paving season.

Stringline – A technique for obtaining accurate grade control by placing taut wire or string alongside the roadway to be paved, accurately set to grade. The electronic controls on the paver are thus guided, which in turn controls the screed elevation.

Stripping - The loss of adhesion between the asphalt coating and the aggregate particle leading to deterioration of the bituminous pavement. Caused by incompatibility of the asphalt and the aggregate, which may be aggravated by moisture in the mat.

Structural number (SN) - An index number derived from an analysis of traffic, roadbed soil conditions, and a regional factor that may be converted to thickness of flexible pavement layers through the use of suitable layer coefficients related to the type of material being used in each layer of the pavement structure. (See the 1993 AASHTO Guide for Design of Pavement Structures.)

Superpave (Superior Performing Asphalt Pavement) - An improved system for specifying the components of asphalt concrete, asphalt mix design and analysis and asphalt pavement performance prediction.

Tack coat - A thin HMA coating of an asphalt emulsion. Routinely sprayed on a paved surface just before HMA paving to increase the adhesion of the new surface. Sometimes called a bond coat.

Tenting - The phenomenon, most noticeable in mid- to late winter, where the HMA surface at a crack tends to heave up on each side of the crack, forming a "peak". This is caused by the action of water entering the crack, then freezing. With the spring thaw, traffic forces the peaks down.

Thermal cracking - Transverse cracks at a somewhat regular spacing found in an HMA pavement, caused by cold weather contraction that exceeds the tensile strength of the surface.

Top course - The last and final HMA course to be placed in a surfacing or resurfacing operation.

Viscosity - The resistance of a fluid to flow under gravity. Performance grading is now used instead of viscosity grading.

VMA - Voids in the mineral aggregate. The space between aggregate particles available for asphalt and the "passing 200" fines. It allows sufficient asphalt content to provide adequate particle coating, as well as a 3-4% air content to help prevent flushing.

Wearing course - Until recently, a term referring to the top course of an HMA concrete pavement. With adoption of the term "top course", the use of this term is being discouraged.

Wedging - The practice of placing HMA material in selected low spots to further level the base prior to resurfacing. If used continuously along the pavement edge, it would flatten an excessive crown. If used along the center portion of the pavement, it would build up a too-flat crown.

6.03.03 Philosophy of the Use of HMA Surfacing

Both the HMA and portland cement concrete industries are vital parts of Michigan's economy. The Department therefore endeavors to make impartial use of both materials. Because of its adaptability to the maintenance of traffic, needing only to cool before traffic can be allowed on it, asphalt is the common type of resurfacing in use. It is also used rather extensively as the pavement type on new construction in the areas of the state having granular soils.

The purpose of resurfacing is to extend the useful life of a pavement for a given length of time, usually for a period of 8 to 12 years, but sometimes for as little as 3 to 5 years. If no design life is specified when a resurfacing project is assigned, assume it to be 10 years. In some situations a shorter design life may be desired.

6.03.04 Surface Preparation

(revised 8-24-2026)

6.03.04A Conditioning Aggregate Base / Surface

When existing aggregate base/surface remains in place see Section 6.02.09D.

6.03.04B Concrete or Composite (HMA on Concrete) Pavement

6.03.04B1 Crown and Superelevation Modification

Current methods for modifying pavement crown and superelevation are expensive and need careful consideration. Many resurfacing projects call for modifying the crown from the former parabolic configuration to the current 2% cross-slope and/or upgrading pavement superelevation. Modification of pavement slope is typically accomplished by wedging with HMA and/or cold-milling. The need for modification will be based on a safety analysis and applicable design standards. Crown modification may include changing the shape, changing the rate of the cross-slope, adjusting the crown point location or a combination of the three. Existing pavement slope(s) should be thoroughly reviewed during the project design (including cross-sectioning where applicable) to minimize construction problems and cost overruns.

6.03.04B2 Cleaning Pavement

The Standard Specifications for Construction state that the pavement surface must be clean prior to resurfacing. Some designers have purposely omitted the item when milling is done on the assumption that sweeping after the milling accomplishes the desired result. The fallacy with this is that several weeks can elapse between milling and resurfacing, giving the pavement time for dirt to be tracked upon it once more. The pay item "Pavt, Cleaning", measured as a lump sum, should therefore be included in all resurfacing projects. It can be deleted during construction if for some reason it is not needed.

6.03.04B3 Removing Pavement for Joints

All joints on the trunkline where HMA surface is started or terminated should be butt joints. Construction of a butt joint requires removal of the existing surface to a depth sufficient to receive the resurfacing, so that it will be flush with the adjacent surface at the joint. Whereas this work was once done by means of a jackhammer, much of it today is done by a milling machine. The pay item “Pavt for Butt Joints, Rem”, measured in square yards, includes removing and disposing of concrete or HMA materials. The removal depth, width and taper shall be according to the Standard Specifications for Construction.

Paving of side street approaches may be ended by feathering unless recommendations to the contrary are received from the Plan Review Meeting. Feathering is much more economical than a butt joint, but it has a tendency to eventually loosen where it is extremely thin unless extra precaution is taken during construction to fine up the mix, especially for feathering. Refer to the Standard Specifications for Construction for the taper rate of feathered joints.

A butt joint, if used on a side street approach, could vary in length depending on the nature of the side street. For a low volume, low speed side street, a 10 foot length generally would be adequate. However, at major intersections where the volume and speed are comparable to mainline, the required length of the transition should also be comparable. Thicker overlays may also require longer transitions.

6.03.04B4 Edge Trimming

An old HMA pavement, whether over gravel or concrete, develops a ragged edge over the years. Sometimes this is merely raveling, other times it may be extruded material overhanging the underlying pavement edge. This loose or uneven material may need to be removed prior to resurfacing by trimming and truing the edge, as determined in the Plan Review Meeting. This is usually done by means of either a saw or a coulter wheel, the base being left undisturbed.

The pay item of "Edge Trimming", measured in feet, covers the work of cutting the pavement edge, prior to removing HMA shoulder material adjacent to the traveled lane, and the removal of the severed debris. If it is necessary to remove HMA over concrete material near the edge, but within the traveled lane, the work will be paid for as HMA Surface, Rem.

6.03.04B5 Cold Milling HMA Surface

The development of the rotating drum milling machine around 1976 opened the way for economical, large scale removal of existing HMA surfaces, i.e., volume production without labor intensity. This capability has subsequently encouraged recycling on a large scale, and has made work such as removal for patching and butt joints comparatively easy. While the difficulty of removal, whether HMA or concrete, varies with the hardness of the aggregate and the depth of removal, it is possible to remove up to 4 inches or 4½ inches of existing HMA in a single pass of the milling machine. (However, it is usually more economical for a contractor to remove a 4 inch thickness of asphalt in two passes.) Machine widths, i.e., drum widths, vary from about 12 inches to about 12 ft.-6 in.. The smaller drums are available on a variety of equipment. Although a minimum 12 inches of width may be removed by milling, for practical purposes provide a minimum of half a lane width when reclaiming a curb face covered by previous resurfacing.

About 1½ inch depth is the minimum that can be cold milled economically. (Lesser depths can obviously be removed, for reasons other than economy.)

Any hand work required when removing HMA surface around catch basins, manholes, or SCANDI loops should not be paid for separately, but noted as included in payment for "Cold Milling HMA Surface". This should be clearly stated on the plans or in the proposal.

Occasionally, when requested by Construction, stringline control may be called for in conjunction with cold milling. This is not feasible where only 1-inch or 1½ inches is being removed, however, as there simply is not enough latitude available for grade adjustment. "Cold Milling HMA Surface" may be measured by either square yard or by the ton. The unit to use will usually be determined at the Plan Review Meeting.

Where there will be varying cold milling depths use tons. When square yards are used, the thickness of HMA surfacing to be removed must be clearly indicated on the plans or in the log. Cores should be taken prior to construction (one every 1000 feet per lane) to verify the thickness to be milled and the condition of the underlying material.

When a milling machine is used to construct a butt joint to receive the full depth of all resurfacing courses, the butt joint should be included in the payment for Cold Milling. When the depth of milling is reduced to less than the full resurfacing depth at the joint, it should be paid for as Pavt for Butt Joints, Rem. Butt joints for driveway approach removal should also be paid for as Pavt for Butt Joints, Rem. The butt joint should be detailed on the plans showing either full or reduced removal depth against the existing pavement and indicating the appropriate pay item.

6.03.04B6 Removing HMA Surface

Use HMA surface, Rem (Syd) when the thickness of the HMA cap to be removed is 12 inches or less and the underlying pavement is either removed or left in place. Use Pavt, Rem (Syd) when the thickness of the HMA cap to be removed is more than 12 inches” and the underlying pavement is either removed or left in place.

There are a number of methods for removing HMA surface:

A. Motor grader with ripper teeth

   Suitable for HMA over aggregate. Largely obsolete for removing an HMA surface from underlying concrete.

B. Jackhammer

   Being labor intensive, only suitable for small areas such as preparing a butt joint.

C. Front end loader

   Suitable for removing an HMA surface from underlying concrete. On recycling projects the material is processed through an aggregate crushing plant.

D. Cold-milling Machine

   Fastest, most modern method for removing an HMA surface over a pavement that is to be left in place. The machines are relatively expensive, however, which may put them beyond the means of small contractors.

E. Heater planer

   By softening the material with either direct or indirect flame, volume production is possible. This method tends to be energy inefficient and environmentally objectionable, if smoke is not controlled. Not many large machines are located in this part of the country. A heat planer may cause damage to the material, if it is to be recycled (direct flame can burn asphalt to ash).

6.03.04B7 Removing HMA Patches

Existing surface patches (not full-depth patches) may need to be removed prior to resurfacing. Generally, they are composed of cold patch material placed by maintenance forces. Cold patch is likely to be rich in bitumen, which tends to bleed through the hot resurfacing causing an asphalt-rich spot that can be weak and lacking in surface texture. Some of the cold patch materials do not need to be removed because they are not sensitive to heat. The pay item is “HMA Patch, Rem” measured by the square yard.

6.03.04B8 Joint and Crack Cleanout

Joint and crack cleanout covers the work of removing existing joint sealant and foreign materials, to a depth of up to 1-inch from transverse and longitudinal joints and cracks prior to resurfacing. The work is usually done with a hooked device, not unlike a stove poker. The pay item is "Joint and Crack, Cleanout", measured in feet of joints and cracks so treated. Cleaned cracks 1-inch wide and greater shall be filled with hand patching.

Neoprene joint seals should always be removed prior to resurfacing. Some hot poured rubber sealants need to be removed as they can cause the mat to slide when hot and while being rolled. See Section 6.03.04B14 for treatment of existing pressure relief joints.

6.03.04B9 Hand Patching

There are two methods of placing HMA patching material: by machine and by hand. Obviously, larger areas that would make machine placement cost effective will be patched by a paver. The pay item of "Hand Patching," measured in tons of HMA material necessary to fill the void, is used to compensate the contractor for the additional effort required to do the work by hand (the pay item includes payment for material as well as for labor).

Depressions must usually be patched prior to paving the first course. Hand patching will generally be used for filling in depressions and where cold patches have been removed.

Hand Patching is a difficult item to estimate because of the many variables involved. When Detail 7 or 8 joint repairs are done using a milling machine, quantities of hand patching will increase about 50%. The problem is magnified because this item has a relatively high cost and is prone to large overruns during construction.

A quantity of Hand Patching should always be included with joint repair items. The following guidelines are offered to aid in estimating Hand Patching:

Joint Repair	Estimate
Detail 7	5 tons / 100 ft of repair
Detail 8	* 10 tons / 100 ft of repair
Holes, old patches, etc.	Approximate Area and Depth

* Based on a depth of 11 inches and a width of 18 inches. This estimate may need to be adjusted based on the size of the repair.

Details for joint and crack repairs are shown on Standard Plan R-44-Series.

6.03.04B10 Repairing Pavement Joints and Cracks

The Detail 7, surface repair for joints or cracks, and Detail 8, full depth repair for joints or cracks, do not include the corresponding "Hand Patching". Design quantities for either repair seldom match as constructed quantities. A cursory surface inspection is unlikely to reveal the extent of joint deterioration and construction forces complain that, for a given number of joints set up on a project for repair, there may be an equal number, equally deteriorated, for which no repair quantities are provided.

It is not unusual for Construction to pay for 12 feet of joint repair as, i.e., 7 feet of Detail 7 and 5 feet of Detail 8. Designers should attempt to break down quantities to the extent possible, but should realize, the extent of joint deterioration can only be determined after the joint is opened up.

There are two pay items involved with Detail 7 and 8 joint repairs, "Pavt Joint and Crack Repr, Det [insert 7 or 8]" and "Hand Patching". See preceding Section 6.03.04B9.

If the project includes milling off the old HMA surface, it may be recommend at The Plan Review that the milling machine drum be lowered perhaps 1-inch into the deteriorated joint to remove the deteriorated concrete and debris. If this is done, the contractor is merely compensated for the additional milled material that is removed, and the additional new surfacing material required to fill the deeper void at the joint. If, after the milling has been done, it appears that the joint is in such condition as to require a bonafide Detail 7 or 8 joint repair, then the engineer will order that this be done. The subsequent repair would then be paid for as an ordinary Detail 7 or Detail 8 joint repair.

6.03.04B11 Pavement Patching

Pavement patching consists of a cast in place concrete patch, in most situations. A concrete patch is used when a Detail 7 or Detail 8 repair method is not sufficient. Standard Plan R-44-Series illustrates a concrete patch design. Full depth HMA patches are used in lieu of concrete patches only when maintaining traffic concerns warrant the change. Full depth HMA patches are typically recommended on low commercial volume routes. Full depth HMA patches should only be used on freeways when maintaining traffic is an overriding concern.

Backfill material for a full depth HMA patch is mainline top course mixture and is paid for as Hand Patching. See Section 6.03.09.

The patching mixture will be placed flush with the surface of the existing pavement. The patch is paid for as “Pavt Repr, Rem” in square yards of material removed, and as “Hand Patching” in tons to the cover the HMA mixture put back.

6.03.04B12 Guidelines for Preparing a Deteriorated Jointed Reinforced Concrete Pavement for an HMA Overlay

The Engineering Operations Committee has approved the following guidelines for repairs to jointed reinforced concrete pavement in preparation for an HMA overlay.

1. Traffic Volume Range 0-5,000 ADT (per roadway)

   Replace all joints and cracks having a distress severity level of 1 with a Detail 8 repair. Remove all cold patch material and loose concrete from all remaining joints and cracks and replace with a Detail 7 patch. All previously placed concrete repairs are to be left as is, except cold milling of concrete repairs faulted more than ¾ inch is optional (in lieu of replacement).

2. Traffic Volume Range 5,000-10,000 ADT (per roadway)

   Repair all joint, cracks, and undowelled repairs having a distress severity level of 1 with a dowelled concrete repair. Remove all cold patch material and loose concrete from all remaining joints and cracks and replace with a Detail 7 patch. Cold mill all undowelled repairs faulted more than ½ inch.*

3. Traffic Volume Range 10,000 and up ADT (per roadway)

   Replace all joints, cracks, and undowelled repairs having distress severity levels of 1 and 2 with a dowelled concrete repair. Remove all cold patch material and loose concrete from all remaining joints and cracks and replace with a Detail 7 patch. Cold mill all undowelled repairs faulted more than ½ inch.*

   * In lieu of cold milling replace all remaining undowelled repairs with dowelled repairs if the replacement cost (based on total pavement repair and overlay cost) is less than 15 percent above the cold milling cost.

6.03.04B13 Additional Uses of Detail 8 Joint Repairs

1. When the expected functional life of the repaired pavement is no greater than 5 years.
2. When the overall integrity of the pavement has deteriorated to the extent that the load transfer and slab flexure capacity no longer allows the pavement to function as a rigid pavement.
3. When the pavement has deteriorated to the extent that it can no longer accept the stresses that would be imposed upon it by the installation or action of load transfer devices.

6.03.04B14 Surfacing Over Pressure Relief Joints

Pressure relief joints have been used in concrete pavement since 1975. The foam filler placed in those joints should be removed prior to resurfacing, if possible to do so. Sometimes the pavement is so compressed that the foam filler is almost a solid. In this case it is not only very difficult to remove but it will do no harm if left in place.

Problems seem to occur when the width of the opening exceeds about 1-inch. Lack of support leads to inadequate compaction of the new surface mix over the crack or joint. The poorly compacted, porous mix is subject to cracking, water penetration, and early failure. When setting up logs for resurfacing of roadways that have had previous joint repair and pressure relief, the designer should call for removing the joint filler if the joint is more than 1-inch wide. The void should then be filled with a sand-asphalt mixture before resurfacing. Payment for sand-asphalt should be included in other surface preparation payment items.

Note: Cracks over 1-inch wide should likewise be cleaned and filled with a sand-asphalt mixture.

6.03.04B15 Wedging

Wedging is used to build up insufficient areas in the existing surfacing, such as to increase insufficient crown, to increase superelevation, or to level out sags that distort the profile. While the regular HMA surfacing can be thickened to take out up to 1-inch of sag, wedging, as a separate operation, must be used for thicker modifications.

Wedging shall be 3 inches or less using the same HMA mix as the top course of the mainline pavement. Additional wedging can be accomplished with variable thickness in the leveling and/or base course.

6.03.04B16 Scratch Coat

An 80 lbs/syd (about ¾ inch thick) scratch coat is usually required whenever a pavement is cracked and seated, or the existing HMA cap is removed from a composite pavement and the exposed concrete surface has joint and surface deterioration. This is to prevent ravelling of the old concrete under traffic, and possibly a rolling ride when the finished pavement is in place. The material is similar to an HMA leveling course, perhaps modified to use a different size aggregate, computed in addition to the regular rate of resurfacing proposed for the project. If, for some reason, the scratch coat needs to be thicker (as recommended at the Plan Review Meeting) then consideration should be given to reducing the regular leveling course by the additional application rate in excess of the nominal 80 lbs. A scratch coat should be provided on all such applicable projects unless it is specifically deleted at The Plan Review Meeting.

A scratch coat can also be used to fill longitudinal irregularities such as rutting or faulting between lanes. Scratch coat quantities should be shown separately from the regular resurfacing quantities, and designated as "scratch coat", e.g. HMA, LVSP (Scratch Coat).

6.03.05 Adjusting Drainage Structures and Utilities

(revised 8-24-2026)

It is the practice of the Department to adjust the elevation of manhole and catch basin covers to fit the finished elevation of proposed resurfacing. Designers should therefore provide quantities for this adjustment, but with the knowledge that site by site decisions will be made on construction relative to tapering the surfacing down (or up) to meet the cover at its existing elevation. Depressed covers, e.g., possibly as much as 1-inch low, can sometimes be tolerated in the gutter, and a manhole cover in the center of a lane that is ½ inch low may not pose a problem. On the other hand, a cover in the lane wheeltrack that is ½ inch low will be a constant annoyance to the motorist. Some local agencies, for reasons of economy, will shape the new HMA to fit the existing elevation of the cover even if it is 1½ inches to 2 inches low. This practice may be acceptable on low volume, low speed residential streets, but it is not acceptable on a street designated as trunkline.

6.03.05A Adjusting Drainage Structures Covers

The item of "adjusting" applies where the elevation of the cover is changed 6 inches or less. It applies to manhole covers, whether drainage or utility, inlets, and to catch basin covers. While adjustment is usually upward, it can apply where the cover is lowered as well, as might occur in a widening situation.

If the existing structure is in poor condition, it should be reconstructed.

Normally, adjustment is by means of raising the casting with a masonry lift. From time to time, various manufacturers introduce adjusting rings that raise the lid or grate without necessitating adjustment of the frame.

Designers should take the maintaining traffic scheme into account when setting up drainage structure adjustment quantities. If it is determined that traffic will be carried on the leveling course for a period of time, it may be necessary to adjust the covers twice. In this case it might be prudent to contact the Region/TSC for confirmation of the need for double adjustment.

There have been occasional problems with settlement of the HMA surfacing in the area for 10 inches to 12 inches around manhole covers, the area usually disturbed during adjusting. There are several theories as to the cause of this settlement: allowing traffic over the cover before normal strength mortar has attained strength, inadequate compaction around the cover, and deterioration of the manhole itself. The problem has been particularly prevalent in the urban areas.

One method that has proven successful in overcoming this problem is cutting out approximately a 6 foot square around the cover, after the leveling course is laid, and recasting it with concrete base course about 2 inches below the finished grade of the top course. This method of adjustment was approved by the Engineering Operations Committee on January 19, 1983.

6.03.05B Drainage Structure Cover, Adjust, Additional Depth

The item of "adjust additional depth" applies where the elevation for the cover is changed more than 6 inches (unless reconstruction to top of footing is necessary, in which case the work is paid for as a new structure). Additional depth adjusting also applies where the corbel (cone) of an existing structure must be rebuilt to adjust the lateral location of the cover.

Frequently, drainage structures set up on plans to be adjusted are found on construction to be in such poor condition that they require additional depth adjusting, resulting in a cost overrun. To compensate for this, designers should set up a lump sum quantity of "entire project" additional depth adjusting of drainage structures equal to 25% of the total of structures set up on the plans to be adjusted. (This figure of 25% will be in addition to the number of structures known to require additional depth adjusting and so set up on the plans.) On projects where the drainage structures are unusually old, or where there is a large volume of heavy trucks, the 25% estimate should be increased to 40%.

6.03.05C Measurement and Payment

The pay item “Dr Structure Cover, Adj, Case 1”, measured as each, applies to structures located in pavement (including curb and gutter). Removal and replacement of pavement is included in this pay item if not already covered elsewhere. Replacement of curb and gutter is paid for separately.

The pay item “Dr Structure Cover, Adj, Case 2”, measured as each, applies only to structures located outside the pavement area.

The pay item “Dr Structure, Adj, Add Depth” is measured per foot beginning 6 inches from the level of the existing structure (in the direction of adjustment) to the limit of the additional depth of adjustment. This also requires payment for, “Dr Structure Cover, Adj, Case [insert 1 or 2].

If a new cover is required in conjunction with an Adjustment it is paid for separately. Also, see Standard Specifications for Construction for details.

6.03.05D Adjusting Water Shutoffs and Gate Boxes

The pay items “Water Shutoff, Adj, Case [insert 1 or 2]” and “Gate Box, Adj, Case [insert 1 or 2]” measured as each, should be set up as applicable. Case 1 refers to structures located in hard surfaced travel areas and unit prices includes saw cutting, removing and replacing existing pavement, curb, or curb and gutter, and adjusting the water shutoff or gate box to final grade. Case 2 refers to structures located outside existing pavement, curb, or curb and gutter and unit prices includes restoring disturbed vegetated or sidewalk areas.

6.03.05E Facilities Owned by Private/Public or Municipal Utility

Manholes, shut-off valves, etc. owned by a private/public or municipal utility that require adjustment or reconstruction ***may*** be altered by the facility owner. The facility owner should be contacted to discuss whether they want to adjust the facility or have the MDOT contractor do this work. The designer should coordinated efforts with the Region/TSC utility coordination engineer for contacting the effected utility. If the work will be done by the utility, such structures should be referenced by a note on the plans to the effect that the work will be done by others. The Region/TCS utility coordination engineer should include language regarding this work in the projects utility coordination clause.

6.03.05F Adjusting and Placing Monument Boxes

Payment for installing or adjusting monument boxes in paved areas will be according to the Standard Specifications for Construction for "Monument Box Adj" or "Monument Preservation"

In addition, it is required that all monument boxes be adjusted whether shown or not. To ensure that all government corners are adjusted or preserved, the designer shall place the following note on the plans or in the log of any project that includes section or quarter corners.

It is the intent that all government corners on this project be preserved and that, where necessary, monument boxes be placed or adjusted whether shown or not.

Monument box castings are furnished by the contractor according to Standard Plan R-11-Series.

If a Design Unit has a resurfacing project to design without benefit of a survey, the Design Engineer should check with the Survey Section to determine if a pickup survey to locate monument boxes could be made within the time available to complete the plans.

Designers may encounter monument boxes in existing pavements at previous survey or construction control points. On a major reconstruction project these monuments probably need not be preserved, whereas on a resurfacing job, a quantity should be set up to adjust or place new boxes. The Lansing Survey Unit should be contacted by the Design Unit whenever these points are encountered on a project.

For additional information concerning monumentation, see Section 5.14.

6.03.06 Special Base Treatments

(revised 11-28-2011)

For detailed information and applications of each of the following specified treatments contact the Region/TSC Soils Engineer and the Pavement Design Engineer. Also contact the Region/TSC Soils Engineer and the Pavement Design Engineer regarding any emerging technologies and applications that may be available.

6.03.06A Concrete Pavement Cracking and Seating

Michigan has used this method on a limited number of projects with mixed results. Pavement Cracking and Seating was developed as a means to reduce or eliminate reflective cracking in an HMA over concrete pavement. The process involves cracking of the old concrete slab prior to placing an HMA overlay. The results of the process have varied from a severely cracked slab with portions literally pounded into the subgrade to cracking so slight that it is hardly visible. Cracking and Seating is only effective when the bond between the steel reinforcement and the concrete is broken. Research has shown that breaking this bond is difficult to accomplish. Cracking and Seating should only be used when the concrete slab is nonreinforced and where an approved base course exists. The Region Soils Engineer and the Pavement Design Engineer should be consulted. An effective Cracking and Seating operation yields concrete pieces ranging from 18 inches to 48 inches.

A major advantage to this method is that traffic can be maintained on a Crack and Seated surface. This is particularly useful on two lane roads where lane closures are difficult. High traffic volumes can cause high dust levels.

The Region/TSC Soils Engineer and the Pavement Design Engineer should be consulted when designing an HMA overlay for a Cracked and Seated pavement. They should also be consulted to determine whether Cracking and Seating is an appropriate fix type for a project. A special provision is required.

6.03.06B Rubblizing Concrete Pavement

Rubblizing is another method used to reduce or eliminate reflective cracking in an HMA overlay. This method results in concrete pieces averaging in size from 1-inch to 2 inches. Rubblizing succeeds in destroying the bond between the concrete and the reinforcing steel, but it results in even less base support than does cracking and seating.

Rubblizing is the predominant method used to rehabilitate badly deteriorated concrete pavement prior to an HMA overlay. Rubblizing should be avoided in areas with a high water table or where an approved base course does not exist. Rubblizing is used on both freeways and nonfreeways. Two lane roads are difficult to rubblize because of maintaining traffic concerns. Traffic cannot travel on a rubblized surface because of possible protruding steel, severe dust from the broken concrete, and roughness of the driving surface.

Experience to date has indicated that a full depth saw cut should be used where the rubblizing abuts concrete pavement that will either remain in place or be removed. Generally a pavement in such poor condition as to warrant rubblizing would also have bad joints. It would be undesirable to leave one-half of a bad joint, therefore this saw cut should be located 10 feet to 12 feet from a joint.

A widening or shoulder reconstruction that extends significantly below the top of the pavement being rubblized should normally be completed before rubblizing. The staging should not require that the shoulder or widening excavation expose the unsupported edge of the pavement being rubblized. Any widening and/or shoulder work shall be completed up to the elevation of the existing pavement surface before rubblizing. These areas can then be utilized to support the pavement breaking unit while rubblizing the existing pavement.

6.03.06C Crushing and Shaping

Crushing, as defined in the Glossary of Terms, Section 6.03.02, is essentially the conversion of an HMA-over-gravel surface to a crushed material, which can be reshaped to the desired cross-section. This type of recycling is appropriate where poor base material is a problem; where the surface is badly cracked; where 1 foot to 2 feet of widening is proposed; or where extensive wedging, crown modification, or superelevation modification is required. Marginal base material can be upgraded with admixtures to provide high quality support. The Bituminous Unit of the Construction Field Services Division should be consulted for guidance in determining the feasibility of the different options. Also see Section 6.03.09 for the placing of HMA over "crush and shape" projects.

Crushing is usually more economical than hot-mix recycling, unless the asphalt surface is quite thick. When the existing mat is quite thick, a common procedure is to mill off part of the HMA, then crush the remainder. A mat of nominal thickness, e.g., 6 inches or less, would probably not be milled off. Normally anything over 6 inches is cold-milled prior to crushing and shaping.

Projects are selected by the Region/TSC by including crushing in the project concept statement in the Call for Projects.

Design quantities should be based upon the limits of the shaping of the crushed material, not the width of the existing pavement surface. If an existing 24-foot wide pavement is to be crushed and shaped to a 30-foot width, quantities should be based on the 30-foot dimension. A bulking factor of about 20% should be used, i.e., 30 feet wide will do about 36 feet at same depth.

6.03.06D Stabilization in Place

The term "stabilized-in-place" is used to describe cold-mix recycling, in situ recycling, in-place recycling, and stabilizing. The stabilized-in-place process involves adding a stabilizing agent to improve the strength of the pavement section. This is accomplished by a special machine that scarifies the existing surface to a given depth, crushes it in a pug mill, adds asphalt cement, and lays the resultant mix back down, almost in its original location. The process has been used in Michigan to upgrade pavement sections varying from a full-depth HMA freeway to sealcoated shoulders. The finished product is considered as a base only, and a hot-mix surface course is necessary.

There are two principal shortcomings of base stabilization, 1) the lack of uniformity, with occasional "fat spots" of excess asphalt cement concentrations, and 2) the cost of both the mixing process and the amount of asphalt cement used. For these reasons, Michigan has done very little stabilization-in-place since 1985.

Following an investigation of the nature and depth of the existing material, the Construction Field Services Division will advise Design as to the depth of stabilization. This depth must then be shown on the plans or an application rate of ½ gallon per square yard per 1-inch of thickness should be used by designers in estimating the amount of HMA Material, Base Stabilizing required. A note should be placed on the typical cross-section sheet, or prominently in the log, indicating the estimated application rate per square yard.

A commonly used depth of stabilization is 4½ inches of base, surfaced with 250 lbs/syd of plant-mixed asphalt.

The HMA base stabilization should be the same width as the proposed asphalt mat that is to be surfaced.

6.03.07 Hot-Mix Recycling

(revised 11-28-2011)

6.03.07A General

Energy and environmental concerns beginning in the early 1970's sparked development of techniques for hot-mix recycling of old asphalt pavements. Two significant technological advances, that seemed to occur almost concurrently, made asphalt pavement recycling feasible. These were the development of the cold-milling machine and the drum mixer asphalt plant. The one opened the door to economical removal of the old material, the other led to volume production of the recycled mix.

As recycling projects were successfully completed, the Department gave the contractors progressively more latitude to generate cost savings through recycling. Initially, a blend of 50% recycled material and 50% new material was used. The recycled material had to be obtained from the project and its use was restricted to lower courses. Recycled Asphalt Pavement (RAP) was eventually allowed in #500 (stability) mix, regardless of the source of the material, provided it had the approval of the engineer. Later, 50% RAP was allowed in #900 and #1100 mixes in leveling courses, regardless of the source. As a general principle, currently:

1. Milled-off material becomes the property of the contractor. Because there is no item for crediting the Department, the value of this is usually reflected in a reduction in the bid price for some other unrelated item (HMA mix).
2. The contractor has the option of using RAP in all courses unless the plans or proposal specifically prohibit it.

6.03.07B Heat-Planers

Before the advent of cold milling machines, and beginning about 1950, heater planer machines were the only practical method of volume removal of old HMA surfaces, while not disturbing the base and even leaving part of the old HMA thickness when desired. These machines were large and ungainly, and required a great amount of energy to heat the asphalt to the point where it was soft enough to scrape off. Additionally, they were environmentally objectionable because of the smoke generated from burning asphalt. Burning was also detrimental to the flexibility of the asphalt. Improvements were made in the form of radiant heaters that alleviated the smoke problem, but it was the cold milling machine that has made the heater planer uneconomical and obsolete. Today, heater planing in Michigan is almost exclusively limited to maintenance work, removing humped pavement joints with small radiant heaters attached to various scraping machines or devices.

6.03.07C Cold-Milling Machines

Michigan was one of the first states to use the cold-milling machine. There are a number of manufacturers of such machines and they are available in a variety of sizes. Most all use the principle of a relatively low speed rotating drum having a number of carbide-tipped teeth. See Section 6.03.04B5.

6.03.07D Factors to Consider Relative to Recycling

There are some pavements that cannot be recycled using current technology. Pavements containing tars or liquid asphalts high in solvents are poor candidates for recycling because of the attendant air pollution problem in connection with drum mixer plants. Sealcoats are not recycled. Tar-bound macadams, which may contain rocks as large as 5 inches to 6 inches, are not recyclable because of both the tar and the size of the aggregates. The decision as to whether or not to recycle, however, should be made by Construction Field Services Division.

When the use of milled material is allowed back on the project as recycled mix, the hot-mix prices will generally be lower than that for virgin hot-mix. Variables affecting this price reduction are: the size of the project, the total amount of RAP available for use back on the project, and the location of the project relative to a permanent asphalt plant. The contractor will normally choose the most economical alternative suited to his operation, which, of course, must be competitive with the operations of other competing contractors. Recycling will reduce the additional required asphalt by about one percentage point. This is where the contractor saves money, not in the aggregate saved. (While aggregate costs may be roughly equal, it remains that recycling conserves aggregates.)

6.03.08 Matching the Treatment to the Project

(revised 6-28-2021)

6.03.08A Alternatives to Consider

1. Overlay
2. Pulverize/Rubblize the existing pavement and resurface
3. Mill the existing pavement and recycle back as hot-mix
4. Combination of #2 and #3

6.03.08B Minimum Structural Requirements

Ensure that for each alternative the minimum structural requirements for the design life are met. See the Michigan DOT User Guide for Mechanistic-Empirical Pavement Design.

6.03.08C Life Cycle Cost Analysis

Reference the Pavement Selection Manual for Life Cycle Cost Analysis.

6.03.08D Selecting a Treatment

Selecting the proper treatment is determined by comparable cost/benefit analyses after consideration has been given to the following variables.

1. **Cause and rate of deterioration** - Poor results are likely, when overlaying a pavement that has failed from thermal cracking. Good results are likely, when overlaying a pavement that has not yet reached poor condition, but has shown signs of age or load related deterioration.

   Regardless of the treatment chosen, pavements that have deteriorated rapidly because of drainage problems, will continue to deteriorate rapidly unless the drainage problem is corrected.

2. **Pavement condition** - Pavements in badly deteriorated condition are not good choices for overlays.

3. **Location** - The location may have an effect on expected contract prices.
4. **Existing pavement layer depths and material types** - These factors affect structural requirements, cost, and feasibility. The pavement depth affects pulverizing cost, a seal coat or oil aggregate may not be recyclable in an HMA (leave this decision to Construction Field Services Division), a pavement with macadam or soil cement may be a poor milling or pulverizing choice.
5. **Subgrade soil** - Subgrade soil will have an effect upon structural requirements.
6. **Amount and Type of Traffic**
7. **Drainage**
8. **Aggregate Wear Index**
9. **Lane width** - Widening a 10 foot or 11 foot lanes to 12 foot lanes and overlaying will create two additional longitudinal cracks, which may lead to premature deterioration and in turn create maintenance problems.
10. **Shoulder condition, type of material, width and depth**
11. **Maintenance of traffic during construction** - Rubblizing may necessitate a detour.
12. **Uniformity of the cross-section** - Correcting an existing pavement distortion or modifying the crown may be necessary.

Predicting the average design life for various treatments is still rather indeterminate. For this reason, each district should make use of the variety of treatments available.

6.03.09 Hot Mix Asphalt (HMA) Mixture Selection Guidelines

(revised 8-24-2026)

This guide is to aid in the selection of Hot Mix Asphalt (HMA) mixtures, asphalt binders and Aggregate Wear Index values. It is the ultimate responsibility of the Region Soils/Materials Engineer to provide appropriate hot mix asphalt and thickness recommendations. Any questions regarding these guidelines should be addressed to either the HMA Unit or the Pavement Design Engineer in the Construction Field Services Division.

6.03.09A Rehabilitation, Reconstruction (R&R) and New Construction Projects

6.03.09A1 Mainline Paving

6.03.09A1a Mixture Selection

All mainline paving shall be composed of Superpave mixtures.

Computed Design BESALs (HMA Equivalent Single Axle Load) will be used to identify the appropriate Superpave mixture type.

Superpave Mix Type	Design BESAL (millions)
EL	Less than 0.3
EML	Between 0.3 and 3.0
EMH	Between 3.0 and 30.0
EH	Between 30.0 and 100.0
SMA	Between 10.0 and 100.0

SMA is to only be used as a top course mixture.

Design BESALs are calculated using the following information:

- Commercial Traffic
- Traffic Growth Rate
- Lane Distribution of Commercial Traffic
- BESAL Axle Load Equivalency for Flexible Pavement
- Total accumulated BESALs for 20 year design

The method for calculating ESALs for flexible pavements (BESALs) is explained in the ***AASHTO Guide for Design of Pavement Structures,*** 1993. Design BESALs should be requested from the Project Planning Section of the Project Planning Division. The Pavement Design Engineer of the Pavement Management Section of the Construction Field Services Division can provide an approximate BESAL value (for estimating purposes only). Show the 20 year design BESALs on the design plans.

6.03.09A1b Superpave Mixture Number Designation and Thickness Guidelines

After mixture selection has been determined, based on design BESALs, the mixture number for use in the various pavement courses can be determined**.** The mixture number will be 2, 3, 4 or 5 depending on the nominal maximum size aggregate. Following are the mixture numbers, minimum/maximum application rates and course type application:

Mixture #	Minimum Application	Maximum Application	Course Application
2	435 lbs/syd	550 lbs/syd	Base
3	330 lbs/syd	440 lbs/syd	Base and/or Leveling
4	220 lbs/syd	275 lbs/syd	Leveling and/or Top
5	165 lbs/syd	220 lbs/syd	Top
SMA (⅜" Nom. Max.)	165 lbs/syd	225 lbs/syd	Top
SMA (½" Nom. Max.)	220 lbs/syd	275 lbs/syd	Top
ASCRL	300 lbs/syd	500 lbs/syd	Base

NOTES:

1. Estimated application rate of 110 lbs/syd. per inch of compacted thickness. When using GGSP contact the HMA Unit at the Construction Field Services Division for the estimated application rate. When using ASCRL the estimated application rate is 100 lbs/syd per inch of compacted thickness.
2. Pavement designs requiring greater thickness than the specified maximum will require multiple lifts.
3. Crush and Shape: Use a minimum of two lifts over crushed materials. A minimum of 220 lbs/syd for the first lift is required for construction purposes.
4. Rubblized Concrete: The first lift over the rubblized concrete will be a minimum of 220 lbs/syd. For freeways and divided highways, traffic should not be allowed on the rubblized section until at least two courses have been placed. In those situations where the rubblized roadway must be opened to traffic at the end of each day, traffic may be allowed on the first course provided there is a minimum thickness of 265 lbs/syd.

The following are the Superpave definitions for Top, Leveling and Base course. This definition should be referred to when making the asphalt binder and mixture selections:

- The Top and Leveling courses are defined as the mixture layers within 4 inches of the surface.
- The Base course is defined as all layers below 4 inches of the surface.
- For mixture layers which fall within the 4 inch threshold, If less than 25% of a mixture layer is within 4 inches of the surface, the mixture layer should be considered to be a base course.

Below are examples of Superpave Pay Items and descriptions:

- HMA 3EML - A leveling or base course with a minimum application rate of 330 lbs/syd on a project that has design BESALs between 3 and 30 million
- HMA 4EL - A top or leveling course with a minimum application rate of 220 lbs/syd on a project that has design BESALs less than 3 million

6.03.09A1c High Stress HMA

High Stress HMA is to be used at locations that are susceptible to rutting early in a pavement's life. This typically occurs at signalized intersections, areas of stop/start traffic, roundabouts and areas where there are high levels of commercial turning movements. The difference between the High Stress HMA and the typical Superpave HMA is the Performance Graded binder. High Stress HMA requires the upper temperature limit to be increased one level as can be seen in the Asphalt Binder Selection tables of Section D. The increase in the high temperature number results in an asphalt binder with improved high temperature stiffness or rutting resistance for both the leveling and top course. High Stress HMA is only applicable for top and leveling courses.

Application Guide:

- Use High Stress HMA 1000 feet on either side of the center of signalized intersections, other areas where stop/start traffic occurs, and at locations that experience high levels of commercial traffic turning movements (for quantity calculations use 1100 feet).
- Intersecting roads and commercial drives that are adjacent to the High Stress HMA mainline should use High Stress HMA Approach.
- Use High Stress HMA between signalized intersections when they are spaced 1 mile or less.
- Use High Stress HMA Approach for the circulating lanes and the entry and exit legs of a roundabout to the point where the roadway returns to the normal approach road width.

When developing plans the designer should set up the pay item of High Stress HMA. Standard pay items exist for all Superpave Mix Types that are applicable to High Stress HMA. When the pay item of High Stress HMA is set up on a project the applicable frequently used special provision should be included in the proposal. Additionally, the appropriate High Stress binder grade must be identified in the HMA Application Estimate Table. It is recommended that High Stress HMA not be used for quantities of less than 500 tons of individual leveling or top course mixture.

6.03.09A1d Asphalt Binder Selection

The following pages contain the Asphalt Binder usage table for all Superpave mixtures and High Stress HMA. Asphalt Binders with the suffix P denotes that polymer modified performance grade binder is required. It is the responsibility of the designer to select the appropriate binder for each mixture and course. The selected binder (including the suffix P when applicable) needs to be clearly identified in the binder column of the HMA Application Estimate Table.

Metro, North, Grand, Bay, Southwest and University Region

Mixture Type	HMA Mainline and Ramps		High Stress HMA	
EMH^, EH, SMA	PG 70-28P PG 64-22*	Top & Leveling Course Base Course	PG 76-28P PG 64-22*	Top & Leveling Course Base Course
EML, EMH^^	PG 64-28 PG 58-22**	Top & Leveling Course Base Course	PG 70-28P PG 58-22**	Top & Leveling Course Base Course
EL	PG 58-28 PG 58-22**	Top & Leveling Course Base Course	PG 64-28 PG 58-22**	Top & Leveling Course Base Course

Superior Region

Mixture Type	HMA Mainline and Ramps		High Stress HMA	
EL, EML, EMH^^	PG 58-34 PG 58-28	Top & Leveling Course Base Course	PG 64-34P PG 58-28	Top & Leveling Course Base Course

^ Greater than 10 Million ESALs

^^ Less than 10 Million ESALs

* Use PG 64-28 for North Region

** Use PG 58-28 for North Region

NOTES:

1. For shoulders paved greater than or equal to 8 feet or in a separate operation, use PG 58-28 for top and leveling course and PG 58-22 for base course for all Regions
2. For Temporary Roads, commercial and private Approaches, Wedging, and Hand Patching, use PG 64-22 for all Regions except Superior and North, use PG 58-28.
3. This table represents standard selection guidance. Variations may occur subject to approval by the Bituminous Section, Pavement Design Engineer, or designated pavement design personnel.

6.03.09A2 Non-Mainline Paving

Non-mainline paving mixture selection should be based on the following table:

Non-mainline mixture selection should be based on the following table:

Design BESALs (millions) Mainline	Shoulders ≥ 8 feet or shoulders paved in a separate operation All Courses (2)		Temporary Roads All Courses		Street Approaches and Wedging (1) (3)	Hand Patching and Private Drive Approaches (4) (5)
	Mixture Type	Application Rate	Mixture Type	Application Rate	Mixture Type	Mixture Type
≤ 3.0	Mainline Mix	meet appropriate min/max application rates	5EL Top 4EL Level	165-220 lbs/syd 220-250 lbs/syd	Mainline Top Course	EL
> 3.0	5EML Top 4EML Top	165-220 lbs/syd 220 lbs/syd	5EML Top 4EML Top	165-220 lbs/syd 220 lbs/syd	Mainline Top Course	Mainline Top Course or EL
	4EML Level 3EML Level	220-275 lbs/syd 330 lbs/syd	4EML Level 3EML Level	220-275 lbs/syd 330 lbs/syd		
	3EML Base 2EML Base	330-410 lbs/syd 435-540 lbs/syd	3EML Base 2EML Base	330-410 lbs/syd 435-540 lbs/syd		

NOTES:

1. The appropriate shoulder or mainline mixture (determined from 20 year design BESALs) may be used on driveways and low traffic volume approaches.
2. Shoulders paved integrally with the mainline will use the same mix as used on the mainline.
3. If more than one mixture and/or binder combination is required for HMA approach, it should be clearly shown in the HMA Application Estimate Table.
4. Show the mixture type for Hand Patching in the HMA Application Estimate Table.
5. When using SMA, use 5EML or 5EMH for hand patching.

6.03.09B Capital Preventive Maintenance Projects (CPM)
Mainline and Non-Mainline Paving

Selection is based on present day two-way commercial ADT. This table is to be used for CPM projects only.

Mixture Type and Binder Selection

Commercial ADT 0 - 300	Commercial ADT 301 - 1000	Commercial ADT 1001 - 3400	Commercial ADT ≥ 3401
5EL	5EML	5EMH	SMA or 5EMH
PG 58-28 *	PG 64-28 *	PG 64-28 *	PG 70-28P *

*Use PG 58-34 asphalt binder in the Superior Region for full depth flexible pavements.

*Use PG 58-28 asphalt binder in the Superior Region for composite pavements.

NOTES:

1. For shoulder paving, use a EL mixture.
2. For mainline paving the application rate is 165 lbs/syd (1½ inches compacted thickness) for all mixes unless approved by the CPM Engineer. For shoulder paving the maximum application rate is 330 lbs/syd (3 inch compacted thickness).
3. For hand patching, use the appropriate mainline mixture. Use a PG 58-28 binder for all regions.
4. When using SMA, use 5EML or 5EMH for hand patching.

6.03.09C Aggregate Wear Index
(All R&R, CPM and New Construction Projects)

Aggregate Wear Index (AWI) is required for all aggregates used in bituminous top course mixtures. The following table identifies the required minimum AWI, based on the present average daily traffic (vehicular and commercial) per lane (ADT/Lane):

ADT/Lane	Minimum AWI
< 100	None
100 - 200	220
> 200	260

It is the responsibility of the designer to select the appropriate AWI for each top course mixture. When a bituminous top course mixture requires an AWI, the appropriate number corresponding to each top course mixture should be clearly identified in the HMA Application Estimate Table.

6.03.10 Plan Development Using HMA Mix Selection Guidelines

(revised 3-25-2024)

6.03.10A General

The Designer should consult with Department HMA experts when questions arise concerning HMA mixtures. These experts consist of members of the Bituminous Section, the Pavement Design Engineer, and other department personnel who are responsible for pavement design.

6.03.10B Past Mixture Designations

Designers researching plans for old projects should have some familiarity with HMA mixture designations formerly used, as well as those in present use. Beginning with the 1957 Standard Specifications for Construction, there were basically three HMA plant mixtures: 4.09 Bituminous Aggregate Surface Course, commonly referred to as oil aggregate; 4.11 Bituminous Aggregate Surface Course-Hot Plant Mix, commonly referred to simply as bituminous aggregate; and 4.12 Bituminous Concrete Pavement, called bituminous concrete. The oil aggregate mixture was rarely if ever used on state trunkline projects, and bituminous aggregate was used only on the lesser traveled trunklines. Bituminous concrete was most frequently used for trunkline resurfacing and for state projects in cities.

Beginning with the 1979 Standard Specifications for Construction, designations were changed. The 4.09, 4.11, and 4.12 mixtures became No. 9, No. 11, and No. 12 respectively. There were a number of sub-designations relative to stone size in the mix, as well as the material being either leveling course or top course.

In late 1981 the Department adopted a supplemental specification that labeled HMA mixtures with a number corresponding to their minimum required Marshall Test stability. (These have come to be called "stability mixtures" or "performance mixes".)

In early 1992, the Department revised the HMA Specifications once again. This was in response to wheel rutting problems experienced with the former stability-based mixes. These new mixes are referred to as Marshall Mixes.

The following historical HMA mixtures are listed with their approximate replacements in terms of their former designations:

Stability Mixes	Marshall Mixes
#500	11A
#700	11A
#1100	13 or 13A
#1300	“B” series
#1500	“C” series

In 1997, the Department began implementing Superpave Mixtures. Superpave (short for SUperior PERforming Asphalt PAVEments) was developed from the Strategic Highway Research Program of the late 1980's and early 1990's. It consists of a classification system for asphalt binders (PG grading system), and a mix design methodology that replaces the Marshall method.

In 2000, the Department went to full implementation of Superpave for all mainline pavements. Marshall Mix designs (13A, 36A, and the C series) were still allowed for non-mainline paving such as shoulders wider than 8 feet, ramps, and low-volume Capital Preventive Maintenance projects.

In 2008, the Department moved to phase out the use of Marshall Mix designs. See Section 6.03.09 for the current HMA selection guidelines.

6.03.10C Traffic Volumes

Designers should obtain total Annual Average Traffic Volumes (AADT). Total AADT is necessary in determining the Aggregate Wear Index (see Section 6.03.10D following). The Bureau of Transportation Planning, Data Collection Section publishes maps yearly that show total AADT for all trunklines. The Data Collection Section may also be contacted directly if the Designer requires more up to date traffic data.

For pavement thickness determination and mix type selection, designers should obtain the number of Equivalent Single Axle Loads (ESALs) over the design life of the project. See Section 6.01.02 for information on obtaining ESALs. ESAL values for HMA (referred to as BESALs) and concrete (referred to as CESALs) will be different due to differences in material response under loading. BESALs are used to determine the Superpave mix type (see Section 6.03.09) and are also used in the AASHTO design method to determine the HMA thickness.

6.03.10D Aggregate Wear Index

Starting in 1965 and continuing for a number of years afterward, the specifications included a footnote, in the table of physical requirements for coarse aggregates and surfacing aggregates, prohibiting aggregate from limestone quarries for use in HMA top courses. In addition, aggregates from natural gravel sources containing more than 70% carbonates were prohibited in the top course. The reason is that limestone in HMA pavements tends to polish under traffic, with a subsequent loss of skid resistance. The specification restriction imposed a hardship on projects in the tip of the thumb and in the counties of both peninsulas bordering the Straits; US-2 is a classic example of a route so affected. The restriction was too all-inclusive, however, as some limestones are better than others with respect to polishing. Indeed, aggregates produced from different parts of the same pit or quarry may vary in polishing characteristics.

In an effort directed at more utilization of the better limestones, the Construction Field Services Division constructed a circular test track whereby coarse aggregates from a given source could be cast into thin concrete slabs and subjected to 4 million passes of a pneumatic-tired wheel. Data collected from these tests gave a good indication of the polishing potential of aggregates from a large number of sources, and led to the establishment of an Aggregate Wear Index wherein the higher the number, the greater the resistance of the aggregate to polishing under traffic. Enough data was collected to allow AWI evaluation to be based on aggregate types used in an HMA mix. Wheel track testing is still performed. Blending of aggregates is frequently required of the contractor in order to meet a specified AWI.

Because polishing is primarily a function of the vehicle tire interaction with the pavement, and not of vehicle weight, passenger car traffic volumes share equal consideration with trucks. For the table of minimum aggregate wear index (AWI) values based on ADT, see Section 6.03.09C.

Note that the design year ADT received from the Bureau of Planning includes trucks. It is the responsibility of the designer to select the appropriate AWI, or to determine that the project does not require one. If possible, only one AWI should be specified for a project, or two at the most. When more than one is needed, e.g., as when the project includes top course surfacing of both a freeway and a lesser road, three asterisks (***) should be shown in the AWI blank, with the asterisks explained by a supplementary note below the body of the special provision indicating the respective AWI numbers and where, or with what mixtures, they apply.

In assigning an AWI to a project and basing that selection on traffic counts, it must be remembered that the number is based on ADT per lane. Errors that result in specifying an AWI that is too high can materially increase the bid prices and perhaps unnecessarily eliminate an aggregate source from consideration.

6.03.10E Application Rates

The application rate ranges in the HMA Mix Selection Guidelines reflect Department policy and should be adhered to unless the Bituminous Section, the Pavement Design Engineer, or other department personnel who are responsible for pavement design are consulted. Minimum lift thicknesses are based on 3 times the nominal maximum aggregate size in the mix. The maximum lift thickness is based on 4 times the nominal maximum aggregate size. In addition, the maximum is based on the maximum thickness that can be adequately compacted in one lift. However, the designer should remember that the specified application rate indicates ***average*** thickness.

Generally, an HMA surface weighs about 110 pounds per square yard per 1-inch of thickness.

The minimum application rate of a single course resurfacing should be 165 lbs/syd. A two course resurfacing should have minimum total application rate of 385 lbs/syd.

An old HMA surface, worn to such an extent that the coarse aggregate becomes the predominant material exposed, should probably be resurfaced in two courses to ensure proper adherence.

6.03.10F HMA Application Estimates

Projects that include HMA surfacing have a tabulation entitled "HMA Application Estimate" on the typical cross-section sheet as shown in the Road Sample Plans. The tabulation is basically an attempt at simplifying the typical cross-section sheet by showing in tabular form, information that would otherwise be duplicated, perhaps several times on the typical cross-sections. It also serves to reduce clutter. The number and letter designations shown in the column "Ident. No." are shown on the various typical cross-sections and refer to rates and types of application that apply to the project.

6.03.10G Unusual Conditions

When it is proposed or the designer is asked to incorporate construction that is outside the norm of generally accepted procedure, the Pavement Design Engineer and the Bituminous Section of the Construction Field Services Division should be consulted. The staff in these divisions may in turn elect to take the proposed treatment to the Pavement Committee for further comment and consideration.

6.03.10H Asphalt Usage Guidelines

MDOT adopted the use of Superpave HMA Designs in 1996. Superpave mixes resulted from the Strategic Highway Research Program (SHRP). The asphalt used in Superpave mixes are classified based on Performance Grade (PG). Performance Graded Asphalts are classified using the minimum and maximum temperatures that an HMA mix will experience at the location placed. The Department has monitored pavement temperatures around the state using temperature sensors. The data was used to determine which asphalt grades should be used in various regions of the state. Performance Graded Asphalts may or may not require an additive (Polymer) to meet the minimum and maximum temperature requirements specified. The MDOT 1996 Standard Specifications for Construction replace penetration grade asphalts with performance grade (PG) asphalt binders. Usage guidelines for PG asphalt binder grades are based on seasonal temperature variations and various traffic conditions. The EOC approved guidelines are shown in Section 6.03.09A(1d).

6.03.11 HMA Construction Considerations

(revised 9-28-2026)

6.03.11A Bond Coat

Bond coat is commonly an asphalt emulsion used to enhance the adhesion of an HMA surface to an underlying paved surface. Several factors affect its need; e.g., an old, polished asphalt surface on a 50° F day would probably need it, whereas the second lift on a clean new leveling course, on a hot day, would probably not need it. Thin applications (approximately 0.05 gal/syd) are frequently referred to as "fog" or "tack" coats.

Bond coat is no longer a pay item, although the contractor must use it when it is determined necessary on construction. It must therefore be shown on the HMA Application Estimate, with a rate of application of up to 0.15 gal/syd indicated. Quantities should not be shown on the plans or in the log.

6.03.11B Prime Coat

Prime coat was formerly a medium-curing asphalt used at a rate of 0.25 gal/syd to seal off a gravel surface preparatory to paving with HMA and to aid in stabilizing the aggregate base so that trucks could run on it. Construction experienced delays waiting for it to cure, and with the dense-graded aggregate mixtures in use, it was often determined that prime coat was unnecessary. If prime coat is needed, Construction will add it by authorization. Designers are instructed to omit any reference to it.

6.03.11C Feathering and Tapering

(See Section 6.03.04B(3)) Feathering, as a method of discontinuing HMA surface at the ends of the project, or longitudinally at a curb face, is not as widely used as it was before the advent of the milling machine. There is still an occasional project, however, which requires that feathering be done. While more economical than constructing a butt-type joint, it is more prone to deterioration because of insufficient compaction at the thickness where the large-size aggregate tends to support the roller. This can be helped somewhat by using a finer mix for constructing approaches. Generally, the designer should provide for making butt joints along the trunkline, and for feathering at intersecting roads and streets, unless recommended otherwise at the Plan Review Meeting.

When feathering at a curb face, do not show the taper sharply breaking or a dimension for the width of the feathered area. The typical cross-section should illustrate the leveling course feathered out somewhat short of the curb and gutter, with the top course feathered at the curb. Quantities should be computed on the basis of full thickness to the curb face.

Sometimes it is necessary to transition a resurfacing to meet the existing top of pavement elevation, as when resurfacing a bridge deck or meeting railroad tracks. The proposed transition required to wash out the added thickness should be on the order of ¾ inch in 25 feet. This transition length should be shown on the plan or in the log.

6.03.11D Stage Construction

Occasionally, it is planned that a new HMA roadway will be constructed in stages, usually by delaying placement of the top course for a period of from 1 to 5 years. The reason may be to conserve finances, but a side benefit is that weak spots and areas of settlement show up under traffic, so they can be corrected when the top course is eventually laid. There are other times when the contractor fails to get the top course on before the onset of winter, and traffic must be allowed on the leveling course until the following spring. In any case, the designer need not particularly concern himself as the Construction Field Services Division will adjust the design of the leveling course by adding more asphalt cement to the mix.

6.03.11E Joint Lines Coinciding with Lane Lines

It is highly desirable that longitudinal construction joint lines in the top course coincide with the lane lines that will eventually be painted. Even when the joint is constructed perfectly, it will usually show up prominently at night and when wet, and traffic is prone to follow the most distinguishable line resembling a lane marking. Paving to coincide with lane lines is now a requirement of the Standard Specifications for Construction. However, there are certain situations, e.g., where a lane is picked up or dropped, when the designer should detail the lane striping on the plans or in the log.

6.03.11F "Paving Through"

There have been occasions in the past when a contractor, paving a shoulder ribbon or a full width shoulder prior to paving approaches, has paved through cross road approaches or freeway ramps in a continuous operation, coming back later to pave the approach or the ramp. At the least, this type of construction is unsightly, and it may lead to premature deterioration of the approach or of the ramp when the shoulder edge, now a transverse joint, opens up. The designer should give consideration to adding a note or detail to address this issue.

6.03.11G Bridges

When resurfacing projects include resurfacing on or under bridges, a standard form letter (available from the Bridge Management Unit) is to be sent to Bridge Management Unit for either a load analysis or a review of underclearance requirements, as appropriate. Minimum standard underclearance can be found in Section 3.16. If the resurfacing will reduce the underclearance below minimum, it may be necessary to remove some of the existing surfacing under the bridge.

The preferred method is to remove old concrete pavement and replace with either concrete or HMA base course, and run the overlay under the bridge. This is done to improve the appearance and ride. In cases where the existing underclearance is adequate, the alternatives of thinning up the overlay or grinding the existing concrete pavement should be investigated.

If pavement removal is not cost effective, other methods such as gapping the section under the bridge may be used to retain existing underclearance within minimum standards. Measures must be taken to improve pavement integrity and ride. This may include pavement repair/rehabilitation within the gapped section. In all cases where the resurfacing is gapped, the final driving surface must be diamond ground to improve ride.

For cases where additional underclearance must be obtained, site by site studies will be required to determine the most economical method. To improve appearance and ride, the riding surface at the underpass should be the same material as the abutting section of the roadway.

6.03.11H Paving Over Neoprene-Sealed Joints

Concrete pavements to be overlaid with HMA require removal of the Neoprene Seals. The plans or proposal should note that the neoprene seals are to be removed prior to resurfacing. This is to avoid expansion of the seal in contact with the hot asphalt which will cause cracking of the new HMA overlay.

6.03.11I Stringline Grade Control

The Standard Specifications for Construction provide that pavers must, with certain exceptions, have a 30-foot (minimum) grade referencing attachment, usually a ski, for grade control on all lower courses and the first pass of the top course. Generally this is adequate to ensure a smooth riding pavement. There are conditions, however, e.g., building up superelevation, when it is desirable to have a more elaborate control, an accurately set "stringline" for the pavers electronic sensors to guide on. Actually, the stringline is usually a high tensile wire on stakes 25 feet apart, offset laterally from the path of the paver. Machine accuracy is on the order of ⅛ inch in elevation, with start-up distance as short as the length of the paver.

Stringline control is usually not paid for separately, but it has been on occasion when requested by the Region/TSC. It adds about 2% to the cost of material placed, not including the cost of additional quantities required for wedging that may be called for by the grade control.

The following situations may warrant calling for stringline grade control:

1. When paving covers the gutter pan and the longitudinal grade is less than 0.5%.
2. Wedges greater than 100 feet in length. When paving a wedge to increase superelevation, the tangent section of the transition should be included with the curve.
3. The first course on an aggregate grade or the first course on a grade from which material has been removed for recycling. (A stringline would ***not*** be required, if removal and replacement of the old surface is to be done part-width. In this case, a stable surface would always be available on one side from which to operate a ski for grade control.)
4. Over portions of old pavements in such condition that the 30 foot ski will not take out surface irregularities (as recommended by the Region/TSC or determined at the Plan Review Meeting).
5. Next to concrete median barrier when the longitudinal grade is less than 0.6%.

It may be difficult to determine whether the stringline should be required, when the grade is slightly more or less than 0.5% or 0.6%. Where there is doubt the designer will have to rely upon Region/TSC recommendations.

The grade of the stringline will be established during construction. The designer's concerns are:

1. The need for a special provision,
2. Specifying the areas where stringline control will be required,
3. Whether or not stringline control will be paid for separately. The designer should note that use of stringline control inherently requires more material to fill low spots to achieve the smooth surface. An alternative to consider is milling off existing ***high*** spots, thus reducing the depth of low spots. A cost analysis will sometimes reveal that milling, in conjunction with a stringline, is the more economical alternative.

6.03.11J Longitudinal Joint Density Quality Initiative

The quality of HMA pavements at longitudinal joints can be affected by the method and circumstance in which the joint is formed. Whether a cold joint is formed adjacent to existing surfaces or adjacent to new pavements from preceding stage construction, or a hot joint is formed with echelon paving, influences the ability to achieve sufficient density at the joint.

The specifications for Longitudinal Joint Density Quality Initiative is applied to all trunkline HMA projects (except non-motorized paths) and includes a pay item for incentives to the contractor for achieving acceptable ranges of density. The incentive payment is applicable to longitudinal joints between two new adjacent HMA pavements (Type 1). It does not apply to longitudinal joints adjacent to existing pavements or surfaces (Type 2), or where the contract documents specify the paving method (echelon paving, etc.).

The dollar amount of the incentive is prescribed by the Standard Specifications for Construction or special provision and is dependent on the level of density achieved. The designer should base the estimated dollar amount on the maximum achievable incentive rate. This provides the Engineer the resources to encourage, reward, and maximize contractor effort and pavement quality.

6.03.11K Temporary Pavement Markings

There are two basic types of wet reflective temporary pavement markings. Type R (removable) is an adhesive backed tape. Type NR (non-removable) may be either a tape or a painted stripe. Measurement is based on the length of marking actually required, not including the skips in the dashed lines. Temporary pavement marking quantities are determined as part of the maintaining traffic design.

For detailed information on temporary pavement markings, including type application, staging, payment, removal, and more, see Chapter 6 of the Work Zone Safety and Mobility Manual.

For specific details on temporary marking size and layout please refer to the pavement marking standard PAVE-904-Series Temporary Longitudinal Line Types & Placement for detailed information.

The pay items that can be used are listed below:

- Pavt Mrkg, Wet Reflective, Type NR, Paint, [Insert width] inch, (color), Temp
- Pavt Mrkg, Wet Reflective, Type NR, Tape, [Insert width] inch, (color), Temp
- Pavt Mrkg, Wet Reflective, Type R, Tape, [Insert width] inch, (color), Temp

If a project has multiple stages and configurations, pavement markings for each stage need to be calculated. If the project is going to be over more than one construction season, additional quantities to refresh or replace the temporary markings should be accounted for.

6.03.11L Admixtures

Over the years, a number of admixtures have been used in asphalt pavement to improve the properties of the mix, reduce reflective cracking, or, in the case of sulphur, as a substitute for asphalt. Many of these admixtures have been used in Michigan. In addition to those listed in the following paragraphs, these have been used: asbestos, crushed glass ("glasphalt"), Trinidad Lake (a natural asphalt found in its pure form in Trinidad, high in ash but requiring no refining), resins ("Whyton"), rejuvenators ("Reclaimite"), and special aggregates ("Lakelite"). While the use of an admixture will only be used if recommended by others, the designer should be acquainted with some of the ones in more common use, and their advantages and disadvantages.

1. Rubber - Rubber comes in two forms, scrap and virgin latex. There are two types of scrap rubber: reclaimed, which involves a heated chemical process that breaks down the vulcanization, and ground rubber, which is simply ground up old auto tires. Rubber is used in two ways: as a binder in hot asphalt cement (latex and reclaimed) and as a resilient filler modifying the aggregate (ground rubber). Claimed benefits are improved skid resistance, reduced reflective and thermal cracking, better stability at high temperatures, and more pavement flexibility at low temperatures.

2. Polyester fibers - Polyester fiber asphalt is currently the common type of waterproofing used on bridge decks. It is laid at the rate of about 70 lbs/syd and is called a waterproofing membrane, rather than a lower course of asphalt. The fibers resemble 1½ inches to 2 inches long pieces of yarn and are used in conjunction with a small-size aggregate (⅜ inch maximum), a higher than usual asphalt percentage, and mineral filler. The resultant mix tends to have a sticky consistency. A conventional wearing course is used over the membrane.

Another admixture that has been used experimentally, with mixed success, is sulphur. Elemental sulphur, when melted to the liquid state, has qualities very similar to asphalt and in fact, can be substituted for up to 50% of the asphalt in an HMA mix. Because of transportation costs and the need for special equipment, it is more expensive than asphalt and has been used experimentally only to prove its feasibility in the event that asphalt, a petroleum derivative, is ever in short supply.

6.03.11M Causes of Contract Overruns

1. **"Vertical" edge** - It is impossible to pave succeeding bituminous lifts and maintain a vertical edge. Practically, the edge assumes a slope of about 60° from the horizontal. On a long project with thick lifts, the extra material required because the base must be wider than the finished surface is quite significant, and extra quantities should be provided. Assuming a 4 inch thick pavement, this extra material amounts to about 22 tons per mile (two sides).

2. **Edge settlement** - Characteristically, the existing crown is likely to be accentuated in a fill section and reduced in a cut section. This condition is not always evident on casual inspection, unless unusually severe. Field review personnel should be watchful to see if this condition does exist and if it is severe, wedging quantities should be provided.

3. Wedging quantities are difficult to estimate. The tendency is to underestimate the severity of the condition to be modified.

4. HMA base course widening tends to squeeze outward, e.g., a nominal 12 inches widening might be 15 inches wide at the bottom.

6.03.11N Ramps

An advantage of the current method of designing pavement cross-section is the capability to fine tune various component thicknesses. In its extreme this practice could yield a slightly different pavement section for every ramp in an interchange. Because of the possibility of future changes in traffic patterns and to minimize construction inconvenience (which translates to increased cost) and potential for confusion, the Engineering Operations Committee has decided that no more than two different ramp cross-sections should be used on any one project. This decision is in the context, however, of thickness, not width. Unless there is a substantial variation in thickness requirements, a single ramp cross-section is even more preferable.

Pavement design standards may call for HMA shoulders to be thinner than the HMA mainline pavement. To construct, this cross-section might require three paver passes for every course of HMA. Two passes might suffice if all elements were at the same level for each course. Occasionally, it will be found more economical to construct the shoulders the same thickness as the mainline pavement, if it will mean fewer passes of the paver are required.

6.03.12 HMA Base Course

6.03.12A General

Several decades ago, as part of a national promotion of its product, the asphalt industry coined the phrases "deep strength" and "full depth." More recently the term “perpetual pavement” has been used to mean the same thing. These terms refer to an HMA pavement design that includes a surface course that is supported by a base mix having a reduced asphalt content. The Department also describes lower course as HMA Base Course or "black base." Because it generally has about 1.5% less asphalt than the conventional surfacing mixes, black base is a comparatively economical, quite stable base material that can be laid in lifts of 3 inches (or more, if permitted) to create bulk paving. It facilitates ease of construction staging and maintaining traffic. For nominal additional cost, a stable HMA material can be obtained rather than plain stabilized aggregate.

6.03.12B Wedging

See Section 6.03.04B(15).

6.03.12C Widening

Black base has an advantage over other types of pavement widening in that it can be laid directly on the subgrade, provided the grade isn't subject to frost heave. This sometimes reduces the construction problem associated with confined excavations that have no drainage outlet.

Thickness of the widening is usually determined by computing the required structural number. Major widening will be approved by EOC after a review of possible alternative cross-sections.

When widening an existing concrete pavement, Region/TSC forces should be requested to investigate the condition of the existing pavement edge. Deteriorated concrete, and its residue, should be removed and replaced as part of the widening operation.

6.03.12D HMA Separation Course

As a separation course over old concrete pavements in poor condition, experience has shown that a thickness of 6 inches is about minimum for a significant reduction in reflective cracking. If used as a separation course, the HMA base would take the place of the sand lift shown in the drawing in Section 6.02.12.

6.03.12E Minimum Cover Over HMA Course

The Standard Specifications for Construction provide the smoothness tolerance for HMA base course surfacing mixtures. To attain the desired smoothness, pavements should be designed with at least two courses, a top over a base course.

6.03.13 Deleted

Section deleted.

6.03.14 Small Tonnages of HMA

When HMA quantities on a project are less than 500 tons, the use of a single HMA mixture should be considered. This item is especially important when the HMA plant is located an appreciable distance from the project. This item should also be discussed at the Plan Review Meeting.

6.03.15 HMA Approaches and Auxiliary Lanes

(revised 11-28-2011)

The separate pay item for HMA approaches is intended to compensate the contractor for the additional work involved in doing very short runs with a paver, often in conjunction with considerable hand labor, especially in constructing the fillets. In other words, the payment is for a relatively small tonnage combined with more than average work. Besides approaches, the HMA approach pay item should be used for miscellaneous non-production HMA paving, such as driveways and traffic control islands, crossovers, and tapered lanes.

It is difficult to set forth a "rule" relative to approaches as the reconstructed and regraded approach road may extend several hundred feet back from the trunkline, of which a considerable portion could be considered production paving.

A corollary problem occurs along the mainline when long tapers are used, often in conjunction with auxiliary widening, that vary in length from 50 feet to several hundred feet.

It has been agreed upon by Construction staff that the Designer should set up the stippled portion of the sketches shown in Section 12.02.03 as HMA Approach, and this should be clearly described on the plans or in the proposal. Even though the taper length or the paving distance along the crossroad may be greater than that depicted, the pay item will still be HMA Approach. However, in extreme cases involving 500 feet or more of auxiliary lane or repaving of the crossroad, the designer should discuss the situation with Construction to determine if handling and payment should be different.

6.03.15A Guidelines for Use of HMA Approach Pay Item

1. The pay item HMA Approach includes all HMA mixes used in the approach area (Including top, leveling and base materials).

   The HMA Approach pay item is not used in areas where paving by machine is likely. Typically this is where the length (including tapers) along the mainline (or crossroad where applicable) is greater than 500 feet and the width is 10 feet or greater. Mainline pay items should be used in these areas rather than HMA Approach. If there is any uncertainty about paver capabilities or appropriate HMA pay items, the designer should consult with the Construction Field Services Division.

2. On HMA jobs, the HMA Approach pay item is typically used on all crossroad or cross-street intersection approaches back to the spring line or 50 feet minimum from the edge of the mainline if the crossroad is gravel. Provide additional HMA Approach quantities for any necessary resurfacing or crown modification beyond this point.

3. HMA Approach material and rate of application (commensurate with the usage) should be specified for all drive and street approach work.

4. There have been instances when the contractor has requested that approaches be exempted from the AWI requirements of the mainline top course. Even though traffic volumes may be reduced from that on the mainline, there is more localized starting and stopping, which would tend to polish the pavement. Approaches should have the same AWI as the mainline.

5. In most cases HMA approaches should be surfaced with a minimum of 220 lbs/syd. This will provide a sufficient quantity of material for wedging and edge trimming.
6. Use High Stress HMA Approach for the circulating lanes and the entry and exit legs of a roundabout to the point where the roadway returns to the normal approach road width.
7. Sand trails, such as are frequently encountered in the northern part of the state, should have minimal HMA approaches. Approach Treatment Detail I is typically used in these areas (see Section 12.02.03).

   See Section 12.02.03 details of approaches.

6.03.16 HMA Curb

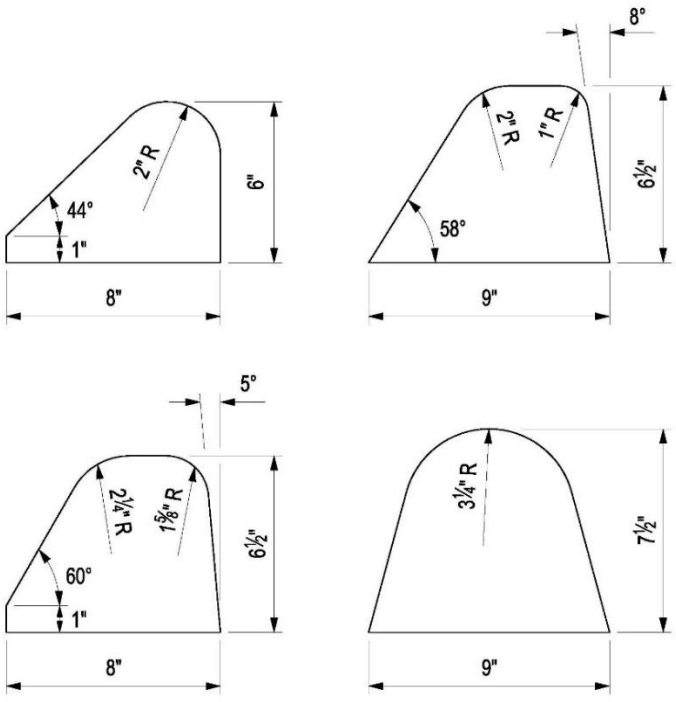
(7-26-2021)

6.03.16A Guideline for Use

The use of HMA curb on trunkline projects should be restricted to replacement in kind, work of a temporary nature, or for maintenance-type erosion control at the edge of shoulder.

6.03.16B Curb Shapes

The Standard Specifications for Construction indicate that HMA curb shapes will be according to the cross-section shown on the plans. Shown below are four shapes, based on commercially available templates that have been adopted by the Department. The shape to be used must be detailed on the plans or in the proposal.



6.03.16C Pay Items

Designers are reminded that the pay items are “Curb Slp, HMA” and “Curb Vertical, HMA”.

6.03.17 Open Graded Asphalt Friction Course

While open graded asphalt friction course (OGAFC) is no longer used by the Department, designers should be aware of its history and use because a number of projects were constructed in the late seventies with an OGAFC riding surface. It as characterized by a very open texture that was created by gap grading of the aggregate. Its purpose was to provide space and drainage for surface water, in effect making up for the possible lack of tread on a vehicle tire, and thereby reducing hydroplaning. It was more expensive than ordinary mix so it tended to be used more for intersections than for entire project resurfacing. Problems with durability caused a moratorium to be placed on its use in the early eighties; this moratorium has never been lifted.

Other disadvantages of OGAFC are: more salt is required for ice control, the pavement is slower drying after a rain, adhesive-type pavement markings do not adhere as well, and hand work is difficult and therefore prone to be unsatisfactory.

6.03.18 HMA Paved Ditches and Valley Gutters

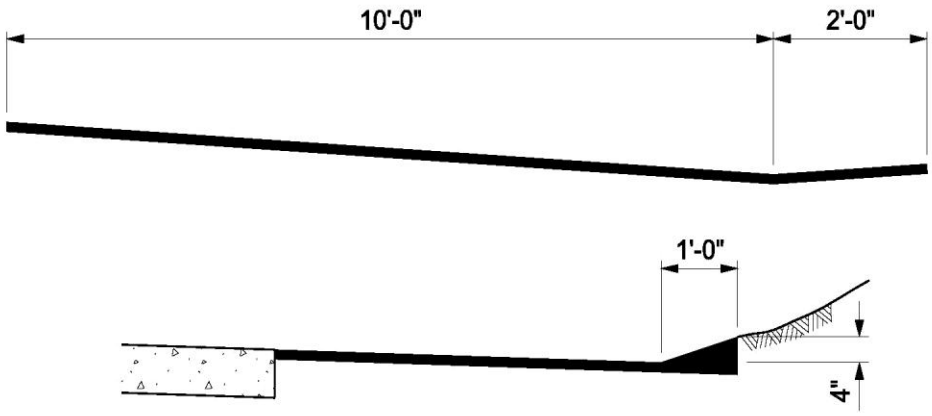
6.03.18A General

HMA paving of anything other than a reasonably flat surface is difficult. Although there are special pavers on the market with curved and V-shaped screeds, few contractors have them. Drum-type rollers are geometric cylinders. Combine the difficulty of paving directly on earth with the difficulty of obtaining compaction with a roller that doesn't "fit" the surface, and the result will often be less than desired. Even with these drawbacks, HMA paving of drainage courses, when necessary, is often a satisfactory, more economical alternative to concrete paving or placing riprap.

6.03.18B Thickness and Cross Section

A typical HMA paved ditch section (the pay item is “Paved Ditch, HMA”) is depicted on Standard Plan R-46-Series. The HMA requirements and the placement on the prepared base are described in the Standard Specifications for Construction, which also state that it be measured and paid for by the square yard.

Other configurations than the one shown on Standard Plan R-46-Series may be used, but must be detailed on construction plans. Where conditions permit, a better and more economical "V" ditch may be constructed as shown below.



This section permits the use of a paver with vibrating screed and a 2-foot extension. The 2-foot section requires the use of a small roller, however.

A variation of a valley gutter, in conjunction with a paved shoulder, is also shown below. This treatment is applicable in a tight Right-of-Way situation, as might be encountered adjacent to a cemetery, where the proximity of a cut slope prohibits a ditch beyond the shoulder. Obviously, the runoff capacity of this valley gutter is limited, but it can be a solution to a cut-slope problem of short length, i.e., of 200 feet to 300 feet. It is usually paid for as "Shoulder Gutter, HMA", per foot (not a standard pay item). The additional quantity of HMA material required is included in the shoulder quantity, however.

The second variation of an HMA "curb" has also been used with success to reduce runoff erosion on long fills. The wedge-shaped curb is usually 1 foot to 2 feet wide and approximately 3 inches to 4 inches in increased thickness. With periodic outlets, there should be no limit to the length such a run can be.

This second variation has also been used in conjunction with guardrail as shown in Section 6.06.16. It is important that the effective height of the guardrail not be reduced. Therefore, none of the increased thickness of the wedge should be in front of the vertical plane of the rail.

6.03.19 Miscellaneous HMA Surfacing

6.03.19A Traffic Control Islands

If not surfaced with concrete, traffic control islands up to about 6 feet in width should be surfaced with HMA, either with a single course of "HMA Approach" (170 lbs/syd) or a double course (250 lbs/syd), as recommended at the Plan Review Meeting. Wider islands up to 10 feet and, in the extreme, 15 feet might be HMA surfaced if it is likely that the grass would not be mowed.

The use of a soil sterilant should be considered under HMA surfacing of islands, as it is not uncommon for the hardier weeds, e.g., thistles, to literally force their way up through 2 inches of new asphalt.

Traffic control islands should have 4 inches of Class AA Approach Material under the surfacing.

6.03.19B Splash Areas

When recommended at the Plan Review Meeting, a strip of HMA 3 feet wide may be provided behind the curb and gutter on major urban projects. This is to cover an area subject to winter salt splash where grass would not ordinarily flourish. Surfacing type and thickness would be as described under "Traffic Control Islands," preceding.

6.03.19C Rumble Warning Areas

There have been locations, such as on the dead-end leg of a T-intersection, where the accident history has dictated unusual means are needed to warn the approaching driver of an upcoming stop condition. Milled-in rumble strips have proven quite effective in this application, and long lasting as well. The depressions are milled in across the approaching lane approximately ½ inch deep by 4 inches wide, on 12 inches centers. Another option is the use of thermoplastic rumble strips. Contact the Pavement Marking Specialist of the Design Division for assistance on determining the type and placement of rumble strips on traveled lanes.

For Shoulder Corrugations, see the Standard Specifications for Construction and Standard Plan R-112-Series.

6.03.19D Emulsified Coal-Tar Pitch Protective Seal Coat

Leaking gasoline and diesel oil, such as may overflow from cars and drip from trucks, is detrimental to an HMA surface because it dissolves the asphalt. Diesel fuel is worse than gasoline in this respect because, taking longer to evaporate, it has more time to "work" on the asphalt. While not a problem in roadways under moving traffic, this can be a real problem in parking areas. A protective coating of coal tar emulsion, followed by a coating of coal tar emulsion and sand slurry, helps to protect the pavement from these drippings.

Tar emulsion protective seal coat is expensive because of a number of restrictions on its application; e.g., a minimum of 30 days of prior curing time of the mat, it cannot be applied in wet weather or when rain is predicted within 8 hours, air and pavement temperature must be between 50° and 80° F, and there should be at least 3 hours of sunshine remaining after application.

Provide quantities for tar emulsion on HMA surfaces in:

1. Rest Areas – in the truck parking area only.
2. Weigh stations - 100 feet each side of the scales.
3. Maintenance garages - in the vicinity of fuel pumps, as requested by Maintenance.

Current instructions are to provide for this item in the regular surfacing contract for the parking area requiring it. See the latest Special Provision covering tar emulsion.

Do ***not*** provide this treatment for park-and-ride lots where the need is less because there is less vehicle turnover.

“Tar Emulsion" is measured and paid for by the gallon. Quantities should be estimated on the basis of 0.35 gal/syd of pavement to be covered.

6.03.20 Seal Coats

(revised 11-28-2011)

Seal coats were widely used by the Department until about 1972, when it was concluded that, for a little more cost, a single course HMA could be used instead. For a period of about 15 years there was virtually no seal coat work done under contract and what little that was done was by maintenance forces. During this time a number of the counties continued to do seal coat work, some using their own forces and equipment. Around 1987 the Maintenance Division took note of the generally good results that some counties were getting and concluded that, if it is done right, there is a place in modern technology for seal coats on roads. They have therefore negotiated a few contracts with certain counties to do some seal coat work on state trunklines. While seals are insufficient to keep surface water from entering large joints and cracks, they are quite effective, if properly constructed, in sealing the numerous small cracks that may show up in an older HMA pavement or overlay. If these cracks can be effectively sealed, the life of the old pavement can be extended, with reasonable rideability, until the pavement can be more extensively rehabilitated.

The current practice notwithstanding, designers may be called upon to design a surface treated roadway. In this event, the Construction Field Services Division staff should be contacted for details.

A variation of a seal, sometimes used in conjunction with a mat, is the sprinkle treatment. It consists of a properly graded, precoated aggregate applied to the surface of a hot-mix asphaltic pavement immediately after laydown so that the chips can be rolled into the surface. The objective is to provide a skid-resistant wearing surface.

6.04 CONCRETE CONSTRUCTION

6.04.01 History of Concrete Paving in Michigan

The first mile of rural concrete pavement in the nation was located on Woodward Avenue between 6 and 7 Mile Roads. The 17 ft.-8 in. wide pavement was built by the Wayne County Road Commission and completed in 1909.

The beginning of the state trunkline system can be traced to a law enacted in 1913. At the time, road building was largely HMA and water-bound macadam on the "Class A" roads close to cities; gravel and earth predominated everywhere else. Although records are sketchy, it appears that the first concrete paving project, let for contract by the state, was on Dixie Highway just north of Monroe, in 1918. The circumstances of this project are peculiar in that it appears that the original contract was let by the Monroe County Road Commission. The original contractor went bankrupt so the project was taken over by the Department, which let a new concrete paving contract.

6.04.02 Glossary of Terms

(revised 6-28-2021)

Aggregate interlock - Load transfer that occurs across a concrete fracture by virtue of the irregular nature of the fracture surfaces due to cracking around, rather than through, the aggregate particles. The faces must be held in close proximity to one another in order to develop aggregate interlock.

Base plate - The galvanized metal base of joint dowel baskets that last appeared on Standard Plan E-4-A-130E (October 1963) and on E-4-A-138. Its purpose was to prevent sand from working up into the joint (It was used prior to subbase stabilization).

“Black and white job" - A non-technical term referring to a roadway having both HMA surfaced and concrete surfaced lanes.

Blow-up - The upheaval and sometimes spectacular shattering of a concrete pavement caused by hot weather expansion in combination with loss of room for expansion, infiltration of incompressibles, and loss of cross-section in the lower portion of the joint, with consequential reduction of compressive stability and compressive strength. Usually occurring at a joint, it may commence in the period when the pavement is 8 to 18 years old.

Bonded overlay - A concrete overlay of an existing pavement that is encouraged to chemically and physically bond to the underlying pavement surface. The existing surface must be thoroughly cleaned by milling, grinding, or sand or water blasting prior to resurfacing.

Bulkhead joint - The formed joint, either longitudinal or transverse, between two adjacent concrete slabs, created when one slab is cast up against another already hardened slab.

Cold joint - The division between two concrete pours, one of which has begun to set before the other is cast against it. This disparity prevents the mixture from forming a continuous uniformly consolidated mass and may lead to separation of the concrete along this same line of division at sometime in the future.

Composite pavement - A portland cement concrete pavement with an HMA overlay.

Concrete base course - A concrete pavement slab intended to be overlaid with a surface course, usually an HMA surface course. Hence, more tolerance in the surface finish is acceptable, joints are not separately sealed, etc.

Concrete pavement - As normally used in the Department, a term referring to a pavement on which the portland cement concrete is the riding surface, as distinguished from concrete base course.

Continuously Reinforced Concrete Pavement (CRCP) - Concrete pavement which contains substantial steel reinforcement. Steel reinforcement (commonly #4 or #5 bars) is placed in either the longitudinal direction or in both directions. CRCP pavement does not normally contain joints except at structures.

Contraction Joint - A joint in concrete pavement that serves as a plane of weakness joint. Movement in the slab due to contraction occurs here.

Crg Joint (Contraction-Reinforced-Grouted) - A contraction joint between an existing concrete pavement and a full depth concrete pavement repair. Epoxy coated load transfer bars are drilled and grouted in the existing pavement at the joint.

Curb-cut - A rounded reduction of curb height such as is encountered at a driveway or curb ramp.

D-cracking - Deterioration along transverse or longitudinal pavement joints or cracks, caused by moisture absorption in the concrete coarse aggregate near the joint, with cracking occurring during subsequent cycles of freezing and thawing. This type of cracking takes its name from the characteristic concentric semicircular (as viewed in the vertical plane) hairline cracks that appear as parallel lines on the surface. These cracks often contain calcium hydroxide residue causing a dark surface stain. The deterioration progresses to a series of parallel cracks adjacent to the joint and eventually to disintegration and spalling, under traffic, 1 foot to 2 feet away from the joint.

Dowel basket - See "Load Transfer Assembly”

Dowel Bar Inserter - A machine that inserts load transfer dowels directly into the plastic concrete at contraction joints, eliminating the need for dowel baskets.

Drilled-in anchor - A method for anchoring a bar into an existing concrete structure. The bars are inserted into a previously drilled hole and anchored by an epoxy grout.

Durability, specifically, freeze-thaw durability - A term applied to the coarse aggregate in concrete to indicate its ability to resist the action of freezing and thawing while in a moisture saturated condition. Until 1988, it was expressed in terms of "Durability Factor" (0 = poor to 100 = excellent). In 1988, durability values were changed to dilation (expansion, expressed in units of percent per 100 cycles of freezing and thawing), with values from 0.000% (excellent) to about 0.200% (poor, failure in 12 cycles). Dilation of 0.067% per 100 cycles is equal to a durability factor of 20, which was a minimum specification limit from 1976 to 1988. A value of 0.040% per 100 cycles relates to the former durability factor of 36, and is the current minimum for freeway pavements.

Econocrete - A contraction of "economy concrete" applied generically to a concrete proportion of less strength and durability, utilizing either less cement, a more easily obtained aggregate gradation, a lower grade of aggregate, or a combination of any of these three.

Edge slump - The tendency for the outside edge of a slip-formed pavement to sag from the vertical immediately after the form has passed.

Erg Joint (Expansion-Reinforced-Grouted) – An expansion joint between an existing concrete pavement and a full depth concrete pavement repair. Epoxy coated load transfer bars with expansion caps are drilled and grouted in the existing pavement at the joint.

Expansion Joint - A joint in concrete pavement which is filled with an elastic material to provide opportunity for a small amount of movement (expansion).

Faulting - The vertical displacement of one pavement slab in relation to the adjacent slab. Common when there is no provision for load transfer across the joint. Such movement results from the rearrangement of aggregate fines under the joint, caused by the combined action of water and truck loading. Faulting can occur at a joint or crack.

Flowable fill - A mixture of portland cement, fly-ash, sand and water having sufficient fluidity to allow it to be poured into potholes, utility trenches, abandoned culvert or sewer pipes, and other cavities that need filling. It forms a weak concrete when set up, which can be re-excavated if necessary.

Frozen joint - A pavement joint that, through corrosion or misalignment, seizes up and no longer accommodates movement of the adjacent pavement slabs.

Gutter pan - The portion of curb and gutter, that is exclusive of the curb.

Integral Curb – Curb which is connected to (with reinforcing steel) and usually poured at the same time as the adjacent pavement.

Joint / Construction Joint - A break between successive deposits (slabs) of concrete used to control cracking and facilitate construction.

Jointed Plain Concrete Pavement (JPCP) - Concrete pavement containing no steel reinforcement. JPCP requires no steel mesh due to a very short joint spacing. Short joint spacing minimizes transverse cracking.

Jointed Reinforced Concrete Pavement (JRCP) - Concrete pavement containing steel mesh. The steel mesh is placed to hold anticipated cracks as tight as possible.

Lane ties – Deformed steel bars spaced at a given interval at 90 degrees to a longitudinal joint for the purpose of holding adjacent lanes tightly together.

Load transfer - Mechanism for transferring load carrying capacity across the opening between slabs.

Load transfer assembly - The metal framework that keeps the load transfer dowels in proper alignment through a transverse pavement joint during casting of concrete. Often referred to as a dowel basket.

Longitudinal Joint - A joint that runs parallel to the centerline of the roadway.

Lune widening - A variable widening of a pavement, usually on the inside of a curve, that allows more lane width for negotiating the curve. A 4-foot lune widening would start at nominal zero width at the beginning of the curve, gradually widen to 4 feet in the middle of the curve, then go back to zero width at the other end. The word has its root in the latin word for "moon", from which we get "lunar".

Margin - The area between a curb and sidewalk, usually in a residential area and seeded to grass. Synonymous with outlawn.

Mesh and Dowel - See Jointed Reinforced Concrete Pavement.

Metal - A somewhat archaic term referring to the road surface structure whether it is aggregate, aggregate and HMA, or concrete. "Edge of metal" would today be synonymous with "edge of pavement." The term was not applied to a paved shoulder.

Monolithic - In the context of concrete construction, two or more adjacent structural components cast together as one continuous unit.

Outlawn - The area between the curb and a sidewalk usually used in the context of a residential area where this strip is seeded to grass. This term is not commonly used in the Department. (See "Margin")

Panel - In the context of concrete pavement, the pavement slab between two consecutive transverse joints. See “slab”.

Paving train - The succession of paving equipment used to place and finish the plastic concrete. May consist of a spreader, mesh carrier, paver, float, texturing machine, and cure applicating machine. Other equipment having a specialized function may be used.

Plane of weakness joint - A simple joint formed or cut in a concrete surface to reduce the cross-sectional area and thus encourage any cracking to occur along a predetermined straight line, rather than randomly.

Pressure relief joint (PRJ) - A full depth groove cut in hardened concrete pavement, usually 3 inches to 4 inches wide, filled with an easily compressible filler, to relieve pressure caused by growth of the pavement. Typically installed where a blow-up has occurred.

Profilometer - A device for determining the smoothness of a pavement surface by mechanical, electronic, or optical methods.

Pumping - The water borne ejection of underlying base material from under the pavement, caused by deflection of the pavement during truck traffic loadings. The ejected water carries fine particles from the base, resulting in a progressive loss of pavement support, settlement of the slab, and eventual fracture of the slab.

Reliability - A term used in pavement design. Expressed as a percentage, it is a measure of the probability that the proposed design will succeed, i.e., that it will not fail.

Return - That part of a street intersection consisting of the fillets and the curved portion of any curb and gutter. When considering a mainline, the return would be that part of the sidestreet approach around to the springpoint.

Shapefactor - The ratio of the width to the depth of the joint sealer in a pavement joint.

Slab - A term used to describe a length of concrete pavement between consecutive joints. (See “Panel”)

Sleeper slab - A concrete slab placed at a depth such that the pavement surfacing slab can rest upon it. May accommodate movement of the surfacing slab by means of a bond-breaker between the two slabs. Usually used at bridge approaches.

Springpoint - The point in a paved or curbed intersection where the edge on tangent meets the curved portion of the return radius.

Square – An abbreviation of "square yard”.

Subgrade - The following term is defined in the Standard Specifications for Construction.

Transverse Joint – A joint that runs perpendicular to the centerline of the roadway.

Trg Joint (Tied-Reinforced-Grouted) – A tied joint between an existing concrete pavement and a full depth concrete pavement repair. The existing pavement is drilled and tied to the pavement repair with grouted epoxy coated deformed bars.

Unbonded overlay – A concrete overlay of an existing pavement that is discouraged from bonding both chemically and physically to the underlying pavement surface. This is usually accomplished by using an HMA separation course.

Widened Slab – When the outside slab (truck lane) width between longitudinal joints is 14-feet, instead of the standard 12-ft. width.

Working crack - A random transverse crack in the pavement that accommodates expansion and contraction of the adjacent slabs. For this to happen the pavement reinforcement must first have fractured. Often, an adjacent pavement joint will have "frozen" so that it becomes a non-working joint.

6.04.03 Characteristics of Concrete Pavement

The concrete used in pavement has a coefficient of thermal expansion of 0.0000055 in/in/°F. Considering a pavement with a 27-foot joint spacing, a contraction of just greater than $^{1}/_{16}$ inch would occur at each end of the slab, because of a 90° decrease in temperature from its original casting temperature. It can be seen that a potential contraction of about ⅛ inch must be accommodated in each slab. There is also shrinkage during the curing of the concrete, and this increases with the amount of water in the mix.

Concrete pavement has a tendency to curl upward when saturated by moisture on the underside or when the temperature of the top surface is lower than that at the bottom. This tendency is most evident at night and is manifested in greater pavement edge deflection due to curl.

Concrete pavement has a tendency to lose its ability to accommodate expansion over the years, which is evidenced by open joints that don't close up when warmer temperatures return. This is usually the result of dirt and incompressibles entering joints and cracks and effectively filling up any available expansion space, or from actual expansion of the concrete due to alkali-silica or alkali-carbonate reactions and/or freeze-thaw deterioration. This phenomenon can have serious consequences when, for example, it results in excessive expansion pressures on the backwall of a bridge, or causes blow-ups at weakened pavement joints.

Admixtures can change the characteristics of portland cement concrete, particularly during the casting and setting stages. Plasticizers can increase the slump, and thus the workability, without changing the water-cement ratio. Calcium chloride will increase the heat of hydration, important in the winter time to allow the mix to set up without freezing. It is also used to accelerate the setting, therefore resulting in obtaining higher strength faster and allowing the roadway to be opened to traffic sooner. However, chlorides cause corrosion of reinforcement, so this material should not be used in heavily reinforced structures or those where corrosion will excessively reduce the life of the pavement. Extra cement and/or alternate non-chloride chemical additives can be used for fast strength gain when needed for reinforced concrete.

6.04.04 Concrete Pavement

(revised 9-22-2025)

6.04.04A General

Michigan has constructed three types of concrete pavement in past years. These are: Jointed Reinforced Concrete Pavement (JRCP), Jointed Plain Concrete Pavement (JPCP) and Continuously Reinforced Concrete Pavement (CRCP). JRCP and JPCP have been widely used while CRCP has been used in the past.

6.04.04B Thickness

Conventional thicknesses of concrete pavement range from 8 inches to 12 inches uniform. Many Metro area freeways were built utilizing 10 inches thickness and there are many rural trunklines 8 inches thick.

Some older pavements placed prior to 1950 were constructed with variable thicknesses. For example, a 9 inch-7 inch-9 inch pavement is 9 inches thick at each outside edge, tapering to 7 inch thickness 3 feet in from the edges. When rehabilitating a concrete pavement of this era, the designer should be aware of this possible design. Pavement cores can confirm or deny this

situation if old plans do not exist.

Pavement thicknesses greater than 9 inches are usually required only on the freeway system. The Pavement Designer will make the thickness determination.

6.04.04C Deleted

Section deleted.

6.04.04D Load Transfer

Load transfer can be achieved in three ways: (1) by aggregate interlock at tightly abutting irregular concrete surfaces, (2) by having an adequate base course (adequate stiffness) and (3) by the addition of a mechanical device (dowel bars) at the joint. Michigan has used dowel bars most frequently.

Load transfer is essential at the joints, otherwise faulting will occur. Faulting is caused by pumping of the slab, which in turn causes a migration of aggregate fines from under the "entering" slab to under the "leaving" slab. (Direction of traffic).

The driver will feel and hear the rhythmic "thump" of the faulted joints, even though the joint lines ahead will be barely visible. Looking in the rearview mirror, however, the joint lines will be prominent. Faulting adversely affects ride quality making a pavement less desirable to drive although the structural condition may be good.

Standard Plan R-40-Series, "Load Transfer Assemblies for Transverse Joints," shows the design of a load transfer assembly using a basket design.

Designers should be aware that older pavements, constructed prior to 1965, had metal base plates as part of the load transfer assembly. The department has determined that the presence of base plates is detrimental because they trap moisture and de-icing salts, which accelerates joint deterioration. Transverse joints in these pavements can be expected to be in much worse condition than the surface reveals. A common distress, in this situation, is “D” cracking.

6.04.04E Transverse Joints

The purpose of a transverse joint, besides allowing for expansion and contraction, is to minimize random transverse cracking. A joint acts as a designed crack location which is straight and is aesthetically pleasing.

6.04.04E1 JRCP Joint Spacing

Early reinforced concrete pavements placed in Michigan either had no joints or else joints were placed at almost any spacing conceivable between 15 feet and 100 feet.

Standard reinforced pavement joint spacing has ranged, based on year of construction, as shown below:

- 99 feet or 100 feet used prior to 1965
- 71 ft.-2 in. used from 1966 to 1975
- 70 feet used from 1975 to 1979
- 41 feet used from 1979 to 1996
- 27 feet used currently

Original joint theory was based on minimizing the number of joints constructed. Joints were the principal source of problems in concrete pavement. Therefore, the fewer joints constructed the less joint problems which could develop. The average transverse contraction joint width in a 99-foot slab was approximately ⅝ inch. An economical joint seal material does not exist that can accommodate a possible movement of ⅝ inch. The current 27-foot joint spacing requires a transverse contraction joint width of about ½ inch. Neoprene seals work very well with joint widths in this range.

6.04.04E2 JPCP Joint Spacing

Plain concrete pavements are designed to virtually eliminate random transverse cracking. Standard joint spacings are based on slab thickness and are shown on Standard Plan R-43-Series.

6.04.04E3 Expansion Joints

Expansion joints are placed on both sides of bridge structures and at-grade railroad crossings as specified on Standard Plan R-43-Series.

6.04.04E4 Contraction Joints

With any reduction in temperature, concrete will be subjected to tensile stress because of the frictional restraint along the plane of the base. Since concrete has negligible tensile strength, especially at an early age, a crack will occur. Therefore, concrete should be saw cut as soon as construction allows. A typical “relief” cut is ⅓ the thickness of the slab. Sawing can commonly be done on the day of paving or early the following day. Early relief cutting is intended to reduce early random cracking of the slab. See Standard Plan R-39-Series.

6.04.04E5 Joint Sealants

The Department typically requires hot poured rubber type joint sealing compound in expansion joints and either hot poured rubber or preformed neoprene compression type seals in contraction joints. Cold applied asphaltic sealants are not permitted.

The geometry of the joint reservoir, the sawed groove in which the sealant is placed, is very important. The reservoir must therefore be designed specifically for the joint spacing and type of sealant that will be used. In the past hot poured rubber would retain its adhesion to the sides of the joint groove reasonably well over a long period of time if not required to be extended more than 10% of original width. This would require ¼ inch of initial width for each 4 feet of slab length, i.e., a 1-inch wide joint groove would function for a 16-foot long slab. It follows that the use of hot poured rubber for transverse contraction joints are not practical for slab lengths more than 16 feet. In the 1990’s, the Department began specifying lower modulus hot poured rubber, which can be extended further while maintaining good adhesion. Because of this, in 2004 the joint widths were reduced to ¼ inch for slabs less than 16 feet. Other issues that are improved because of narrower joints are: reduced tire noise, improved ride perception, and decreased spalling. One drawback is that hot poured rubber is somewhat difficult to place on highly superelevated pavements.

Neoprene seals must be in compression at all times, or they will be ineffective and may come out of the joint. In general, neoprene seals are designed to function in a compression range of 20% to 50%, based upon their nominal width. A minimum of 20% compression is required to maintain an adequate seal; compression beyond 50% may cause the seal to extrude above the pavement surface where it may be damaged or lifted out by traffic.

About 10 joints were sealed with neoprene seals on I-96 south of Lansing as part of an experimental project in 1962. Neoprene joint seals first appeared in quantity, by Construction Authorization, on some projects paved in 1965.

Because of the higher cost of neoprene joint seals and specialized equipment needed to maintain them, some local agencies prefer to use hot poured rubber. They are thus reluctant to allow the Department to use neoprene seals on pavements such as service roads and crossroads that they will have to maintain at their expense. Before final plans are completed, a determination should be made as to the joint spacing and type of joint sealer the local agency desires. This information must be a part of the final plan documents; a special provision will likely be required.

In Wayne County, either hot poured rubber or neoprene seals are used, while the City of Detroit prefers hot poured rubber.

Silicone joint seals have been used experimentally in Michigan. Their first use on a relative large scale was on approximately 1.6 miles of I-69 north of Lansing between Airport Rd. and Dewitt Rd., constructed in 1985. In the EOC Minutes of August 4, 1992, because of excessive failures, there was a moratorium placed on the use of silicone sealant for concrete pavement joints. The moratorium was made permanent at the October 2000 EOC meeting.

6.04.04E6 Measurement and Payment

All transverse pavement joint details, except H and U, are paid for separately by the foot. This payment includes any load transfer devices (if required), sawing, and sealing of the completed joint.

In urban areas, joints at intersections are to be provided according to Standard Plan R-42-Series.

The estimate of "Expansion Joints" should include the E3 type expansion joint specified on Standard Plans R-39-Series and R-43-Series, located at bridge headers, even though this joint does not have a load transfer device.

A breakdown of each type of joint by pavement thickness, i.e., 8 inch, 9 inch, or other thickness, should be shown on the plans for information only. The bid items will continue to show the total quantity of each type of joint.

Pay items for concrete pavement joints should be set up regardless of the size of the project. At one time it was practice to pay for pavement joints as a part of the pavement. However, it was found that small contractors, who were more likely to be awarded the contract for a small project, were also the ones least able to recognize the type of joints needed and how to estimate them.

6.04.04E7 Concrete Intersection Joint Layout

Design of concrete intersection plane of weakness joints vary with each intersection's geometry and the location of structure covers within the intersection pavement. On September 2, 2004 the Engineering Operations Committee approved the concept of contractor intersection joint layout. The contractor will be required to submit a joint layout plan to the Engineer prior to concrete placement. Prior to or at the pre-construction meeting, the designer must furnish intersection work sheets to the Resident Engineer. The format should be 11-in. x 17 in. sheets to scale (1-inch = 40 feet) showing all proposed curb, longitudinal lane lines leading up to the intersection and all existing and proposed utility/drainage structure covers within the intersections.

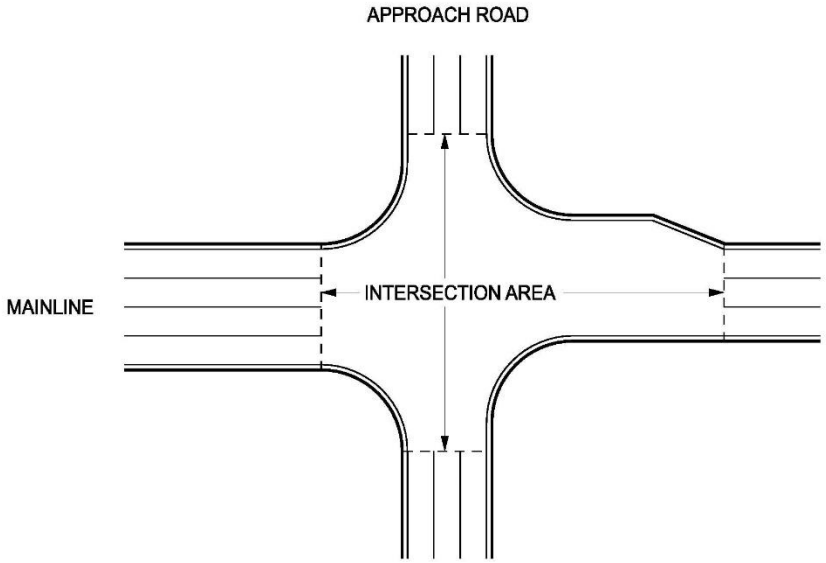
Estimating Transverse Intersection Joints

Compute quantities for mainline transverse joints (Symbol C) with no deduction through intersections. Estimate additional quantities for approach road transverse joints (Symbol C) from the approach road spring points or turn lane tapers to the mainline edge of pavement. Assume the same minimum spacing as mainline.

Assume an additional number of transverse joints for each roadway, equal to the total number of lanes crossed plus one. For the figure below, the mainline crosses three lanes of approach road, therefore, add quantities for four additional transverse contraction joints. Also add quantities for five additional transverse contraction joints on the approach road which crosses four mainline lanes.

Expansion Joints at spring points or turn lane tapers can be estimated using the intersection joint layouts shown in Standard Plan R-42-Series. Assume for estimate purposes that the mainline is not "paved through" the intersection and that the edge of mainline is not tied with an E2 joint through the intersection. This results in estimated quantities for either E2 or Erg joints at each of the intersection terminals.

Finally, estimate a quantity for miscellaneous plane of weakness joints (either symbol D1 or W) equal to 5% of the total length of transverse joints in the intersection.



6.04.04F Longitudinal Joints

Longitudinal joints are used to prevent irregular longitudinal cracks within the slab. Such cracks normally result from the combined effects of load, base weakness and restrained warping under traffic. Rapidly dropping air temperatures during the first night after paving may induce longitudinal cracking due to subgrade frictional restraint. Typically, sawing of longitudinal joints occurs within 24 hours of casting the concrete.

Longitudinal joints should coincide with the location of proposed painted lane lines, unless widened slab is specified (see Section 6.04.04F(6), "Widened Slab"). When the pavement geometry is such that the location of lane lines are not readily evident, the plans should include a joint layout diagram for the area in question.

See Geometric Design Guide GEO-370-Series for details of longitudinal joint lines at a T-ramp intersection with a crossroad.

See Standard Plan R-41-Series, "Longitudinal Pavement Joints."

6.04.04F1 Joint Spacing

Standard longitudinal joint spacing is the same as the specified lane width, which is typically 12 feet. When a widened slab is specified, longitudinal joint spacing matches the specified lane widths, except for the outermost travel through lane (truck lane), which will be 14 feet wide. See Section 6.04.04F(6), "Widened Slab" for further details and guidance.

Maximum width of a concrete pavement slab without a longitudinal joint is 16 feet. A 30-foot wide concrete service road should have one longitudinal joint at the centerline.

Thinner slabs should have longitudinal joints at closer spacing, e.g., an 8 inch thick, 16-foot wide ramp should instead have the longitudinal joint offset 12 feet from one edge and 4 feet from the other edge.

6.04.04F2 Lane Ties

Lane ties are used to hold adjacent concrete pavement structures in close relationship to one another. As a general principle, the more lanes that must be tied together, the closer the required spacing of the lane ties. The closest spacing is needed farthest from the free edge. (See the table on Standard Plan R-41-Series.)

With form paving, bulkhead joints are created at the edges where the forms are used. Deformed bars are used as lane ties across these joints. With slip-form paving, several techniques have been tried, including inserting a straight bar into the plastic concrete immediately behind the slip-form. Currently, most contractors utilize equipment that inserts a bar bent at 90 degrees such that they do not interfere with the paver tracks. After the concrete has set, the bar is bent perpendicular to the edge of pavement.

6.04.04F3 “L” Joints

"L" and "L1" joints are no longer used. The hook bolts used in these joints have been replaced with epoxy anchored lane ties when a future widening is made. The epoxy anchored lane tie is referred to as an "L2" joint and is specified on Standard Plan R-41-Series.

6.04.04F4 External Longitudinal Pavement Joint

Sawing and sealing of longitudinal pavement joints is included in the payment for the concrete pavement. This includes the exterior longitudinal joint between the concrete pavement and a concrete shoulder, concrete curb and gutter, or concrete valley gutter.

The external longitudinal joint between concrete pavement and Detail E (straight) curb, between concrete pavement and concrete dividers, and between HMA surfaced concrete base course and curbings are not required to be sawed and sealed. (The axle protrusion of the saw prohibits sawing a joint adjacent to a vertical face of any appreciable height, and our standards do not provide for either sawing and sealing of joints in base course.)

6.04.04F5 Longitudinal Joint Sealant

Longitudinal concrete pavement joints are generally sealed with hot poured rubber.

6.04.04F6 Widened Slab

If appropriate, MDOT may use a 14-foot widened outside slab (truck lane). The widened slab is intended to reduce stresses and deflections at the outside longitudinal concrete pavement edge caused by vehicle tires running on or near the edge. Widened slabs may also reduce the amount of shoulder maintenance. While widened concrete slabs can be beneficial, they may also be susceptible to longitudinal cracking if the pavement thickness is too thin. Therefore, MDOT recommends using a 14-foot widened concrete slab when the roadway has all of the following attributes:

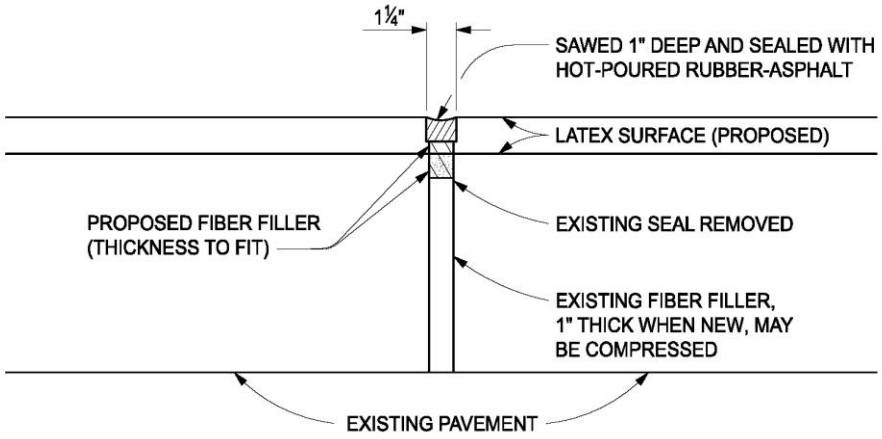
- Is a new/reconstruct project.
- Is a freeway.
- Allowable width for widening (ie. not constrained by curb or Right-of-Way).
- Additional outer lanes are not currently planned.
- Significant length of auxiliary lanes adjacent to the truck lane are not present or planned.
    - The concrete pavement thickness is 9.5 inches or greater.
    - If the pavement thickness is less than 9.5 inches, but a hot mix asphalt shoulder is planned, then consider widening with a slab width of 13-foot.

6.04.04G Joints in Latex Concrete Bridge Approaches

When bridge decks and their approaches are resurfaced with latex concrete, the joints in this approach wedging must be detailed in the plans. Latex concrete is used on approaches, rather than HMA, when the approach concrete is in good condition. Usually there is a series of expansion joints in this area.

Provision must be made to continue the function of the underlying pavement joints through the overlay. The seals in the expansion joints should be removed and the joints resealed. The sketch shown below is to be detailed on the plans when this treatment is used.

The longitudinal joints should also be matched, with a bond breaker such as duct tape placed between the latex pours to continue the joint through the overlay. The joint should then be sawed and sealed as shown for symbol "B" on Standard Plan R-41-Series



6.04.04H Miscellaneous Concrete Pavement

The pay item for Miscellaneous Concrete Pavement is “Conc Pavt, Misc, Nonreinf __ inch”. The pay item is intended to compensate the contractor for the additional cost involved with low production paving and to allow the use of modified equipment and construction methods, when appropriate. Low production paving may be odd or variable width or of limited quantity. Modified equipment and construction methods are warranted when the length of paving is too short for the effective use of a full paving train.

There is no rigid criteria for determining when and how much Miscellaneous Concrete Pavement should be used on a project. The plans or proposal should therefore clearly designate which areas of pavement will be paid for as Miscellaneous. Examples of it are intersection betterment projects, speed change lanes (including uniform width as well as tapered sections), ramps, and collector-distributor roads even though they may include uniform pavement widths exceeding 500 feet in length.

If Miscellaneous Concrete Pavement compose a major part of the total jointed concrete pavement on the project, consider making all of the concrete pavement Miscellaneous.

The pay item should also be used on projects where the paving operation will be continually broken up into short segments because of pavement gapping. However, ride quality requirements (see Section 6.04.05) should still apply if the pavement to be placed is to ultimately function as part of a high speed through lane.

6.04.04I Construction Considerations

6.04.04I1 Pavers

Pavers used in Michigan today are capable of paving two 12-foot lanes and extending, if necessary, to more than 27 feet wide. Pavers 36 feet wide have been used here, but they are unwieldy, particularly in a superelevation transition, and none are presently in active use.

Current paving machines generally have the capability of taking out crown hydraulically, which is required in superelevation. Contractors do not attempt to take out crown during subgrade grading, however, preferring to thicken the pavement through the transition, instead. In cases where an odd number of lanes are involved (3, 5 or 7), designers should avoid calling for the crown high point in the center of a lane because some equipment cannot accommodate it. (Standard Plan R-107-Series presently does not provide for the high point to be in the center of a lane, anyway.)

6.04.04I2 Forms

While use of paving forms has diminished because of the higher efficiency of slip-form equipment, form paving may still be found on some small jobs and projects involving strictly Miscellaneous Concrete Pavement. Contractors on larger projects will use them for paving fillets, etc. (Fillets are usually paved before the curb and gutter is added.)

6.04.04J Gaps in Concrete Pavement

Gapping out portions of concrete pavement, either for one or two lanes, or for the entire width, is frequently done for purposes of maintaining traffic, either on the roadway itself, or for ingress and egress at adjacent businesses.

Concrete gapping is also used where the paving train must be discontinued and the work completed by less mechanized methods. An example may be at a bridge approach where the deck is already cast. Gapping length here may be on the order of 70 feet or less.

6.04.05 Ride Quality

(revised 9-22-2025)

The purpose of a ride quality specification is to obtain a smoother riding pavement than is typically obtained with the traditional 10-foot straightedge smoothness requirements. Michigan first adopted a ride quality specification in 1979. The current specification prescribes classified levels of ride quality requirements described in subsequent paragraphs of this section.

The ride quality specification should be used on new concrete and multiple lift HMA paving projects more than a mile in length. Also use on the following projects of any length:

- Cold mill and one course HMA overlay
- One course HMA Overlays
- Diamond grinding projects

Consult with Construction Field Services Division before using on urban non-freeway projects. Do not use on Local Agency projects except for new concrete or multiple course HMA paving projects on NHS routes.

Unless specifically noted on the plans, the following areas are excluded from ride quality:

1. Ramps other than freeway-to-freeway ramps
2. All ramp tapers
3. Shoulders
4. Railroad crossings
5. Bridges – Within Class II, III, and IV areas, the predetermined excluded area is that area between the two end reference lines or between the outermost limits of any structure expansion joint devices.
6. Designated QC/QA loose material sampling areas on the wearing course of flexible pavement projects within Class II, Class III and Class I sections only.

Ride quality requirements are not intended for application with stand-alone bridge projects. However, bridge deck replacements, and shallow or deep concrete bridge overlays included within the limits of a Class I ride quality section in a corridor project will be subject to ride quality requirements. All other bridges are excluded from ride quality requirements. Consult with bridge designer prior to classification.

The only pay item associated with ride quality is bump grinding. A small quantity should be included for each location where the contractor may be directed to grind *existing* pavement (i.e.: pavement not placed as part of the contract) in order to smooth the transition from old to new pavement. This includes the POB, the POE, and any *existing* bridge or railroad approaches within the project limits. 25 square yards for each lane at each of the above locations should suffice.

Bump grinding is normally not paid for in areas excluded from ride quality. Instead the pavement is accepted or rejected based on the 10-foot straightedge criteria. (Standard Specifications for Construction) If it does not meet the straightedge criteria, it is the contractor's responsibility to grind or replace at their cost.

Specific requirements for ride quality are identified by classification. Each classification (Class I, II, III & IV) specifies criteria for roughness, method of measurement, and applicable incentives and disincentives. The matrix on the following page provides instructions for assigning ride quality classification based on scope of work, design speed, grade control and adaptability to production paving.

Using this criteria, the designer will assign a ride quality classification to each applicable section of paving throughout the project. The locations and classifications are then tabulated for inclusion in the Notice To Bidders.

Ride Quality Classification Selection Matrix

How To Use This Matrix Divide the project into Sections [1] based on the amount of control the contractor will have over the final surface grades, the scope of work, and the design speed. Determine the recommended ride specification type for each section. Confer with Construction Field Services staff for exceptions or unique circumstances.		Contractor **has control** over grades		Contractor **has limited or no control** [2] over grades				
		Construction on Existing Roads [3]	New Construction or Reconstruction [3]	Construction on Existing Roads [3]	New Construction or Reconstruction [3]	Single Course of Flexible Pavement (with/without milling)	Diamond Grinding Projects	Flexible Ultra Thin, Paver Placed Surface Seal
Section length **allows** for production paving [4]	Design Speed below 50 mph	Class II	Class II	Class II	Class II	Class III	Class III	Class III
	Design Speed 50 mph or above	Class I or II	Class I or II	Class II	Class II	Class III	Class III	Class III
Section length **does not** allow production paving [4]	Design Speed below 50 mph	Class III	Class II	Class IV	Class IV	Class IV	N/A	Class IV
	Design Speed 50 mph or above	Class II	Class I or II	Class IV	Class IV	Class IV	N/A	Class IV

Key:

Class I Ride Quality: Complete Projects (mainline only) where no excluded areas are allowed, a thresh hold IRI criteria must be met, and incentives and disincentives apply. Use Class I only on limited access roadway with design speeds 50 mph or greater and where most or all bridges include deck replacement, shallow concrete overlays, or deep concrete overlays. Investigate the feasibility of diamond grinding (at MDOT cost) any bridge decks not being replaced or overlaid. Where diamond grinding a bridge deck is not feasible, a limited section of the project can be designed as Class II Ride Quality such that the bridge would be a pre-determined excluded area within a project that would otherwise meet Class I ride Quality criteria. Consult with the bridge designer prior to classification.

Class II Ride Quality: Sections where threshold IRI criteria must be met, but incentives and disincentives do not apply. (Use Class II if all of the above requirements for Class I are not met.)

Class III Ride Quality: Sections where the pre-construction IRI must be maintained or improved by a certain percentage. Disincentives may apply.

Class IV Ride Quality: Sections where acceptance is based on a 10 foot straightedge criteria. Incentives and disincentives do not apply.

N/A = Not Applicable

Footnotes:

(1) A Section is defined as a length of paving which has the same characteristics (grade control, type of work, design speed).

(2) Locations where a contractor might not have control of grades include locations where they must pave adjacent to an existing lane with marginal ride quality, locations where there are existing curbs to match, and locations where there are frequent existing manholes or structures to meet.

(3) See Chapter 3 for project type definitions and for classification purposes on projects with multiple project types.

(4) Production paving means a slipform paver can be used for concrete paving and that a HMA paver can be used without frequent stopping and starting and there is room for a haul truck to unload directly into the paver or a material transfer device while in motion. MDOT imposed construction staging requirements should be considered when making this determination.

6.04.06 Continuously Reinforced Concrete Pavement

(revised 11-28-2011)

6.04.06A Background

The first CRC pavement in Michigan was constructed experimentally in 1958 on I-96 near Portland (from M-66 easterly to Portland Road). Since then approximately 341 equivalent two lane miles of CRC pavement have been built.

In 1978 a moratorium was imposed on the construction of CRC pavement; this restriction is still in effect. It was precipitated by the following concerns:

1. Difficulty in maintaining the necessary tight construction tolerances and uniformity with respect to steel placement, concrete consolidation, and subbase material and preparation required to achieve the expected life and performance.
2. Reinforcing steel in some sections of freeway was showing serious loss of section because of corrosion, resulting in large crack openings and progressive fracture and delamination of the slab in areas where cover over the reinforcement was minimal.
3. Unique, more costly, and difficult maintenance techniques, combined with higher construction costs, seemed to negate the advantages originally envisioned for CRC pavement, i.e., the elimination of troublesome joints.
4. More specifically, the failure in the summer of 1978 of two wide flange beam terminal joints in the metropolitan area (attributed to stress-corrosion cracking and/or steel fatigue) caused the discontinuance of this type of anchorage. Because this was the type of anchorage then in favor, as well as the most economical, it was not long afterward that the moratorium was imposed.

6.04.06B Principles of CRCP

Continuously reinforced concrete pavement is based upon the principle that temperature, shrinkage, and moisture induced forces in the central portion of the pavement are restrained by friction between the slab and the subbase at the ends. With movement thus theoretically reduced to zero, joints may be eliminated. By increasing the cross-sectional area of the reinforcing steel in the slab (to about four times that in the conventional jointed pavement), the induced tensile forces can be adequately resisted, and the concrete cross-section is sufficient to resist the compressive forces. Frequent, comparatively tight transverse cracks occurring about every 4 feet to 5 feet take the place, in effect, of conventional contraction joints.

Restraint in the interior portion of a CRC pavement is provided by subgrade friction developed over about 6 inches to 12 inches of length at each end. The movement in the free ends can be either restrained or accommodated. Michigan has used three principal types of end anchorages:

1. **Anchor Lugs**

   A series of three or more 4 feet deep concrete lugs, cast monolithically with an 18 inch doubly reinforced pavement slab. Incorporates the principle of complete restraint. Not suitable for use in granular soils and not economical where there are numerous bridges.

2. **Wide-flanged Beam Terminal Joint**

   A 12 inch wide-flanged steel I-beam embedded in a 10 inch thick concrete sleeper slab. This assembly accommodates the contraction displacement of the CRC slab.

3. **Expansion Joints**

4. A series of six to ten conventional expansion joints at relatively close spacing.

5. Both the wide-flanged beam terminal joint and the series of expansion joints are suitable for use in granular soils.

6. Early experimental projects utilized a steel reinforcement ratio of 0.6% (the ratio of steel cross-sectional area to the cross-sectional area of the concrete) and an 8 inch slab thickness. Later projects incorporated 0.7% steel and 9 inch pavement thicknesses. It should be noted that Michigan never constructed a 10 inch thick CRC pavement. (See Section 6.04.06C.)

6.04.06C CRCP Repair

Because of the moratorium on the construction of new CRC pavement, a designer's involvement will be limited to patching and repair projects on existing CRC pavements. Many of the original CRC projects incorporated variations in design and construction techniques; therefore Construction Field Services Division will prepare specific recommendations for each project. A special provision will be required.

In patching CRC pavement, unless the Construction Field Services Division has determined that deterioration of the pavement is too far advanced, it is essential that the continuity of the steel reinforcement be maintained. This requires that the concrete be carefully chipped away from the ends of the patch to preserve sufficient steel for lapping. The steel in the patch must be welded to the existing steel. It is important that patching be done in the late afternoon or early evening to allow the concrete to gain sufficient strength, and bond to the reinforcement, to resist compressive forces during the following day, and tensile stress the next night. Also, an open patch creates two new free ends of pavement tending to move together during expansion, bowing the welded reinforcement during the heat of the day, and transferring excessive compressive stresses into the adjacent lane in the case of a one-lane patch in a two-lane pavement.

In the extreme when the steel reinforcement has repeatedly failed, a CRC pavement should be patched with conventional patches. This has the effect of eliminating the continuous reinforcement feature and transforming the pavement into a hybrid jointed pavement, with possibly closed joints and working cracks.

When contemplating repair of a CRC pavement, the designer should be familiar with the details of the pavement to be repaired, and should understand the theory that is involved. Indiscriminate altering of an existing CRC pavement, if done in ignorance, can have far-reaching consequences. For example, a past project involved removal of a wide flange beam terminal joint down to the sleeper slab and casting a 10 inch thick patch, longer than the sleeper slab. This meant that the lower 1-inch of the patch would be bearing against the end of the sleeper slab. Any movement would be restrained, with fracture bound to occur in one of the structural elements.

Old plans specific to the project should be used to determine the exact details that were used in constructing the pavement.

6.04.07 Plain Concrete Pavement

(revised 5-28-2013)

6.04.07A Guideline for Use of Plain Pavement

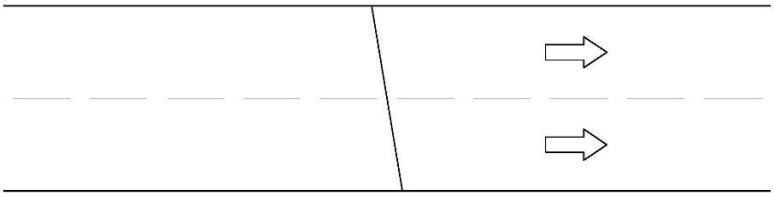
By Department practice, concrete pavements are nonreinforced except at bridge approach slabs and as specifically recommended for isolated special situations.

6.04.07B Joint Type and Spacing

Concrete pavement, if not reinforced, will normally crack transversely at 12 feet to 16 feet intervals. Hence, transverse joints must be within this spacing range if mid-slab cracking is to be avoided. The Department uses 14 feet to 16 feet joint spacing based on pavement thickness.

Skewed joints can be used on service roads when it is the standard used by the local agency for the same class of road or street. The rationale behind skewed joints, which may be combined with randomized spacing, is that rhythmic or resonant responses in vehicles are damped. Skewing also minimizes the effect of any roughness of the joints and improves the riding quality of a pavement if the slabs have curled or if faulting is present. There is some evidence that skewing reduces faulting of plain pavements.

Skewing is generally 2 feet for a 12-foot width, 3 feet for a 16-foot width, and 4 feet for a 24-foot width. The direction of the skew should be as shown below:



(Studies have shown potential for a little less pumping when the skew angle is as shown, rather than the other way.)

When random spacing is employed in conjunction with skewed joints, use the sequence of 12 feet – 13 feet – 16 feet – 15 feet Random spacing is of little benefit on slow-speed roadways, such as rest area ramps.

With reference to Standard Plans R-39-Series and R-41-Series, the following joints should be used in nonreinforced pavement:

1. Service Roads - Use transverse plane of weakness joint, symbol W, skewed 2 feet per 11-foot or 12-foot lane*, spaced at 16 feet. Use lane ties as shown for longitudinal joints, symbol B or D.
2. Concrete Base Course Widening - Use transverse plane of weakness joint, symbol U, spaced at 16 feet, not skewed. (See Standard Plan R-42-Series.) Use lane ties as specified for longitudinal joints, symbol B or D.
3. Urban Streets - Use transverse plane of weakness joint, symbol W, skewed 2 feet per 11-foot or 12-foot lane*, spaced at 16 feet maximum. Use lane ties as specified for longitudinal joints, symbol B or D.

* Skewing of transverse joints may be omitted if cross streets are closely spaced requiring expansion joints at 90° at the spring lines.

6.04.07C Temporary Concrete Pavement

Plain concrete pavement for a temporary road, should have transverse joints at a 16 feet spacing (symbol W, Standard Plan R-39-Series, except that final width shall be ⅛ inch), unsealed and not skewed. The longitudinal joint may be omitted. If the pavement will lay over a winter or longer, a longitudinal joint (⅛ inch relief cut one third the pavement thickness specified for symbol D on Standard Plan R-41-Series, except that final width shall be ⅛ inch), unsealed, should be used. Lane ties should also be provided. If a longitudinal joint and lane ties are desired in temporary concrete pavement, they must be called for in the plans or proposal.

In the event that the "temporary" road will be in service for 4 or 5 years, sealing of joints, mesh reinforcement, load transfer, etc., should be considered on a case-by-case basis.

6.04.08 Concrete Base Course

(revised 6-28-2021)

6.04.08A Criteria for Use

By definition, concrete base course is intended for imminent HMA surfacing. Its use is generally dictated by a desire to maintain the same pavement coloring in a widening as on the original pavement or to differentiate between lanes. For many years expressway ramps and speed change lanes in Detroit were uniformly paved with concrete base course and HMA to make them readily distinguishable to motorists by their contrast with the concrete pavement of the through lanes. This policy is no longer in effect.

A decline in the use of concrete base course in recent years is attributable to the realization that HMA surfacing is not waterproof. Depending on the HMA mixture, a certain amount of moisture can usually be expected to reach the interface between the asphalt and the concrete. In winter this may be salt brine that contributes to deterioration of the concrete and loosening of the HMA surfacing. Reflective cracks also form in the overlay directly above the joints, allowing penetration of water and incompressible materials.

By current practice, concrete base course is limited to widening of existing pavements and patching, and not for full-width new construction. Preferably, it should be further limited to widenings of less than a lane width. For example, a 30-foot asphalt-surfaced pavement being widened to five 12-foot lanes (60 feet) should probably have a 3-foot base course widening and a 12-foot (perhaps monolithic) lane of concrete pavement on each side. (Full-depth HMA construction is an alternative.)

See Section 6.04.09, "Widening of Existing Concrete".

6.04.08B Reinforcement

Concrete base course will not contain mesh reinforcement unless it has been specifically recommended for the project.

6.04.08C Texture and Joints

(See Standard Plan R-39-Series.) Texturing of concrete base course consists of a longitudinal burlap drag. This roughness, combined with a clean, non-oily surface, enables a single-course HMA surface to bond to concrete base course in contrast to a requirement for a two-course

HMA resurfacing over an older concrete pavement previously polished by traffic.

Joints in concrete base course are not sealed.

6.04.09 Widening of Existing Concrete

6.04.09A Criteria for Use of Lane Ties in Longitudinal Bulkhead Joints

The question of whether or not to use drilled and grouted epoxy anchored lane ties arises on every concrete widening project. This question must be answered by investigating the soundness of the existing concrete that, in turn, is an indication of the expected life of the old pavement and the cost effectiveness of epoxy anchored lane ties. This must be determined by a field investigation by Region/TSC personnel prior to the Plan Review Meeting Condition, rather than age, should be the deciding factor.

If the existing pavement is sound, epoxy anchored lane ties should be used for widenings, even if there will be curb and gutter at the outside edge. Epoxy anchored lane ties should also be used when tying a proposed concrete curb and gutter to an existing pavement edge. Concrete curb and gutter in this situation should be paid as the detail type omitting lane tie bars.

Designers are cautioned against committing the error of calling for a 'D' joint where widening abuts the existing pavement. Obviously, this is an impossibility because the lane tie for a 'D' joint must be embedded in plastic concrete on ***both*** sides of the joint. While this might appear to be a minor error, if not caught in time it requires that Construction negotiate either an extra for epoxy anchored lane ties or a rebate for deleted lane ties.

6.04.09B Deleted

Section deleted.

6.04.09C Flush Surfaces

At one time it was customary to cast concrete base course widening at an elevation such that a minimum one-course surfacing of HMA would achieve plan grade. In the event that the existing pavement was to receive a thicker resurfacing, the inner edge of the concrete widening would be higher than the old pavement. Not only does this method create problems in forming the inner edge of the widening, but worse, the inner pavement has no transverse drainage during construction.

When both the existing pavement and the widening must be surfaced with HMA material, the widening should be cast flush with the edge of the existing pavement. This means, of course, that the thickness of resurfacing needed over the old pavement will determine that to be used over the widening. The use of HMA over new concrete is discouraged, however, unless there are compelling reasons for using it. New HMA over new concrete is a source of added expense, and performance of the pavement section is less than ideal. See Section 6.04.08A.

6.04.09D Standard Plans

Standard Plans R-41, R-42, and R-44-Series show various methods to widen pavements.

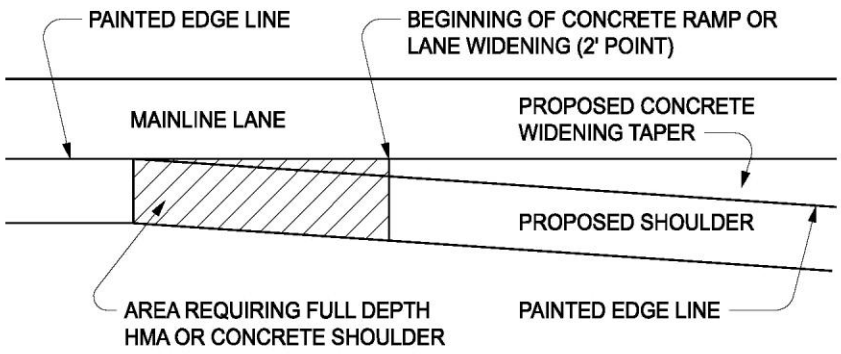
Designers should note the detail on Standard Plan R-44-Series, showing a joint patch adjacent to a proposed pavement repair or widening slab. The intent is to prevent the monolithical keying of the existing pavement to the proposed repair or slab widening which often resulted in corner cracking due to contraction during the first night.

6.04.10 Concrete Tapers

It is characteristic of concrete that thin, pointed tapers will almost always crack and break off. For this reason it previously had been our practice to cast a Concrete Widening Header where the mainline concrete roadway connects to a concrete ramp or concrete lane widening having HMA on aggregate shoulders. Concrete Widening Headers have been found to be very expensive to form, difficult to construct, and a longitudinal crack still forms when this header is used.

Proposed concrete tapers should begin at the 2-foot point. A full depth HMA or concrete shoulder will be constructed from the point where traffic would leave the traveled lane and follow the painted edge line (0 to 2-foot point). The material used in the shaded area below should match the proposed shoulder material.

The painted edge line is typically painted in a continuous straight line from the pavement's edge across the full depth HMA or concrete shoulder and then aligning with the edge of the concrete taper (see sketch below).



6.04.11 Concrete Pavement Overlays

(revised 6-28-2021)

Concrete overlays can be roughly divided into four categories:

1. Bonded overlays of an existing concrete pavement. This is basically a thinner concrete pavement (typically less than 6 inches) poured directly on the existing concrete. Care must be taken to place joints in the overlay within 1-inch of existing joints and cracks. To date, the Department has not constructed such a concrete overlay. Technically, an exception might be the 3 inch thick, steel fiber reinforced, overlay on 8 Mile Rd. in the early seventies. This project failed because of breakup caused by extreme warping, and the pavement has since been replaced.
2. A concrete cap on the order of 4 inches to 6 inches thick, either bonded or partially bonded, probably containing reinforcement and load transfer.
3. An unbonded overlay of an existing concrete pavement. Typically, these are thicker than 6 inches and are separated from the existing pavement by a bond breaker layer. This bond breaker layer is normally a 1-inch layer of HMA. While technically there will be some bonding taking place, the term unbonded is commonly used.
4. Whitetopping, which is a concrete overlay of an existing flexible pavement. Typical thicknesses are greater than 4 inches. When it is less than 4 inches thick, the term ultra-thin whitetopping is used.

6.04.11A Bonded Overlay

While the Department has not constructed a bonded concrete resurfacing, the designer should be aware of what it is, and some of the parameters affecting the design. A reason for using a thin concrete overlay would be to "beef up" a pavement, in good condition and with many years of expected life, to handle increased loads. (Such as might occur if a new heavy manufacturing plant were proposed in a previously low traffic area.) Potholes should be filled with a ready-mixed flowable fill. The thin overlay should be unreinforced, and have transverse joints, both contraction and expansion, matching similar joints in the underlying pavement. Both longitudinal and transverse joints should be sawed to ⅓ the overlay thickness. Bond between the old and the new concrete must be carefully provided for. If such a project is assigned, the designer will be furnished design details by the Construction Field Services Division.

6.04.11B Concrete Cap

The Department constructed about 30 concrete cap projects in the period between 1932 and 1954, with thicknesses varying between 4 inches and 6 inches. While they were moderately successful, it is unlikely this type of construction will be utilized in the foreseeable future.

6.04.11C Unbonded Overlay

This method of pavement rehabilitation provides a new pavement while making use of the old as base and basically involves constructing a new pavement atop the old. The Department completed many such projects since 1984.

While the designer can expect to be furnished details of such construction if a project is ever assigned, it should be noted that, on an I-96 project, from M-66 easterly to the Grand River at Portland, the underlying CRC pavement was sawed into 100 feet long slabs, 7 inches deep sawcut to cut the lowest steel. An 80 lbs/syd (minimum) HMA separation course was used between existing pavement and the overlay. The overlay pavement was 7 inches thick, which necessitated a modified transverse joint design and modified load transfer assemblies. The transverse joints were staggered to keep them at least 3 feet away from joints or open cracks in the underlying pavement.

Some of the obvious disadvantages of a thick concrete pavement overlay are that it raises the level of the pavement sufficiently to render existing guardrail too low, it steepens the foreslope for a few feet beyond the shoulder hinge point, and it usually cannot be used under bridges because of underclearance requirements.

6.04.11D Whitetopping

Whitetopping is a concrete overlay that is bonded to an existing asphalt pavement. In general, whitetoppings are best suited over existing pavements that do not exhibit significant structural distresses, other than where rutting may be present. To reduce curling stresses in the overlay and shear stresses at the asphalt interface, the bonded overlay panels are typically 6 feet by 6 feet It is important that saw cutting occurs as soon as possible. Dowel bars are not used in whitetoppings, but lane tie bars are recommended along the longitudinal joint. Fibers may be considered to control shrinkage cracking. The existing asphalt after milling should be greater than or equal to 4 inches. It is recommended that the existing asphalt pavement be milled to improve bond and reduce rutting.

In 1999, the Department constructed it’s first whitetopping project on M-46 from just east of Carsonville to M-25 in Port Sanilac. It contained two 6 inch sections, one with fiber reinforcement and one without, a small 5 inch transition section, and a 3 inch ultra-thin section in Port Sanilac. The intersection of M-54 and M-83 near Birch Run was also whitetopped in 2000.

6.04.12 Concrete Pavement Patching

(revised 8-24-2026)

6.04.12A References

See Standard Plan R-44-Series, "Concrete Pavement Repair". Also see Section 6.03.04B, Concrete or Composite (HMA on Concrete) Pavement.

6.04.12B General

It is preferable to delay a first-time resurfacing of a concrete pavement as long as possible by patching and joint repair. As the emphasis has shifted from large scale new construction or relocation to improving and expanding the existing trunkline system, and maintaining it, patching and joint repair projects have taken an increasingly larger share of construction dollars.

It is difficult to separate patching from joint repair. Except for construction-induced pavement and base deficiencies, most deterioration of a pavement occurs at the joints, primarily in the transverse joints and, to a lesser extent, in the longitudinal joints and deteriorated transverse cracks.

6.04.12C Distances Between Concrete Patches

The minimum distance between patches should be 8 feet, according to the Standard Specifications for Construction. If less than 8 feet between repairs, the entire section of old pavement should be removed and a longer repair constructed. A note should be included in the plans to this effect. Some judgement should be used, however; if the designer frequently finds that the minimum distance between patches criteria is being encountered, it may indicate that the wrong "fix" has been chosen for the project.

Too many patches per mile is objectionable for two reasons:

1. The motorist visually perceives the pavement to be in bad condition and thus may expect a poor ride even though the patches may actually be quite smooth riding.
2. Excessive patching may indicate that the wrong treatment has been selected and that the money spent on patching could have been better utilized if contributed toward a different type of rehabilitation. A study prepared by Gerald T. Luther in February 1989 concluded that, using a life cycle analysis, about 75 patches per lane mile equates in cost to about 4 inches of HMA resurfacing over a 20-year life span. The HMA project, however, would be ready for total rehabilitation at the end of the 20 years whereas the patched project would still have about seven years of useful life remaining. The Engineering Operations Committee, on March 21, 1989, decided that for design purposes, patches should be limited to a maximum of 60 repairs per lane mile.

6.04.12D Expansion Space to be Provided

Unless the pavement being repaired is to be HMA overlaid, patches and joint repairs should provide 1-inch of expansion space in 1000 feet of pavement. Expansion space is provided by use of Expansion Joint, Erg.

In general, it is preferable to disperse expansion space throughout a project than to concentrate joints at one location. Since most old expansion joints are bound up, providing less than full width relief will only compound the problem. Where the existing joint is an expansion joint, provide a new Erg across all lanes to provide uniform relief. (Do not use an E2 and match the existing joint.) Care must be taken to choose locations where the Expansion Joint, Erg can be placed across all lanes.

6.04.12E Patching Pay Items

The more common pay items applicable to a patching project are:

1.	Pavt Repr, Rem	Square Yard
2.	Saw Cut, Intermediate	Foot
3.	Pavt Repr, Noneinf Conc, [Insert Depth] inch	Square Yard
4.	Lane Tie, Epoxy Anchored	Each
5.	Joint, Contraction, Crg	Foot
6.	Joint, Expansion, Erg	Foot
7.	Joint, Expansion, Esc	Foot
8.	Joint, Tied, Trg	Foot
9.	Non-Chloride Accelerator	Gallon

The following notes clarify the use of these items:

1. **Pavt Repr, Rem**

   The pay item of Pavt Repr, Rem applies to pavement removals from 4 feet (the minimum length of a patch) to 100 feet long. Removals more than 100 feet long are paid for as Pavt, Rem. Removal of concrete shoulders, curb, curb and gutter, and valley gutter are paid for using the same pay item as used for the adjacent pavement.

   It should be noted that Pavt, Rem carries no restriction regarding disturbance of the underlying base, whereas Pavt Repr, Rem does carry a prohibition against disturbing the base, so as to require sawing and lifting methods. Pavement removal for utility cuts, even though unavoidably disturbing the base, should be paid for as “Pavt Repr, Rem.

   If the thickness of the old pavement being removed results in the base being more than 2 inches low, the contractor will be required to bring it up to proper elevation with aggregate. (Concrete would be permitted but payment will be limited to that for aggregate) If the base is 2 inches low or less, or is low as a result of the contractor's removal operation, the contractor must fill the deficiency with concrete at his/her expense. Any disturbed base must be recompacted before casting the patch, otherwise settlement will occur.

2. Saw Cut, Intermediate

Because the pay item Pavt Repr, Rem prohibits disturbing the base, the contractor must lift out the old pavement that is to be replaced. This in turn requires that it be cut up into 6-foot long slabs of a lane width, (a convenient size that will fit a dump truck.) Most repairs occur at a joint or crack where the pavement segment will break into two pieces anyway, but for longer repairs we compensate the contractor for the cost of sawing the old pavement up into 6-foot lengths. For estimating purposes, designers should assume that approximately 75% of the repairs in the over 6-foot to 12-foot range will require one intermediate saw cut. Ten percent of the 6-foot patches should also be set up for an intermediate saw cut. Patches longer than 12 feet (but not exceeding 50 feet) should be set up for one saw cut every 6 feet.

3. Pavt Repr, Nonreinf Conc

The pay item depth for repairs is based on the plan thickness originally specified for the existing concrete pavement plus 1-inch.

If the length of the repair is 100 feet or less, the replaced pavement is paid for as Pavt Repr, Nonreinf Conc, [Insert Depth] inch. If the repair is greater than 100 feet in length, the replaced pavement is paid for as Conc Pavt, Misc, Nonreinf, [Insert Depth] inch.

The texture of the repair should approximate that of the adjacent pavement, e.g., a heavily tined patch in a comparatively smooth textured pavement would not only accentuate the perception of a patched pavement but would provide an audible and tactile discontinuity as well.

4. Lane Tie, Epoxy Anchored

Epoxy anchored lane ties shall be used between the adjoining lanes of full width pavement repairs where the distance between joints exceeds 15 feet and shall be spaced according to Standard Plan R-41-Series. Single-lane pavement repairs, one slab length or longer shall use "Lane Tie, Epoxy Anchored" for that portion of the repair between the joints of the existing pavement. Single-lane repairs greater than 15 feet that are located on curves with radii 3800 feet or less shall also be tied to the adjacent slab. Do not install epoxy anchored lane ties in the offset portion of a tangent repair unless the end aligns with an existing joint or working crack. See Standard plan R-44-Series and Section 6.04.12F for more detailed information.

5. Joint Types

Repairs made in jointed concrete pavements shall be doweled and grouted unless otherwise directed by the Engineer. The transverse joint types used (Tied Joint, Trg, Contraction Joint, Crg, and Expansion Joint, Erg) are specified on Standard Plan R-44-Series. When the repair includes a curb and gutter and an Expansion Joint, Erg, an undoweled Expansion Joint, Esc shall be placed in the curb and gutter portion of the repair.

6. Early Open to Traffic

When requirements for opening to traffic necessitates faster concrete cure times, concrete pavement restoration according to the Standard Specifications for Construction prescribes the use of Grade P-NC concrete. Its use is based on anticipated cure time and minimum flexural strength.

The Engineer may additionally approve the use of Non-chloride accelerators to speed up the setting of concrete. They are used to achieve the shorter end of the intended opening to traffic times for Grade P-NC concrete. When early opening to traffic is anticipated, include a pay item and quantities for Non-chloride Accelerator. For quantities, estimate two gallons per cubic yard of concrete.

6.04.12F Typical Joint Layouts for Concrete Repairs

Concrete pavement repair joint layouts are detailed on Standard Plan R-44-Series to assist the designer in selecting joint types, their location, and placement of lane ties. The designer is responsible to clearly detail the joint layouts on the construction plans. There may be situations where these layouts do not cover a certain situation therefore, judgment must be used to decide the proper layouts.

An Expansion Joint, Erg may be used on the departing joint where a Contraction Joint, Crg is illustrated in the layouts on Standard Plan R-44-Series, but only when expansion is needed and when the joint repair extends across the entire pavement, including adjoining concrete ramps or shoulders. See Section 6.04.12D for maximum allowed expansion space in a given distance.

6.04.12G Reinforcement

The purpose of mesh reinforcement is to hold tightly together any cracks that occur in the repair. Repairs to reinforced concrete pavement are typically reinforced regardless of length. This criterion also applies to concrete base course repairs.

6.04.12H Doweled Repairs

Early concrete pavement patches did not incorporate provision for load transfer across the cold joints at the ends. Primarily, this was because there was no economical method of drilling a large number of holes, necessary for production patching, in the existing concrete. Even as drilling holes became more feasible there were the problems of cleaning out the holes so epoxy grout would bond, getting the grout packed into the hole, and drill bits wearing down so as to produce progressively smaller diameter holes (with a tendency for contractors to use larger drill bits initially, enabling the dowels to move around and rock in the holes). Beginning in about 1983, most pavement repairs were doweled as gang drilling equipment was perfected, and it is now standard practice to provide epoxy anchored dowels as load transfer unless there are extenuating circumstances that would make it unwise.

There are two exceptions to the use of dowels in repairs:

1. When concrete recycling, pavement cracking, or rubblizing is planned within three years.
2. Where a thick overlay (5 inches or more) is planned within three year.

6.04.12I Replacing Previously Undoweled Patches

Pavement patching projects are now starting to include segments of pavement that include previously undoweled repairs, most of which have faulted to some extent. At its meeting on September 20, 1988 the Engineering Operations Committee decided that all undoweled patches, within the projects limits, should be removed and replaced with doweled repairs if the additional cost does not exceed 25%. (It is assumed that this means 25% of the originally programmed project cost.) Undoweled patches in pavement to be HMA overlaid should be repaired as follows:

Severity level, as used below, is a description of the condition of pavement based on the ***Concrete Pavement Condition Survey Manual***.

1. Traffic Volume Range 0 - 5,000 ADT (per roadway)

   Replace all joints and cracks having a distress severity level of 1 with a Detail 8 repair. Remove all cold patch material and loose concrete from all remaining joints and cracks and replace with a Detail 7 patch. All previously placed concrete repairs are to be left as is, except cold milling of concrete repairs faulted more than ¾" is optional.

2. Traffic Volume Range 5,001 - 10,000 ADT (per roadway)

   Repair all joints, cracks, and undoweled repairs having a distress severity level of 1 with a doweled concrete repair. Remove all cold patch material and loose concrete from all remaining joints and cracks and replace with a Detail 7 patch. Cold mill all undoweled repairs faulted more than ½ inch. *

3. Traffic Volume Range over 10,000 ADT (per roadway)

   Replace all joints, cracks, and undoweled repairs having distress severity levels of 1 and 2 with a doweled concrete repair. Remove all cold patch material and loose concrete from all remaining joints and cracks and replace with a Detail 7 patch. Cold mill all undoweled repairs faulted more than ½ inch. *

   * In lieu of cold milling replace all remaining undoweled repairs with doweled repairs if the replacement cost (based on total pavement repair and overlay cost) is less than 15 percent above the cold milling cost.

The use of Detail 8 joint repairs is also intended for the following cases:

1. Overall integrity of the pavement has deteriorated to the degree where load transfer and slab flexure capacity can no longer provide for it to function as a rigid pavement.

2. The pavement has deteriorated such that it can no longer accept the stresses which would be imposed upon it by installation or action of load transfer devices.

3. The expected functional life of the repaired pavement is no greater than 5 years.

6.04.12J Adjusting Drainage Structure Covers in Patches

Whenever a drainage structure cover is located within the limits of a pavement repair, the item of "Dr Structure Cover, Adj, Case 1" should be used. Even though there may be practically a zero adjustment in elevation, the work involved when a structure falls within a patch is almost identical to the work involved in conventional adjusting. Pavement removal around the cover frame will probably loosen the mortar and possibly the first row of bricks or blocks as well. Anything so loosened must be replaced.

If the patch is narrow (6 feet to 10 feet), or if the cover is near one edge, e.g., 3 feet, four #4 re-bars, about 6 feet long, should be laid in a square around the cover to control cracking. This can be included in the other pavement repair items if adequately described.

See Section 6.03.05A.

6.04.12K Longitudinal Joints

Generally, an External Longitudinal Joint is not required between the repair and concrete curbing or shoulders. The only time longitudinal joints are called for when patching, is when more than one lane is patched at the same time.

6.04.12L Patching Utility Trenches

Concrete pavement removal for a utility trench should be at least 4 feet wide, to enable use of a gang drill for boring the holes for dowels. It is important that the contractor not be allowed to drill the holes at an angle as any longitudinal stress on the patch could cause the concrete to fracture in the area of the dowels.

6.04.12M Patching Pavements Having a Concrete Cap

A rather unique situation occurs when there is an attempt to patch a pavement having a concrete pavement cap; special repair measures are required. These special measures consist of:

1. Case 1 Concrete cap over HMA overlaid concrete pavement

   Remove the concrete cap and HMA overlay by sawing both full depth. Leave the original pavement. If the concrete repair is doweled into concrete cap, reinforce patches less than 10 feet long with standard pavement reinforcement having the heavy wires transverse to the roadway. Reinforce patches longer than 10 feet with the reinforcement running the conventional way.

2. Case 2 Concrete cap over concrete pavement (no HMA overlay)

   Remove both the cap and original pavement. The end limit saw cuts should be made as deep as the equipment permits. The remaining original pavement may then be broken in place and removed with a front end loader. Damage to the base should be repaired by placing and compacting additional base material as required. The concrete should be replaced to the thickness of normal uncapped concrete pavement elsewhere on the project or if there is none, to 9 inch thickness. Fill to the bottom of the new concrete with compacted aggregate base. Reinforce patches according to Section 6.04.12F.

3. Case 3 HMA overlay over concrete cap

   Remove the HMA overlay and the concrete cap by sawing both full depth. Leave the pavement under the concrete cap. If the concrete repair is doweled into the concrete cap, reinforce patches less than 10 feet long with standard pavement reinforcement, placing it with the heavy wires transverse to the roadway. Reinforce patches longer than 10 feet with the reinforcement running the conventional way.

   In Cases 1 and 3, removal by other than drilling and lifting may be permitted by the Engineer, since the underlying slab will provide an undisturbed base.

   If a repair contract is contemplated on a pavement known to have been capped, the designer should attempt to identify the exact location of the capped area and its type of construction, so that the plans or log can show the proper repair method for the sequence of the various pavement layers. To avoid disputes in the field, the designer should make their intentions clear as to what is expected of the contractor and how the contractor will be compensated.

   Whether or not the repair can be doweled will depend upon the thickness of the concrete cap, i.e., the existing concrete must be thick enough to allow drilling of the dowel holes without cracking or shattering.

   It should be noted that repairs having a concrete cap or overlay less than 9 inches thick requires more strength prior to opening to traffic because they are thinner. Also because commercial traffic causes higher stresses, the possibility of fracture increases, if the patch is opened too soon to traffic.

6.04.12N Other Pavement Repairs

The technology exists for producing a very high level quality of concrete pavement repairs. Unfortunately, the cost of all the combined treatments can be so high that, under funding constraints, they can not all be utilized on one project. Designers should be aware of the "menu" of the possible treatments, that should be considered when funding and circumstances allow. Some of these treatments are:

- **Partial depth longitudinal joint repair** – Deterioration on either side of the longitudinal joint is milled out no deeper than the tie bars. Any remaining loose concrete is removed and the repair area is cleaned with high-pressure water. A bonding grout is applied to the repair area surfaces and then concrete is cast before the grout sets up. The longitudinal joints, transverse joints, and cracks intersecting the repair, must be re-established by sawing or by compressible inserts. The joints and cracks are sealed with a hot-poured rubber.

- **Spalled joint repair** - The semi-circular spalls occur along one or both sides of a joint, and are only partial depth. Saw the perimeter of the patch as a rectangle at least 2 inches beyond the outside of the spall and associated deterioration, to a depth of 1¾" to 2 inches. Clean out the distressed concrete with a chipping hammer. Place styrofoam along the transverse joint and cast the concrete flush with the surface.

- **Surface pop-outs** - Chip out the area of the pop-out, sand blast the surface, cast a fast set concrete patch material.

- ***Small cracks*** - Saw with an 8 inch diameter random crack saw and seal with hot poured rubber.

- **Re-sealing transverse joints** - Remove existing sealant material and re-saw the joints 1-inch wide to 2¼" deep for pavement with 71-foot and 99-foot joint spacing. Pavements with 27-foot and 41-foot joint spacing may or may not need to be re-sawed depending on the existing joint widths (½ inch minimum). Pavements with less than 20-foot joint spacing can typically just be re-sealed. Install a foam backer rod to the proper depth, blow the joint clean with compressed air, seal with hot poured rubber. In cases where failed silicone sealant is being replaced, re-sealing with pre-formed neoprene can be considered if the joints are in good shape (very little spalling). The joints may need to be re-sawed to the width necessary so the neoprene is compressed approximately 40%.

- **Re-sawing and re-sealing of longitudinal joint** - Saw the joint ⅜ inch to ½ inch wide by 1-inch deep. Seal with hot poured rubber.

These types of treatments are likely to be restricted to early, localized deterioration of pavement in quite good overall condition. With this type of high-cost, high quality treatment, it is recommended that Construction Field Services Division provide Design with a good pavement condition survey before beginning design. The treatment is so finely detailed that it almost must be designed on the project. While the preceding indicates dimensions of joint grooves, etc., the data are given for general information only. Detailed dimensions would be furnished by Construction Field Services Division.

6.04.12O Causes of Joint Deterioration

Deterioration of pavement joints in Michigan can be attributed to five principal factors: 1) freeze-thaw deterioration of the concrete, as evidenced by D-cracking; 2) metal base plates in the load transfer assembly, when present (see Section 6.04.04D); 3) seals inadequate to prevent entrance of water and dirt; 4) high volumes of heavy trucks; and 5) de-icing salts.

Typically, inadequate joint seals allow salt, water, and incompressible material to enter the joint. If the load transfer assembly does have a metal base plate or, in the absence of a base plate the pavement is lying on an impermeable base, the salt-laden water does not drain away rapidly and hastens the deterioration of the lower portion of the pavement slab. The load transfer dowels eventually rust and prevent movement at the joints leading to fracture of the reinforcement at transverse cracks. Expansion and contraction are then accommodated at the cracks which, being unsealed, allow free entrance of dirt and other incompressibles when the pavement is in a contracted state. During subsequent expansion, the room for expansion is taken up by the debris in the joints and cracks, and the pavement actually grows, or becomes longer than when originally cast. This causes high compressive stresses in the concrete. If a joint has suffered a loss of concrete cross-section, the pavement may now be too weak to withstand these high compressive stresses and a sudden and violent shattering may occur at the joint. This is called a blow-up. Blow-ups typically occur during the latter part of the afternoon on a particularly hot day. Blow-ups can result in traffic backups and inconvenience to the motorist and are expensive to repair due to the emergency nature of the situation.

Metal base plates were discontinued around 1965, preformed neoprene seals (combined with shorter joint spacing) have been a major improvement, epoxy-coated load transfer dowels are now standard, and there is increased awareness of a need for more selectivity in the choice and gradation of coarse aggregates to reduce cracking.

6.04.12P Provision for Pressure Relief Joints

To combat the problem of joint blow-ups, the Department launched a program in 1974 to prevent them before they occur. This was initially applied in the old concrete pavements having 99-foot slabs with base plates under the joints, and was accomplished by installing pressure relief joints (PRJ) in pavements that were at the age (10 to 16 years) when blow-ups could be expected to start. This relief was in the form of the PRJ joint and undoweled expansion joints in concrete pavement repairs which are shown on previous Standard Plan II-44F. The PRJ was developed for use in roadways showing signs of expansion pressure buildup, but having long stretches of pavement where repairs were not yet required. Pavements older than 16 years would experience joint failures, too, but usually the concrete in the joint would be in a more advanced state of deterioration such that progressive crushing would occur, without the spectacular results usually associated with initial or widely spaced blow-ups, and with less disruption of traffic.

Pressure relief joints, are now seldom being installed. During the main thrust of constructing PRJ joints, the joint filler was a foam material, usually 4 inches thick and as wide as the pavement depth. Unless in compression all of the time, this joint filler (commonly called "ethafoam", which was a trade name) tended to either float up or to be drawn out of the joint by traffic when the joint opened in cooler weather. More importantly, most all of the pavements needing such pressure relief have already been treated. If pressure relief is needed for a special circumstance, such as at the approaches to a bridge where the pavement may be pushing on the backwall, the designer will be requested to include it and details will be furnished by Construction Field Services Division. Such provision for pressure relief is now in the form of multiples of 1-inch thick expansion felt, incorporated in joint or crack repairs. However, PRJ's with urethane foam have been found to stay in place better than ethafoam because urethane seems to "rebound" after compression. Pavement repair projects are likely to encounter some of these pressure relief joints, which were originally intended to extend the life of the pavement for only about 5 years. Most of these are tightly compressed (on the order of 1-inch wide or less). Any foam extruding above the concrete surface should be removed before HMA surfacing.

Most, if not all, of the problems with blow-ups has been associated with the older 99-foot pavements. The 71-foot slabs, which usually do not have the metal base plate and do have the neoprene seals, have shown a growth rate of about half that experienced with the 99-foot slabs and considerably less deterioration of the lower joint face. The introduction of a large amount of expansion space would allow adjacent seals to loosen and be removed by traffic, hastening the deterioration of the joints. Full-depth concrete pavement repairs should thus utilize expansion and contraction joints as shown in Standard Plan R-44-Series or as recommended by Construction Field Services Division.

Tapered sections, acceleration and deceleration lanes, and concrete shoulders, if tied to the adjacent pavement structure, are to be considered as a full-lane width, and expansion material should be extended through if used in the adjacent main part of the roadway (or consideration should be given to moving the expansion location outside the limits of the variable width portion of the roadway.)

6.05 SHOULDERS

6.05.01 References

A. Various Department Design Guides showing geometrics, particularly shoulder width transitions at ramps.

6.05.02 Glossary of Terms

Flush shoulder - A flat finished shoulder, without curb and gutter that intersects and matches the edge of the adjacent pavement surface. Shoulders with valley gutter are considered flush shoulders.

Graded shoulder - The shoulder width measured from the edge of the traveled way to the hinge point.

Hinge line - The line formed when the plane of the shoulder intersects the plane of the front slope.

Hinge point - The intersection of the shoulder slope with the front slope (also called foreslope).

Shoulder drop-off - The condition where the edge of pavement is considerably higher than the abutting shoulder.

Shoulder ribbon - Paved shoulder surfacing, usually HMA material, placed in a narrow strip adjacent to the traveled lane. Normally, a minimum of 3 feet wide but possibly wider if intended to also be a one-way bicycle path, it serves the important function of reducing the possibility of a shoulder drop-off developing.

Shoulder ridge - An accumulation of excess shoulder gravel that sometimes occurs at the edge of the shoulder adjacent to the front slope. Usually caused by successive shoulder blading operations that tends to dislocate this material to the outside of the shoulder. Such a ridge impedes surface transverse run-off and is particularly difficult to blade back onto the shoulder when it occurs under a guardrail. This condition also occurs naturally over time as vegetation and sand build up adjacent to paved shoulders.

Sympathy crack - A transverse crack that occurs in concrete pavement opposite a transverse joint or crack in an adjacent concrete shoulder. Caused primarily by dissimilar joint spacing in the two pavement structures, but also influenced by other factors, such as relative temperatures at the time of casting and differing reinforcing in the two pavements.

Usable shoulder - The AASHTO 2001 Green Book definition: "...the actual width that can be used when a driver makes an emergency or parking stop. Where the sideslope is 1V:4H or flatter, the usable width is the same as the graded width since the usual rounding 4 to 6 feet wide at the shoulder break will not lessen its usable width appreciably."

The Department's current practice is to extend the outside paved shoulder with 1 foot of aggregate to the shoulder hinge point for stabilization. When widening existing shoulders to meet current standards, this is desirable, but not always feasible.

6.05.03 General

(revised 11-28-2011)

It is the usual practice of the Department to construct hard-surfaced shoulders immediately adjacent to the traveled lanes of state trunklines. There are still many miles of gravel shoulders on the trunkline system, however, so this practice does not mandate that projects be let specifically to pave these shoulders. It is current practice, however, if a resurfacing project is proposed, to include at least a 3 feet shoulder ribbon when the average daily traffic (ADT) is greater than or equal to 750. (See Section 3.09.02)

While existing prime and sealed shoulders are considered as "paved", the Department no longer builds prime and sealed shoulders, except as may be done by the Maintenance Division or by contract as part of heavy maintenance. This means that a 3 feet HMA mat is normally the minimum type of paved shoulder that we would now construct. (Sometimes it is prudent to combine a pavement widening with the laying of a shoulder mat, painting the edge line on the shoulder paving in such a way as to provide 3 feet of paved shoulder.)

Flush shoulders are required on ***new*** urban freeway construction. This requirement does not necessarily apply to urban freeway ***reconstruction***.

6.05.04 Shoulder Width

(revised 1-24-2022)

6.05.04A Freeways

Shoulder widths for freeways and ramps are specified in Appendix 3A.

As a general practice, existing shoulder widths should not be reduced. This is of particular importance when upgrading guardrail as part of the project, as the most recent guardrail shoulder designs may have greater lateral width, than the old. Posts that are 8 feet in length may be used to obtain proper shoulder width in guardrail sections (See Section 7.01.41D).

6.05.04B Paved Ramp Gores

To reduce the need for maintenance in gore areas, additional shoulder paving should be provided to the point in the divergence where the 4-foot ramp paved shoulder and the 10-foot mainline paved shoulder are 8 feet apart. This would typically be a total distance of 22 feet (10 feet + 8 feet + 4 feet) between the freeway mainline and ramp edges. This would still end the surfacing in front of the "Exit" sign. (This practice applies to new freeway construction and may apply to reconstruction and resurfacing, as determined.

6.05.04C Deleted

Section deleted. See Appendix 3A.

6.05.04D Widening Shoulder Paving in Guardrail Sections

A gravel windrow sometimes forms under guardrail during blading operations. Shoulder paving in front of guardrail should be widened to within 1 foot of the rail face to reduce the occurrence of windrows forming in these areas and thereby avoiding the costly maintenance to have them removed.

Standard Widening

The Design Recommendations Committee (December 14, 1995 Committee Minutes) approved the following standard treatment of shoulders in guardrail sections:

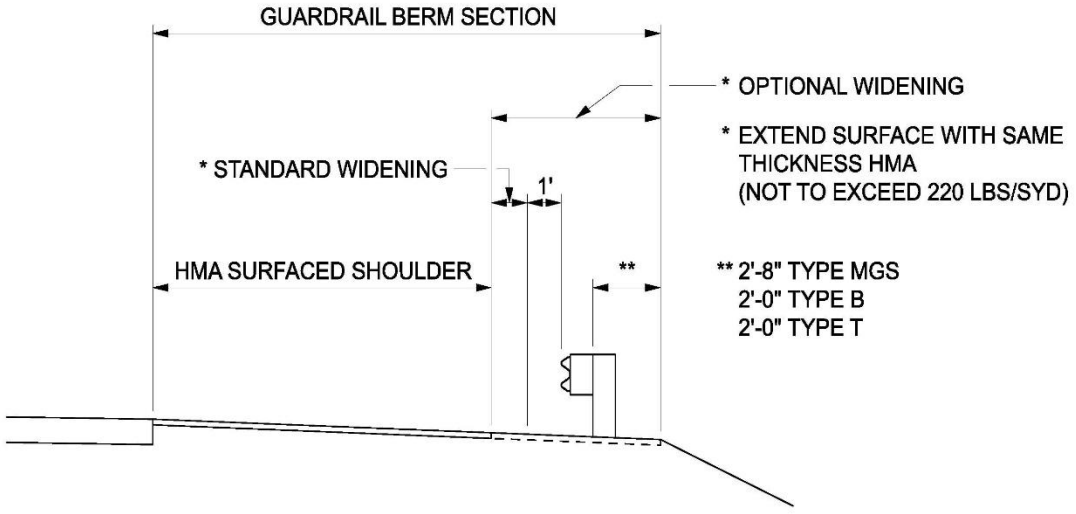
1. HMA shoulders will be paved to within 1 foot of the face of guardrail through areas where the guardrail is parallel to the roadway.
2. Concrete shoulders that are paved full width will not be widened through guardrail areas.
3. Concrete freeway median shoulders (4 feet) will be paved to within 1 foot of the face of the guardrail. The contractor should be given the option of widening with either HMA or concrete.

A 25-foot long transition back to the normal paved shoulder width should begin at the point where the guardrail departs from parallel. A butt joint should be provided at the narrow end of the taper. This transition should be detailed or described on the plans or in the log (See paving transition details).

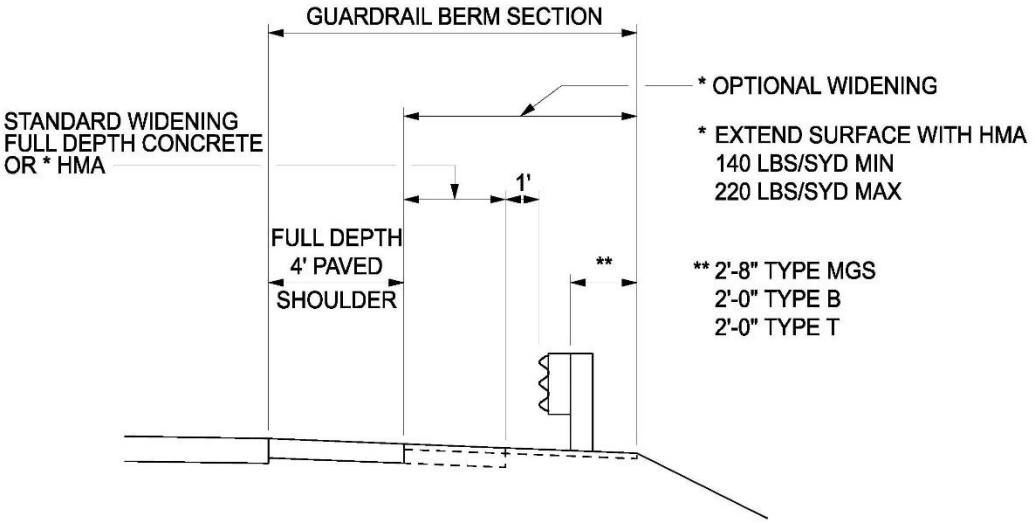
Optional Widening

The Engineering Operations Committee (November 3, 1993 Committee Minutes) has approved the option of extending the HMA shoulder surfacing under the guardrail to the hinge point of the embankment for the purpose of minimizing maintenance in guardrail sections. This option of paving under guardrail is only for new construction or reconstruction projects where new guardrail will be installed. Existing guardrail is not to be removed and replaced for the sole purpose of paving to the hinge point. This option must be specifically requested by the Region/TSC and detailed on the plans.

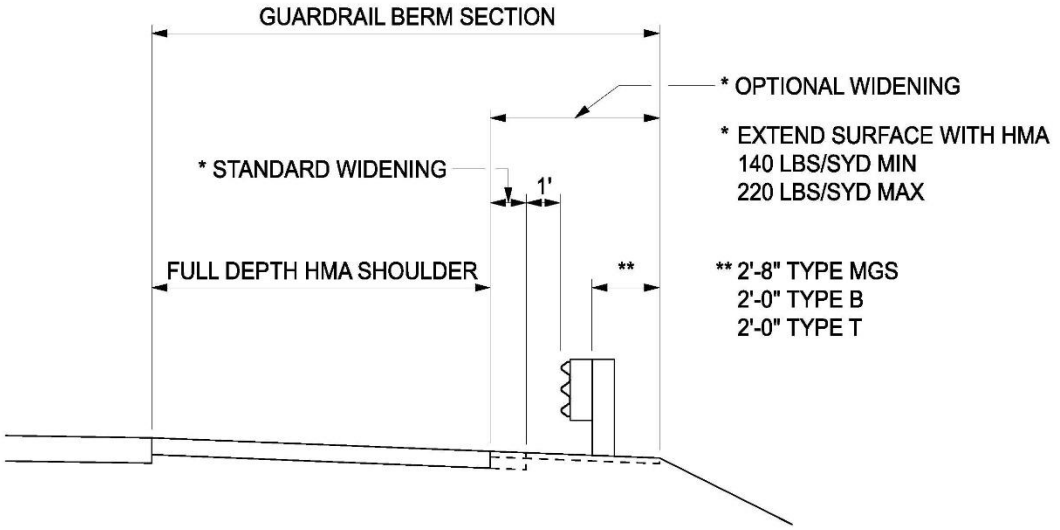
The paving under the guardrail will end at the guardrail flare point or at the end of the non-flared guardrail.



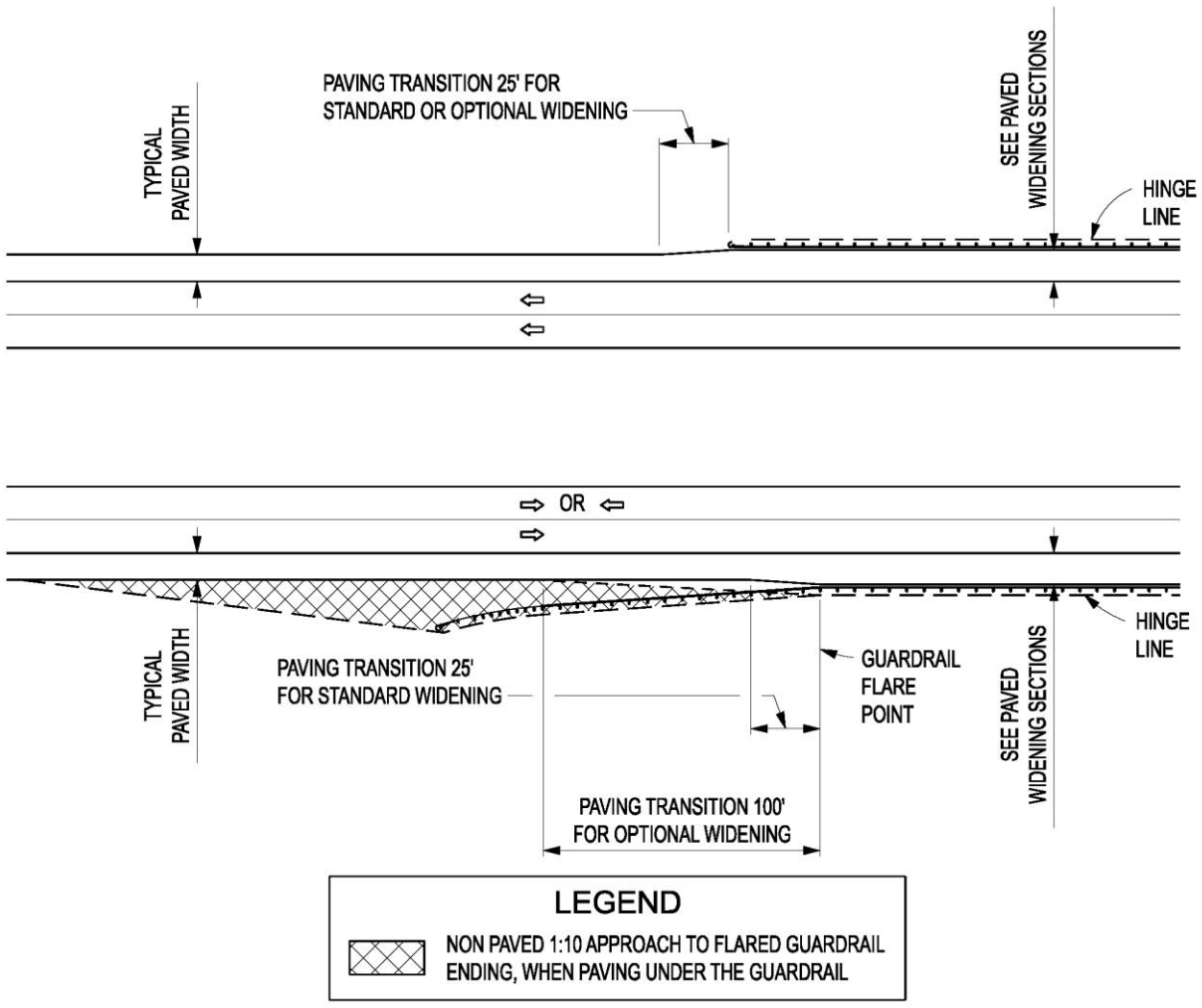
PAVED WIDENING FOR HMA SURFACED SHOULDERS
(220 LBS/SYD OR LESS)



PAVED WIDENING FOR FULL DEPTH
CONCRETE OR HMA 4' PAVED MEDIAN SHOULDERS



PAVED WIDENING FOR FULL DEPTH HMA SHOULDERS



TRANSITIONS FOR ENDING WIDENED SHOULDER PAVING

6.05.04E Adjacent to Truck Climbing Lanes

If possible, the outside shoulder adjacent to a truck climbing lane should be the same width as the normal shoulder, particularly if the climbing lane is long, e.g., on the order of 1 mile. In the case of reconstruction of an existing roadway, where the climbing lane is to be added, this additional width may be very costly to achieve, in which event the outside shoulder should be at least 4 feet wide, and preferably 6 feet wide. Because of the low volume of traffic using the slower outside lane, a parked or disabled vehicle can extend partially into the climbing lane without posing an inordinate hazard or impeding the slow moving traffic.

6.05.04F Adjacent to Auxiliary Lanes

An auxiliary lane, such as might be placed between closely spaced interchange ramps, would normally have the same width shoulder as would be provided elsewhere on the roadway. In the event of limited side conditions, the usable shoulder width may be reduced to a minimum of

6 feet.

6.05.04G Method of Grading Shoulder - Resurfacing Projects

On a resurfacing project, additional shoulder gravel should be called for to bring the shoulders up to grade. There are two methods of grading the shoulders:

1. Maintaining existing shoulder width. This results in a steeper front slope if the proposed shoulder slope is equal to or flatter than the existing shoulder slope. This method is preferable.
2. Maintaining existing front slope. This results in a decreased shoulder width as the front slope is continued up to define the increased thickness of the shoulder material.

It should be determined at the Plan Review Meeting which method is preferable for the project and the plans or log should be clear in indicating which to use. Alternate #1 requires additional fill material for the triangular-shaped added cross-section beyond the shoulder. This may be gravel, topsoil, or earth fill, as recommended by the Region/TSC at the Plan Review Meeting.

6.05.04H With Rolled Curb and Gutter or Valley Gutter

On urban projects, where rolled curb and gutter or valley gutter is used in conjunction with a shoulder, the shoulder width is measured from the edge of the traveled lane and includes the roll curb and gutter or valley gutter.

6.05.04I Berm Behind Curb and Gutter

A berm will always be graded behind a curb and gutter. The width of this berm will be dependent upon available ROW, whether a sidewalk or bicycle path is proposed, and other topographical limitations. This berm is sometimes referred to as a shoulder, although the presence of a barrier curb with a sidewalk all but precludes its use as a refuge for a disabled vehicle. The width of the berm/shoulder, lacking restrictions, will usually be 8 feet, 10 feet, or 12 feet, including the curb and gutter. In an urban cut section, the use of a berm is especially important to control earth sloughing and to reduce the potential for sediment and debris from entering an enclosed drainage system. This berm should be no less than 2 feet wide behind the curb and should preferably be a minimum of 6 feet wide, behind the curb. (See Section 6.05.05E).

6.05.04J Shoulder Ribbon

Shoulder ribbons are generally 3 feet wide for existing 24-foot pavement, and for some 22-foot pavements having low traffic volumes. For a 20-foot pavement, and for some 22-foot pavements, if a decision has been made not to widen it as part of the project, a 4-foot or 5-foot ribbon may be considered at the Plan Review Meeting to achieve a wider lane, with the painted edge stripe located on the shoulder. This latter treatment should include a thickened inner edge to carry wheel loads, unless the shoulder ribbon is somewhat temporary in nature such that a premature weakening or failure would be acceptable. However, in locations where the shoulder is used by bicyclists or pedestrians, designers should consider the effect of narrower shoulders on those users.

6.05.05 Shoulder Slopes

(revised 9-22-2025)

6.05.05A Standard Slopes

Standard slope for gravel- or earth-surfaced shoulders is 6%. Standard slope for paved shoulders is 4%. The rationale for the steeper slope on the gravel or earth shoulder is improved drainage over the rougher surface. No shoulders should be graded flatter than 4% except as may be necessary in superelevation.

The typical cross-section should always show the proposed rate of shoulder slope. Prior to 1983 the rates of slope were expressed on the plans or in the log as fractions of an inch per foot. Since 1983 the rates of slope were expressed as a decimal of a foot per foot until changing to metric system in 1996 which depict rates of slope as a percentage. Thus, 4% replaces 0.04 ft./ft. that was ½ in./ft. and 6% replaces 0.06 ft./ft. that was ¾"/ft. The percentage nomenclature was retained when the Department reverted back the English system.

Non-freeway paved shoulder ribbons (3 feet) and the remainder of the gravel shoulder should be constructed in the same plane with a cross-slope ranging from 4% to 6%. Constructing the shoulder in two planes would complicate maintenance blading and snow removal. Because it is easier and less expensive to make a single pass, the contractor will use the same mix to construct both the shoulder ribbon and the mainline paving. Construction forces should insist that the proper break in slope occur at the edge of the traveled lane, however.

6.05.05B Superelevation

The full superelevation rates of shoulders adjacent to superelevated pavements are specified on Standard Plan R-107-Series. The transition length to full superelevation shall be the same length as that for the pavement.

When transitioning the shoulder slope to/from a bridge section, calculate the transition distance using the superelevation transition slope (∆%) required for the curve, or in tangent sections, use the minimum value for superelevation transition slope (∆%) given in the table in Standard Plan R-107-Series, in the column for the speed of the roadway. (Transition distance = shoulder width x (rate of bridge shoulder superelevation minus rate of road shoulder superelevation) x 100 / ∆%)

6.05.05C Changing Existing Shoulder Slope

Periodic shoulder maintenance may result in changed shoulder slopes, with the greater tendency to steepen them rather than to flatten them, which requires adding material. As part of preliminary engineering for a resurfacing project, the designer should request the Region/TSC to survey the existing shoulder slopes. This is usually done by using a board and spirit level at intervals of 500 feet to 1000 feet, on both sides. This information is useful in computing quantities for additional shoulder material.

If the shoulder slope survey information is more than a year old, the Region/TSC should be requested to verify it or to make a new survey.

Sometimes, particularly in a cut area, an existing aggregate shoulder slope is flatter than the prescribed 6%, as there is no opportunity for maintenance operations to inadvertently grade the material over the shoulder hinge line. Rather than remove and dispose of excess good material, the designer should consider using a finished slope of at least 4% in these areas. It should be clear in the plans or log, however, that additional material should not be brought in to achieve the flatter slope (in the event the shoulders have been regraded to a steeper slope since the survey), because 6% is actually preferred.

When flattening an existing shoulder slope in front of guardrail, the height of the guardrail must be assessed if it is to remain in place. This must be done to determine whether the guardrail will be unacceptably low. The height should be measured directly under the face of the guardrail to the existing ground. Should the height be too low, then it becomes preferable to reconstruct or adjust the guardrail, rather than steepening the shoulder slope beyond 6% to accommodate the existing guardrail. (See Section 7.01.41) As usual, the plans or the log should be clear in portraying the designer's intent.

For Construction on Existing Road project types (freeway and non-freeway), paved shoulder cross-slope may be intermittently increased from the standard 4% to 6% to minimize the change in foreslope or to minimize the need to adjust existing barrier height. It is preferable, when feasible, to maintain a 1:4 or flatter foreslope. Realignment of ditches or backslopes should only be done in extreme cases.

6.05.05D HMA Paver Limitations

Most HMA pavers used on trunkline projects use hydraulically extendable screeds. This affords almost unlimited flexibility in providing a break in slope at the edge of pavement (as when the shoulder and the traveled lane are paved in the same pass), or in changing the slope at any time and in any place. Some of the older machines utilize mechanical extensions to the basic 10-foot long screed, in 6 inch and 12 inch increments. When paving a 12-foot lane and a 3-foot shoulder ribbon with a mechanical extension, the break in slope between the crown slope and the shoulder slope might occur 6 inches onto the shoulder. This is acceptable provided the painted edge line is placed at the normal 12-foot point.

Valleys, such as might be desired adjacent to concrete median barrier, should be avoided because they are difficult to pave and, worse, difficult to roll because of the cylindrical shape of the roller. Such shoulders adjacent to concrete barrier should usually slope in a straight line to the base of the barrier. If there is any doubt as to the feasibility of the proposed paving, the designer should check with Construction Field Services Division.

6.05.05E Graded Berm

(See Section 6.05.04I) Normal slope of a graded berm, whether of normal shoulder width or wider, is 6%.

In a cut section, the berm will slope toward the curb, for drainage.

In a fill section, the berm may slope either toward the curb or away from it. Customarily, it will slope toward the curb if there is the possibility of a sidewalk or bicycle path eventually being built on it. Sloping toward the curb is also preferable from the standpoint of drainage, as it reduces the amount of runoff that may be directed onto adjacent property. Sloping down and away from the curb is usually done when none of these other factors are significant, or where ROW. may be limited.

6.05.06 Selection of Shoulder Surface Types

(revised 6-28-2021)

For guidance as to the type of HMA shoulder surfacing to provide for a project, see the table in the HMA Selection Guidelines, Section 6.03.09.

Freeway shoulders typically employ the same material as the mainline pavement. See Appendix 6A.

Shoulder type on any local roads, constructed or reconstructed as part of the project, will be determined on a location-by-location basis, with input from the local agencies involved.

6.05.07 HMA Shoulder Ribbon

(revised 11-28-2011)

6.05.07A Causes of Low Shoulders

Gravel shoulders typically become low, i.e., exhibit a shoulder drop-off at the pavement edge, because of direct vehicle contact with the shoulder, or because of wind eddies from large passing trucks. These wind eddies blow away the fines and destroy the stability of the gravel shoulder. The narrower the traveled lanes, and the higher the traffic volume, particularly that of semi-trucks, the more pronounced the low shoulder problem can be. Patrol grader maintenance may be required at intervals of only a few days. The HMA shoulder ribbon, usually 3 feet wide, has proven a cost-effective answer to this maintenance problem. Some maintenance personnel state that, with a shoulder ribbon present, routine patrol grading is necessary only once or twice a year.

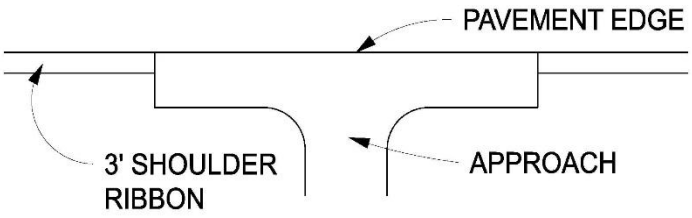
6.05.07B Thickness

The HMA mixture for paved shoulder widths less than 8 feet should be the same as that being placed on the mainline or as recommended by the Region Soils Engineer. When concrete pavement is rubblized, the finished shoulder thickness matches the full depth finished pavement. Guidance for HMA shoulder thicknesses for freeways and ramps are shown in Appendix 6-A.

6.05.07C Construction Considerations

It is preferable to pave narrower shoulders (less than 8ft.) in the same pass as the mainline pavement. This produces a more uniform pavement and reduces the potential for a longitudinal crack to develop at the pavement edge. Since the minimum width of most pavers is 8 feet, constructing the shoulder separately would require a shoulder spreader. This produces less desirable results in pavement quality.

At crossroad approaches the ribbon should ***not*** be carried around the return radius. The entire driving area of the approach is usually paved anyway, and the radius may be too short for the paver to negotiate. If the project is for paving of the shoulder ribbon only, it should be carried across gravel crossroad approaches, as if they were not there. It should be interrupted for paved approaches, however. (See the sketches in Section 12.02.03.)



Occasionally, a crossroad approach will include a paved apron, as shown:

To avoid a misplaced joint line and an undesirable drop-off during construction, any HMA base and leveling course should be paved through for the roadway and shoulder strip combined, followed by the top course for the roadway only, followed by paving of the complete approach.

6.05.07D Aggregate

Use Class I aggregate under the shoulder ribbon. Use Class II aggregate, which has more fines, when an HMA surface will not be used. Full width paved shoulders should have a minimum of 2 feet of aggregate support. See examples in Appendix 6A. Trenched aggregate is often used to reshape the remaining shoulder width if the existing material is acceptable.

6.05.08 HMA Shoulders

6.05.08A Mixtures

HMA shoulders are usually paid for using the same pay items that are used for surfacing the traveled lanes. This reflects the growing practice of paving the shoulder and a lane in one pass. Ideally, or if the shoulder is wide enough to pave in two passes, a separate pay item can be established for the shoulder material, to enable the contractor to obtain a bid price that would reflect the degree of work involved. Also, it is preferable to have a softer material (having a higher penetration) on the shoulder to give it longer life. With one-pass paving, however, it is difficult or impossible to determine a distribution of either material or effort across the width of the pavement plus a shoulder.

See Section 6.03.09 for shoulder treatments. HMA shoulders may be paved in one course if the thickness is 250 lbs/syd or less.

6.05.08B Trenching for Shoulder Construction

Where it is necessary to trench existing material in order to construct the new shoulder, the work is paid for as "Trenching", according to the Standard Specifications for Construction. Measurement is by the station, with trenching on each side of the roadway measured and paid for separately.

Suitable trenched material may be specified for use to replenish low aggregate shoulders outside proposed paved shoulders. Disposal of excess trenched material is at the contractor's expense according to the Standard Specifications for Construction.

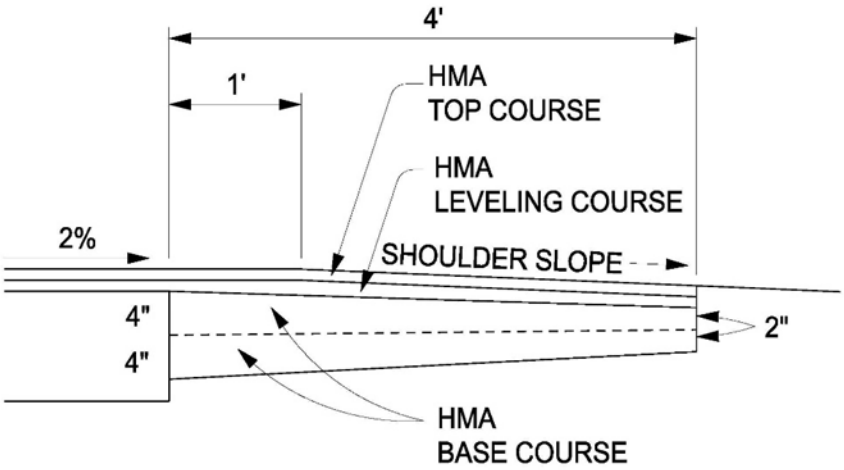
Region Soils should always be contacted for evaluation of existing shoulder materials and condition and for input/recommendations pertaining to proposed shoulder treatments.

See Section 6.05.12, Shoulder Drains.

The method of treatment for varying conditions of existing shoulders will usually be as recommended by the Region Soils and Materials Engineers.

6.05.08C Tapered Thickness

A method of combining a road widening with a paved shoulder involves placing a variable thickness HMA base course shoulder, making it thicker next to the pavement, and tapering it to the minimum shoulder surfacing thickness at the outside edge. There are compaction problems inherent in placing variable thickness HMA lifts, but shown below is a typical method of achieving a 1-foot pavement widening in combination with a 3-foot shoulder ribbon:



Note that the HMA Top and Leveling Course is uniform thickness

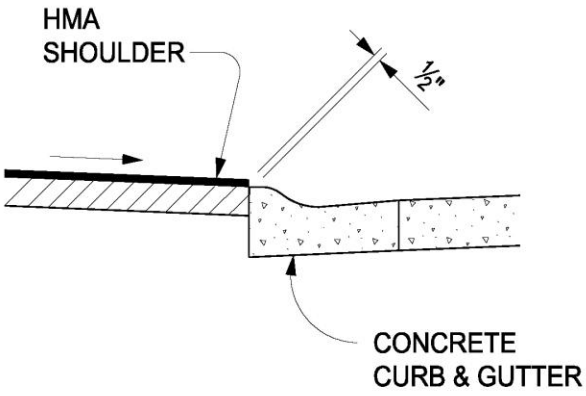
6.05.08D Gravel Windrow Near Hinge Line

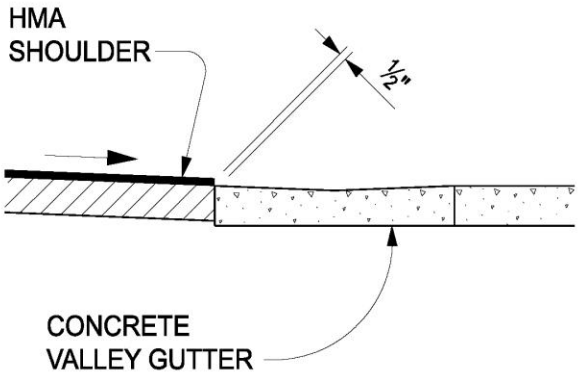
If there is an existing gravel windrow at the edge of the shoulder, it may be possible to ask Maintenance to grade it off prior to construction, perhaps incorporating it back into the shoulder. If the contractor is to remove this ridge, it should be clearly shown on the cross-sections, with instructions relative to what is to be done with the material removed. A special provision will probably be required, indicating whether or not this work is to be paid for and, if so, how it will be measured.

When a windrow builds up under guardrail, it is obviously impossible to simply remove it by grading. Some contractors have devised a plate arrangement, attached to a front end loader, that reaches under the guardrail, shears off the windrow, and then withdraws it for unloading.

6.05.08E Adjacent to Curb and Gutter or Valley Gutter

If there is an existing gravel windrow at the edge of the shoulder, it may be possible to ask Maintenance to grade it off prior to construction, perhaps incorporating it back into the shoulder. If the contractor is to remove this ridge, it should be clearly shown on the cross-sections, with instructions relative to what is to be done with the material removed. A special provision will probably be required, indicating whether or not this work is to be paid for and, if so, how it will be measured.





6.05.08F Deleted

Section deleted.

6.05.08G Existing Sealed Shoulders

It was Department practice from about 1957 to 1973 to place prime and double seal on certain trunkline shoulders. Some of these were paved at 4% (½"/ft.), others at 6% (¾"/ft). When prime and sealed shoulders are encountered on a proposed resurfacing project, the following should be considered:

1. The presence of full shoulder-width sealing does not necessarily mean that the seal should be replaced with a full shoulder-width mat.
2. Scarify/mix the existing seal, outside of the proposed HMA shoulder width, before reconstructing the shoulder.
3. Determine the existing slope so that additional aggregate may be provided if the slope is to be flattened.

6.05.08H HMA “Curb” at Edge of Shoulder

Occasionally, in a cut section combined with a steep longitudinal grade, or in a long guardrail fill section, provision must be made for carrying some surface runoff longitudinally down the paved shoulder. This is done by raising the outside edge of the shoulder to contain the flow. See the sketch and narrative in Section 6.03.16B.

6.05.08I Strip Behind Service Road Curb

Where an urban freeway fence will be within about 5 feet of the service road curb, such as to preclude the use of ornamental plantings, consideration should be given to surfacing the strip with a 170 lbs/syd HMA mat. This surfacing should extend to 1 foot behind the fence.

6.05.09 Deleted

Section deleted.

6.05.10 Concrete Shoulders

6.05.10A General

The first concrete shoulders in Michigan were constructed experimentally in 1971 on three ½ mile segments of I-69 between Charlotte and Olivet. Though some sympathy cracking in the pavement was observed, there was sufficient promise that the concept of concrete shoulders would be a viable and economical alternative to HMA shoulders. This led to other projects in which they were used. Today there are many miles of concrete shoulders on the state's freeway system.

The edge support provided by a full-depth tied concrete shoulder reduces the load stresses in the adjacent pavement and significantly reduces the amount of runoff water reaching the subbase through the joint at the pavement edge.

6.05.10B Compatibility with Adjacent Concrete Pavement

See Appendix 6-A for construction details of concrete shoulders.

Whereas HMA shoulders may be merely adjacent to concrete pavement, concrete shoulders should ideally be tied to the pavement and be similar to the pavement in all aspects of reinforcement, joint type and sealant, and joint spacing. This helps to avoid sympathy cracking that can lead to premature deterioration of the pavement.

It cannot be over emphasized that designers should not neglect this general principle - concrete pavement structures tied together should be as similar as practicable. The only concession to this rule, presently allowed by the standard, is the omission of load transfer in the transverse shoulder joint, an economic trade-off.

6.05.10C Design Considerations

When two-lane pavements are involved, with concrete shoulders, the centerline joint should be designated as a "D" joint on the typical cross-section. This will prevent the contractor from electing to pave a lane and a shoulder monolithically, an option that might be attractive because both slabs are similar. (A "D" joint between lanes is preferred over a "B" joint, other factors being equal.) While the oscillating paving equipment in Michigan is mostly limited to a maximum width of about 26 feet, there might be an incentive to obtain equipment capable of paving two lanes and a shoulder. A "BD" joint should therefore be shown between the lane and the shoulder.

If concrete shoulders are paved integrally with the pavement, the slope of the shoulders in superelevation must be varied according to Standard Plan R-107-Series.

6.05.11 Corrugations in Shoulders and Pavement

(revised 5-24-2021)

Corrugations (also known as rumble strips) provide a visual and audible warning to a driver that their vehicle is either straying off the road or is encroaching an oncoming lane of traffic. Shoulder corrugations also discourage the unauthorized use of the shoulder as a driving lane.

Corrugations are milled into both concrete and HMA pavements. They cannot be formed in. There are two different types of corrugations in use in Michigan; the first being the individual depressions that have been used for decades (herein referred to as “traditional corrugations”), and a relatively new sine wave pattern (herein referred to as “sinusoidal corrugations”, and also known as “mumble strips”). Corrugation cross-sections and locations shall be as detailed on standard plan R-112-Series.

Freeway shoulder corrugations should be used in both median and outside shoulders having paved widths of at least 4 feet. Corrugations are to be included on freeway-to-freeway ramps with the exception of loop ramps, but are otherwise not to be used on freeway exit/entrance ramp shoulders. Corrugations are also omitted where the shoulder is separated from the traveled lanes by a curb and gutter or valley gutter. Freeway shoulder corrugations should be traditional corrugations. Sinusoidal corrugations may be substituted for the traditional corrugations upon evaluation of adjacent land use and discussion with the Pavement Marking Unit.

Existing concrete shoulders might contain intermittent (formed) corrugations that conflict with the proposed placement of retrofit milled corrugations, It should be noted and detailed in the plans that the existing intermittent corrugations should be gapped out rather than milled through.

Non-freeway shoulder corrugations should be used on all rural, 2-lane, 4-lane, and divided trunk line roadways where the posted speed is 55 mph and the paved shoulder is at least 6 feet wide. Non-freeway shoulder corrugations shall be sinusoidal corrugations.

Centerline corrugations should be used on all rural 2-lane and 4-lane trunk line roadways (in both passing and non-passing zones) where the posted speed is 55 mph and the lane plus paved shoulder width beyond the centerline corrugation is greater than 13 feet in width. Centerline corrugations should be traditional corrugations. Sinusoidal corrugations may be substituted for the traditional corrugations where there is either a history of noise complaints from previously installed traditional centerline corrugations or a high anticipated volume of passing maneuvers near residences, and after also consulting Maintenance to discuss the impacts to winter and pavement maintenance practices.

If safety concerns outweigh other issues such as noise and bicycle use, non-freeway shoulder and centerline corrugations can be considered for use on roadways that do not meet the criteria given above. The Region or TSC should contact the MDOT non-motorized coordinator and non-motorized program staff when considering placing corrugations on shoulders paved less than 6 feet wide. When placing non-freeway sinusoidal shoulder corrugations, several modifications to the standard placement shown in standard plan R-112-Series may be applied, and when used must be detailed in the plans. Where the paved shoulder is 3 feet or less or where the paved shoulder is less than 6 feet and has bicycle traffic, the offset may be reduced to 0 inches from the standard 12 inches. Where the lane width is 11 feet or less and the paved shoulder is 3 feet or less, the width of the sinusoidal corrugation may be reduced to 8 inches

from the standard 12 inches. Where the lane width is greater than 11 feet and all available paved shoulder must be maintained due to bicycle traffic or otherwise, the sinusoidal corrugation may be placed as an 8 inches edgeline corrugation.

In locations where horse-drawn buggies utilize the roadway, do not use shoulder corrugations unless a crash history exists. Document this as a context sensitive design decision. When a correctable crash history does exist, consider using corrugations and widening the shoulder 2 feet to accommodate both. Document the decision.

In developed rural areas where driveway density exceeds 30 access points within ½ mile, non-freeway shoulder, edgeline and centerline corrugations may be omitted unless a crash history exists. Document the decision.

6.05.12 Shoulder Drains

With the development of corrugated plastic drainage conduit and prefabricated drainage systems, that can be easily and economically placed at relatively shallow depths, the designer now has a valuable tool for taking subsurface water out from under the shoulder. Many miles of shoulders in marginal soils have been renovated by adding shoulder underdrains, just outside the edge of pavement, and at a depth sufficient to intercept the lateral flow along the plane of the theoretical bottom of subbase.

Circular corrugated plastic drainage conduit is usually a minimum of 4 inches in diameter with 6 inches preferred and is furnished in long rolls that facilitate the plowing-in process. There are several designs of prefabricated drainage systems, but a common one is the "egg crate" configuration, consisting of a hard plastic cellular shape about 18 inches wide and a nominal 1 foot thick. Other widths are available, from 12 inches up to 30 inches to 36 inches, which sometimes have to be used in order to get down to the bottom of subbase. This rectangular section must be trenched-in; it is placed on edge, with the wide dimension vertical, in conjunction with a filter fabric. Both of these types of conduits are outletted through the front slope about every 500 feet, or in sags. The outlets are solid pipe, usually 10 feet of CMP or heavy plastic sewer pipe, with a drainage header at the end.

On new construction, it is now practice to place the prefabricated drainage system directly under the pavement edge, with the width and depth chosen that will allow it to be embedded in the subgrade 1-inch or 2 inches, and to project above the bottom of the open-graded drainage course 1-inch or 2 inches. At one time, it was placed about 24 inches inside the edge of pavement, but this location developed problems because of poor compaction over the underdrain, directly under the pavement wheel track. If the conduit is placed too far outside the pavement, then it falls under the wheel tracks during paving. Circular conduit is centered about 12 inches outside the edge of pavement.

When retrofitting drain to an existing project, the conduit will be trenched or plowed in about 12 inches outside the paved surface, but at a depth as recommended by the Region/TSC Soils and Materials Engineer. It is likewise outletted about every 500 feet. A filter cloth can be incorporated in the plowing-in process.

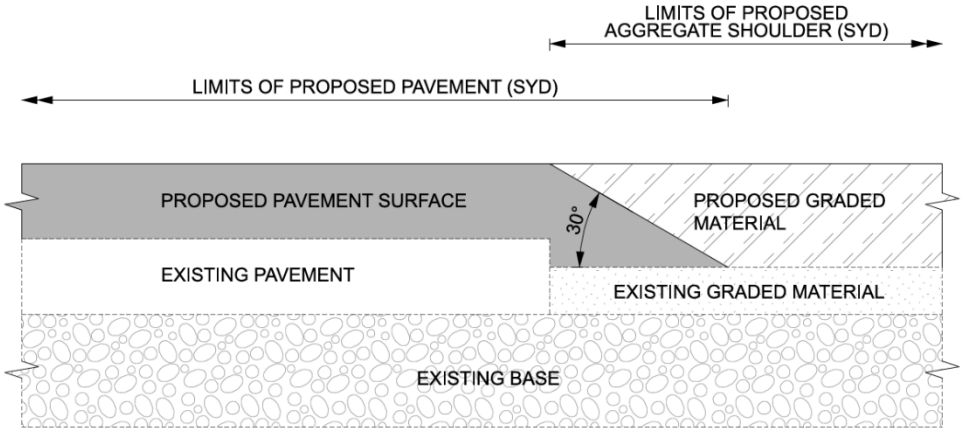
6.05.13 Safety Edge

(revised 6-24-2024)

The safety edge is a beveled pavement edge designed to reduce the severity of vehicle roadway departures and provides increased driver control on re-entry. It is a safer design for motorcyclists and bicyclists, as well as motorists.

On February 6, 2013 the Engineering Operations Committee adopted a policy to incorporate the safety edge.

When the proposed pavement surface and/or proposed graded aggregate shoulder uses square yards as units of measurement, the limits of the respective pay item are to the maximum width of placed material, regardless of depth. This can result in overlap on the plan view between the proposed pavement and proposed graded shoulder at the sloped area of the safety edge. There is no deduction in quantities for either pay item at this location to account for the varying depth at the sloped area when using square yards as the unit of measurement.



The safety edge will be applied as follows for all pavement types:

- **Temporary Pavements -** All newly constructed temporary pavements will be constructed with a safety edge. This includes permanent shoulders that are newly constructed, resurfaced (1½ inches minimum) or widened, and fully or partially used in the course of the same project as temporary lanes with construction speeds of 45 mph or greater. When a safety edge is installed in conjunction with temporary widening that is subsequently staged for removal, construction of a replaced safety edge against the remaining finished shoulder is not required.
- **Confined Edges -** The safety edge should be omitted in those locations where the shoulder is terminated or separated by curb and gutter or valley gutter.
- **Freeway Ramps -** Freeway to freeway ramp shoulders constructed, resurfaced (1½ inches minimum), or widened without shoulder corrugations will be constructed, resurfaced or widened with a safety edge. Regular freeway off and on ramps should not incorporate the safety edge.

- **Narrow freeway shoulders -** (4-foot paved or less) that are constructed, resurfaced (1½ inches minimum), or widened will be constructed, resurfaced or widened with a safety edge.
- **Rural Trunkline –** Trunkline shoulders that are newly constructed, resurfaced (1½ inches minimum) or widened without shoulder corrugations will be constructed, resurfaced or widened with a safety edge where the posted speed is 45 mph or greater .

  The safety edge may be omitted in developed rural areas where driveway density exceeds 30 access points within ½ mile.
- **Safety Application -** If safety concerns are known, the Safety Edge can be considered for use on any roadway or ramp.

Details of the safety edge are shown on Standard Plan R-110-Series. Specifications require that the safety edge be constructed monolithically with the shoulder pavement and that there will be no separate payment for constructing it. Designers should provide additional concrete pay item quantities used for concrete shoulder to construct the safety edge adjacent to concrete shoulder. The locations where the safety edge applies should be identified where appropriate on the typical cross-sections or maintaining traffic details.

The designer should review existing field conditions to identify areas where berming may have developed that would impede positive drainage. Additional details and sperate payment such as station grading modified may be needed to remove the berm.

6.06 CURB AND GUTTER

6.06.01 References

A. Department Standard Plans

1) R-29-Series, “Driveway Openings & Approaches, and Concrete Sidewalk”
2) R-30-Series, “Concrete Curb and Concrete Curb & Gutter”
3) R-31-Series, “Integral Curb and Integral Curb & Gutter”
4) R-32-Series, “Approach Curb & Gutter, Downspouts (For Bridge Barrier on Rural Highways)”
5) R-33-Series, "Concrete Valley Gutter and Urban Freeway Curb”
6) R-38-Series, "Concrete Divider”

6.06.02 Glossary of Terms

Back of curb - The vertical plane of the curb, or curb and gutter, structure, farthest from the roadway.

Barrier curb - In Department usage, a curb having a near - vertical front face of over 6 inches in height. (See definition of mountable curb, below, and further discussion under Section 6.06.05.)

Curb cut - A rounded reduction of curb height such as is encountered for an opening at a driveway or curb ramp.

Face of curb - The vertical plane of the curb structure closest to the roadway.

Face-to-face - The distance between the two front faces of curbs on opposite sides of the street, shown on plans as "f-f".

Gutter pan - The horizontal portion of curb and gutter, i.e., that portion of the curb and gutter structure exclusive of the curb.

Integral curb - (Or integral curb and gutter) - The condition when the curb or curb and gutter is cast monolithically with the concrete pavement structure. When so constructed, there is obviously no visible joint line defining a gutterpan width and so it is impossible, by observation, to determine the nominal width, if any, of the gutter pan.

Mountable curb - In Department usage, a low curb height or having a low sloping or rounded face such as to allow a vehicle to drive over rather easily. (See definition of barrier curb, above, and further discussion under Section 6.06.05.)

Roll curb - (Or roll curb and gutter) - A mountable curb having a broadly rounded curb face that allows a vehicle driving over the curb rather easily.

Traffic control - The use of a linear structure, most often curb or curb and gutter, to visibly and physically define preferred points of ingress and egress to or from areas adjacent to the roadway.

6.06.03 Purpose of Curb and Gutter

Curbs serve primarily to (1) control and direct drainage runoff, and to (2) visibly and physically define the edge of the traveled way. Curbs are used primarily in urban or semi-urban areas. Curbs are not needed in rural areas where flush shoulders are used as a vehicle refuge and safety area immediately adjacent to high speed traffic and where open ditches can be utilized for roadway drainage. Curbs serve other corollary purposes, such as promoting the aesthetics of an orderly roadside development, defining points where vehicles may leave the roadway, and, in some cases, allowing the widest possible roadway use in a restricted Right-of-Way.

6.06.04 Curb Types

(revised 7-26-2021)

Department concrete curb types are shown on Standard Plans R-30-Series and R-33-Series. Details B and D are considered mountable or roll curbs, while Details C, E and F are considered barrier curbs. See further discussions of barrier curbs under Section 6.06.05.

While most curb, used for the purposes described under Section 6.06.03 above, are constructed of portland cement concrete, HMA curbs are sometimes used. See Section 6.03.16.

Some of the earlier city streets in Detroit will have cut stone curbs. These are usually granite blocks, about 4 feet long, and would be classified as straight curbs. Whenever these curbs must be removed, they are usually replaced with our current designed concrete curbs, unless, for some reason, it is wished to retain the "old" character of the stone curb by salvaging them for re-setting and re-use.

Whenever it is necessary to modify a standard type of curb to fit a particular situation, the word "modified" must be included in the pay item, and the curb must be detailed on the plans. An example would be to have a Detail C curb gutter slope ***away*** from the curb face. It would be called "Curb and Gutter, Conc, Detail C, Modified". If the change is of greater magnitude and the curb bears little resemblance to one of the standard curb details, then the reference words "barrier" or "roll" could be inserted in the pay item, as applicable, in place of a detail (letter) designation.

6.06.05 Barrier Curb

(revised 7-26-2021)

With particular reference to Detail F curb and gutter, there has been some blurring of the distinction between a barrier and a mountable curb. The Department considers Detail F to be a barrier curb because of its nominally vertical curb face.

Use of the word "barrier", in reference to a curb, should never be construed as meaning that the curb will provide a means of preventing a vehicle from progressing beyond the line of the curb. A vertical-faced curb approaching 9 inches or 10 inches in height will be somewhat effective in vehicular redirection at reduced angles of impact in the lower speed range.

For curb types and application, see Section 6.06.06C.

6.06.06 Criteria for Use

(revised 11-28-2011)

6.06.06A Gutter Pan Width

The standard plans provide for gutter pan widths (excluding urban freeway curb) of 24 inches, 18 inches, 16 inches and 12 inches (and, of course, no width in the case of straight curb). It is preferable to use the widest gutter pan width possible, up to the 24 inches maximum. As site conditions impose restrictions, such as limited ROW, existing sidewalk, or a row of shade trees, the narrower gutter pan widths will usually be preferable to using a narrower lane width. As a last resort, Detail E curb may be considered. An extreme situation might involve the use 11-foot lanes, with 10-foot center turn lane, and straight curb at the edges. This would require approval from the Geometric section of the Design Division.

6.06.06B High Speed Roadways (50 mph or above)

Generally speaking, curbs are no longer used along high speed roadways when clear zone restrictions apply. Most of the earlier Detroit depressed expressways were constructed with a roll curb and gutter along the right edge, and most of the time along the left edge. Newer expressways, and reconstruction projects on the older ones, now incorporate concrete valley gutter. Roll curb and gutter is frequently used to define the radii of rural crossroad intersections, but these are placed beyond the edge of shoulder and therefore are not adjacent to the traveled way.

6.06.06C Application

- **Detail B** - Detail B curb and gutter may be used for any design speed where high visibility mountable curbs are desired for traffic control and driveway delineation. Typical usage would be at rural intersections on the outside of flush shoulders. (See Section 12.02.03)

- **Detail C** - Detail C curb and gutter may be used where the design speed is 40 mph (35 mph posted), or less, and a barrier curb is desired to inhibit vehicles from leaving the roadway. Typical usage would include locations where sidewalks or obstacles such as light poles, trees, etc., are located close behind the curb; in parking areas; or to match existing curb.

- **Detail D** - Detail D curb and gutter may be used at any design speed where drainage control is the main concern and where roadside or traffic control and driveway delineation are not critical concerns.

- **Detail E** - Detail E curb is a barrier type curb used primarily for traffic control islands or where a gutter pan is not utilized. It is used on service roads in the city of Detroit when the curb can not be tied to a new pavement. When a curb is tied to a new pavement, it is permissible to use the shorter (16 inches depth) curb. This is a specific request of the city of Detroit. See Sections 12.01.04 and 12.01.05. Curb height restrictions will be the same as for Detail C and F curbs and shall be determined by speed and the need for visibility and traffic control.

- **Detail F** - Detail F curb and gutter may be used where a high profile mountable curb is desired and the design speed is 50 mph (45 mph posted) or less. Typical usage would be in areas where Detail C curb and gutter is being replaced or where Detail B or Detail D curb and gutter would not yield sufficient roadside control.

- **Detail G** - Detail G curb and gutter is to be used on urban freeways. See Section 6.06.10.

6.06.06D Unlighted Areas

Generally speaking, it is undesirable to introduce or to use a curb, immediately adjacent to the roadway, in unlighted areas.

6.06.07 Deleted

Section deleted.

6.06.08 Bridge Approach Curb and Gutter

(revised 11-25-2019)

The type, length, and method of drainage at bridge approaches is the responsibility of the bridge designer. The quantities, however, are included in the road plans when road plans are involved.

The designer will need to meet the design spread requirements in the Drainage Manual, including 100% capture (no bypass flows) during the design event at locations where the curbing ends at the approaches to reduce the risk of erosion of the road embankment. The actual spacing and type of drainage capture device (downspout, catch basin, spillway) will be site specific.

Following is a guide to the use of the bridge approach curb and gutter details shown on Standard Plan R-32-Series with a 4 inches maximum curb height. It should be emphasized that this criteria is only a guide and that the designer should use engineering judgement in determining the type of structure to use.

- **Detail 5** - Used on the high ends of bridges where the bridge runoff drains toward the bridge or on the departing ends of bridges when guardrail is not needed.
- **Detail 6 (and 6A)** - Used on the low ends of bridges where moderate amounts of drainage area are involved (<2,500 sft of paved area draining to the curb and gutter) and fills are less than 10 feet high.
- **Detail 7 (and 7A)** - Used on the low ends of bridges where greater amounts of drainage may be expected (>2,500 sft of paved area draining to the curb and gutter) and in fills greater than 10 feet high. One downspout header should be provided for each 3,500 sft (approximately) of paved runoff areas or fraction thereof. If it is not readily apparent whether to use Detail 6 or Detail 7, use Detail 7.

If the bridge railing is other than the standard shape, the approach curb and gutter should be modified or transitioned to fit the bridge curb.

The detail and length of Bridge Approach Curb and Gutter should be shown on the plans, and will be paid for as "Curb and Gutter, Bridge Approach" per foot. The length of the Bridge Approach Gutter, used when the bridge barrier railing extends beyond the pavement seat on bridge, is included in the “Curb and Gutter, Bridge Approach” pay item. The concrete spillway is paid for as a continuation of Bridge Approach Curb and Gutter Detail 6 or 6A. The downspout header in Details 7 or 7A is paid for separately, although the pay length for Detail 7 or 7A includes the length occupied by the downspout header.

6.06.09 Concrete Valley Gutter

Michigan's use of valley gutter goes back to 1968, when it was created in response to an FHWA insistence on flush shoulders on freeways. Initially, it was located where curb and gutter had been used previously, between the travel lanes and the paved shoulder. More recent practice, and that used currently, places the valley gutter on the outside of the shoulder, adjacent to concrete median barrier, if there is one. On the outside, it would be placed adjacent to single face barrier. When there is no concrete barrier on the outside, concrete curb and gutter, or one of the urban freeway curbs, should be used in place of the valley gutter.

6.06.10 Urban Freeway Curb

Standard Plan R-33-Series illustrates an urban freeway curb and gutter, and a concrete valley gutter. Application of these curb details is as follows:

- **Detail G1** - Detail G1 curb and gutter is designed to be used on urban freeways and is to be placed only in cut sections and in front of retaining walls. This curb is to be placed on the outside edge of shoulder to reduce the potential of earth to slough onto the shoulder and also to control drainage. Use Cover W, Standard Plan R-23-Series or any drainage structure cover designed to fit a 24 inches gutter pan.
- **Detail G2** - Detail G2 is similar to Detail G1, except the wider gutter pan allows the use of Cover V, as on Standard Plan R-22-Series.

These urban curb details may be used in other situations when approved.

6.06.11 Integral Curb

See Standard Plan R-31-Series.

Unless otherwise specified in the plans or proposal, the contractor may cast curb or curb and gutter integrally with concrete pavement, at his option. Integral curb has the advantage of eliminating a longitudinal joint and the attendant possibility of water leakage into the subgrade. If widening of the pavement is in the foreseeable future, the integral option should be prohibited. Generally, it would not be used with concrete base course. Designers are cautioned not to inadvertently prohibit the construction of integral curb by failing to list Standard Plan R-31-Series on the note sheet.

6.06.12 Reinforcement

(revised 1-23-2012)

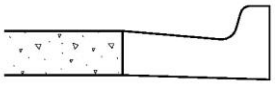
Generally speaking, if the curb and gutter is tied to a reinforced concrete pavement, shoulder or base course, the curb and gutter will be reinforced. Conversely, if it is tied to a non-reinforced pavement, shoulder or base course, reinforcement will be omitted in the curb and gutter.

6.06.13 Curb and Gutter Removal

(revised 1-23-2012)

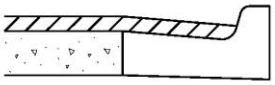
The following five typical cases are to be used where the entire roadway surface is to be removed, together with the adjacent curb and gutter. Pay items, according to the Standard Specifications for Construction, are shown below each sketch:

CONCRETE



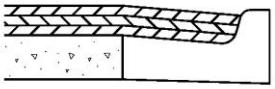
Pavt, Rem
INCLUDES CONCRETE PAVEMENT AND CURB & GUTTER

HMA 12" OR LESS OVER CONCRETE



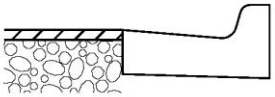
HMA Surface, Rem
Pavt, Rem
INCLUDES CONCRETE PAVEMENT AND CURB & GUTTER

HMA MORE THAN 12" OVER CONCRETE



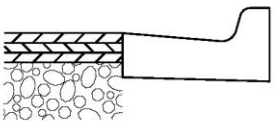
Pavt, Rem
TWO QUANTITIES:
1. ALL OF THE HMA
2. UNDERLYING PAVEMENT AND CURB & GUTTER

HMA 12" OR LESS OVER GRAVEL



HMA Surface, Rem
Excavation, Earth
REMOVAL OF GRAVEL
Curb and Gutter, Rem

HMA MORE THAN 12" OVER GRAVEL

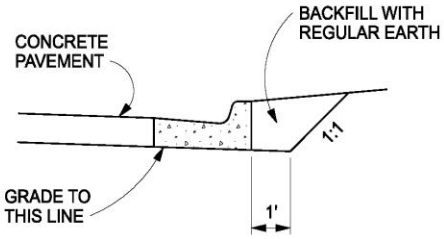


Pavt, Rem
Excavation, Earth
REMOVAL OF GRAVEL
Curb and Gutter, Rem

6.06.14 Grading with Curb and Gutter

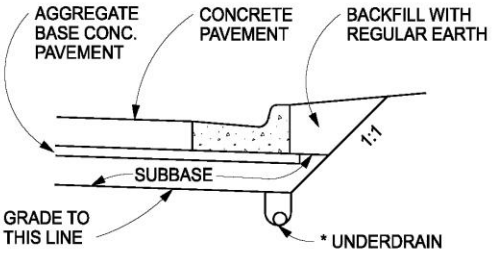
The following sketches illustrate pavement widening with curb and gutter. The grading limits behind the curb would be applicable to new construction as well as to widening.

In a cut section there should be an absolute minimum of 2 feet berm behind the curb, and preferably 6 feet to reduce the potential for earth to slough over the curb, and for debris to collect in the gutter.

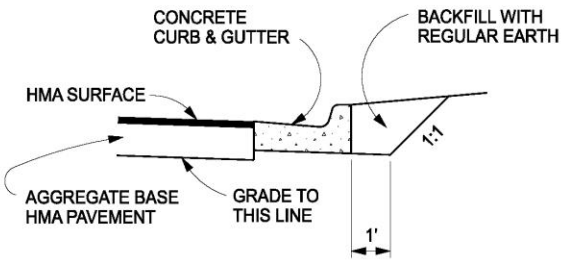


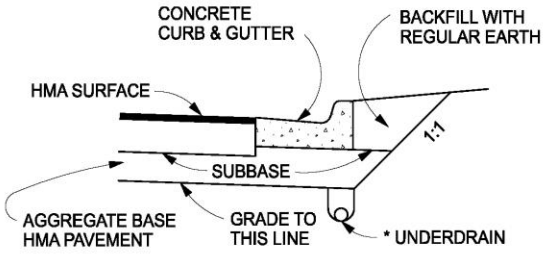
SECTION SHOWING GRADING LIMITS OUTSIDE CURB AND WHEN NO SUBBASE IS USED

(RECOMMENDED FOR SHORT SECTIONS ONLY, UNLESS NATURAL SOILS ARE GRANULAR)

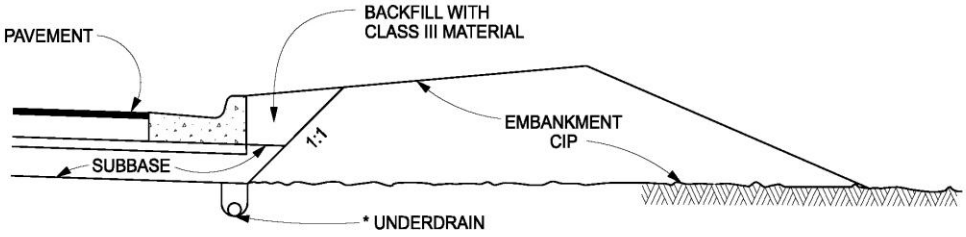


SECTION SHOWING GRADING LIMITS OUTSIDE CURB AND WHEN SUBBASE IS USED





SECTIONS SHOWING FLEXIBLE SURFACE



SECTION SHOWING CURB AND GUTTER IN FILL

* UNDERDRAIN LOCATION MAY BE DIFFERENT FROM THAT SHOWN, OR IF SUBBASE IS DAYLIGHTED THROUGH EMBANKMENT, THE UNDERDRAIN MAY BE OMITTED.

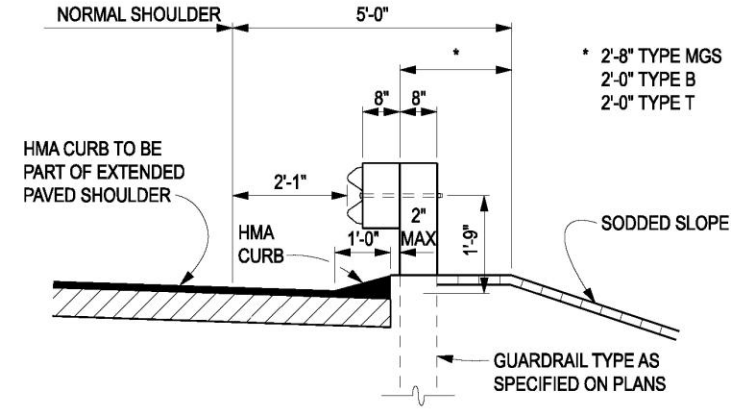
6.06.15 Minimum Curb and Gutter Grades

In lowland urban areas it is frequently difficult to obtain a minimum 0.25% centerline grade and an accompanying minimum gutter grade of 0.30%. In these cases, it is necessary to "roll" the gutter grades to achieve 0.30%. Because of construction tolerances, any grade less than 0.30% makes proper drainage difficult. In critical areas where it is required that this grade be reduced, drainage structure spacing should be reduced accordingly, but under no circumstances should the gutter grade be less than 0.20%.

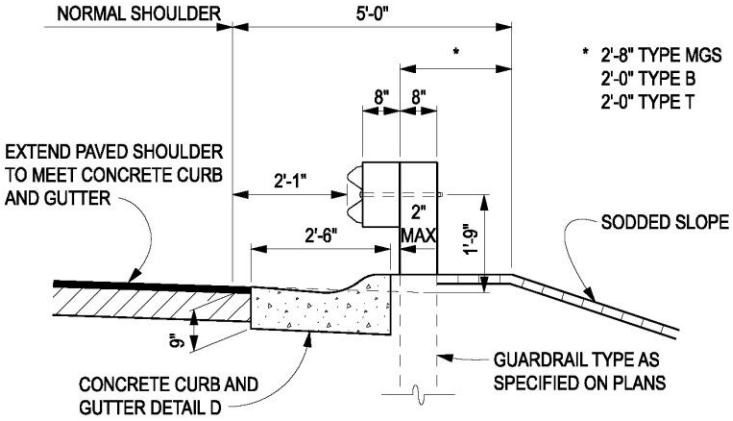
6.06.16 Curb and Gutter for Erosion Control

(revised 1-24-2022)

Long fill sections, usually those requiring guardrail because of their height, are occasionally subject to slope erosion due to concentrations of roadway runoff. This runoff can be controlled by extending the shoulder surfacing and using either a roll curb and gutter, Detail D, or an HMA curb on the outside edge of the shoulder. The placement of the back edge of the curb shall be 2 inches maximum in front of the guardrail post. Concrete downspout headers then conduct the water away. The need for erosion control curb is usually determined at the Plan Review Meeting. The following sketches illustrate this concept.



(HMA CURB)



(CONCRETE CURB & GUTTER)

SKETCHES SHOWING EROSION CONTROL TREATMENT
AT GUARDRAIL EMBANKMENTS RURAL HIGHWAYS

Designers must use some judgment in calling for this type of treatment. It may be necessary to place erosion control curb and gutter on the inside of superelevated curves through guardrail embankments, and on both sides in long tangent sections. FHWA has, in the past, been reluctant to approve widespread use of erosion control curb and gutter; therefore, even if it has been recommended at the Plan Review Meeting, the designer should verify that FHWA has concurred with its use before the Final Project Coordination (FPC) meeting. See Section 6.03.18B.

6.06.17 Concrete Curb Cap

Occasionally a curb will be severely deteriorated or the face exposure lost through repeated HMA resurfacings to the point that replacement of the curb and gutter is considered. If the gutter portion of the structure is sound and if the roadway is not in need of widening, consideration should be given to removing the curb portion of the curb and gutter and replacing it with a new concrete curb, bonded and doweled to the old concrete. A detail must be shown on the plans. Concrete curb cap has generally proven more economical than conventional curb and gutter replacement.

6.06.18 Deleted

Section deleted.

6.06.19 Driveway Openings

The following guidelines apply when a commercial driveway requires curb, unless the driveway rules of the local jurisdiction would conflict:

- **Curbed highways**
  - Roadways with Detail B or D curb, use Detail B for drive.
  - Roadway with Detail C or F curb, use Detail F for the drive.
- **Uncurbed highways**
  - Use Detail B curb unless the adjoining curb types delineating commercial drives are similar to Detail C or F, then use Detail F curb.

Limits of driveway curb construction should coincide with the limits of driveway surfacing construction, but not extend beyond the ROW line unless the driveway construction requires a grading permit.

In general, Detail L curb openings are used at residential drives and Detail M curb returns at commercial drives (as shown on Standard Plan R-29-Series). However, Detail L curb openings may also be used at commercial driveways. Concrete Driveway Opening Detail L is not paid for separately, but included in the pay item of the adjacent type of curb and gutter. “Driveway Opening, Conc, Det M” is paid for by the foot measured from springline to springline. See Sections 12.08.03F and 12.08.03G.

6.06.20 Curb and Gutter Adjacent to HMA Base Courses

Occasionally, an HMA pavement cross-section will be thicker than the curb and gutter, i.e., the HMA will extend considerably below the bottom of the gutter pan. When this occurs, a note should be placed on the plans cautioning the contractor to conduct his operations such as to avoid undermining the curb and gutter.

6.07 CONCRETE DIVIDER

(revised 11-28-2011)

Concrete divider is detailed on Standard Plan R-38-Series, but the width, type and geometrics of the divider must be detailed on the plans. The divider is used to warn the driver of an impending obstacle. It is frequently used in advance of an impact attenuator.

The Geometrics section of the Design Division will advise the designer when a concrete divider is warranted, and will provide the geometric details for the particular site.

6.08 SIDEWALK

6.08.01 Department Position on Sidewalk Construction

(revised 10-20-2008)

On March 29, 2006, Public Act 82 of 2006 was signed into law amending Section 10k of Public Act 51 of 1951. Section 10k requires that one percent of Act 51 funds be expended for construction or maintenance of non-motorized facilities. The amendment allows Act 51 funds to be spent on “the addition or improvement of a sidewalk in a city or village” as eligible Section 10k expenditures.

Sidewalks may be included and paid for as part of trunkline road and bridge construction projects. Through the context sensitive solutions process, the need for sidewalks may be identified, or may be requested by local stakeholders. Regions and TSCs should work with the local agencies to include sidewalks in trunkline projects within a city or village if one or more of the following conditions are met:

1. There is a demonstrated need to include one or more sidewalks along the trunkline
2. There is a reasonable expectation of such need over the design life of the project
3. The community has adopted a non-motorized transportation plan indicating the need for a sidewalk

Maintenance shall be the responsibility of the local unit of government, including liability, removal of debris, snow and ice, and replacement of damaged segments. Any sidewalk construction shall be contingent on a written agreement that addresses ownership, liability and future maintenance being signed by the local agency prior to construction. Sidewalks will seldom be constructed retroactively, but will predominately be in conjunction with ongoing road or bridge work.

For projects where a reasonable expectation of need cannot be determined at the time of design or over the design life of the project, the city or village shall be allowed to construct sidewalks in MDOT right-of-way with their Act 51 or other funds, provided they sign an agreement as described above. Where there is a request or a demonstrated need for a sidewalk along trunkline in a Township, MDOT should work with the Township to enter into an agreement as described above, prior to sidewalk construction.

Sidewalks, curb cuts and driveway aprons removed or destroyed as part of an MDOT reconstruction or rehabilitation project are replaced as part of the MDOT project cost.

6.08.02 Thickness

(revised 5-27-2020)

Concrete sidewalks are normally 4 inches thick. When part of a driveway, it should be constructed to the same thickness as the driveway approach, as detailed on Standard Plan R-29-Series. See Section 12.08.03D.

When it is determined at the Plan Review Meeting that there is evidence of trucks encroaching on curb returns at short-radius intersections or where the potential for encroachment will exist after project completion, the designer should call for 6 inches thick concrete for sidewalk and curb ramps within the return. This thickness can be increased if there is potential for very heavy trucks to encroach on the return.

6.08.03 Reinforcement

Sidewalks are usually not reinforced. Occasionally, a municipality will request the Department to reinforce sidewalk within its limits. If such reinforcing of sidewalk is standard municipal policy elsewhere, the sidewalk may be reinforced at project cost.

The plans should note that 6 in. x 6 in. mesh should be used, with either No. 10 wire weighing 21 pounds per 100 sft or No. 6 wire weighing, 42 pounds per 100 sft, whichever is the municipal standard.

6.08.04 Earth Excavation for Sidewalk

Any earth excavation and backfilling required for construction of sidewalk is included in the pay item for sidewalk.

6.08.05 Curb Ramps

(revised 2-24-2025)

Curb ramps are mandated by Act 8, P.A. of 1973 (amended by Act 35 in 1998), as was the issuance of Standard Plan R-28-Series, “Curb Ramp and Detectable Warning Details". FHWA guidance indicates that ramps be constructed whenever construction involves curb or sidewalk. On May 8, 1973, the Department extended this requirement, by policy to include resurfacing projects that did not ordinarily require the replacement of existing curb or sidewalk.

Federal mandates followed this State law in conjunction with the Americans with Disabilities Act of 1990. The United States Access Board published the Americans with Disabilities Act Accessibility Guidelines (ADAAG) in 1991 and subsequently extended its application to Public Rights of Way in 1994. The Access Board later published the Public Rights of Way Accessibility Guideline (PROWAG) to address accessibility issues specific to public rights of way.

It should be emphasized that there is little permitted reason for failure to place or upgrade a curb ramp on a road construction project if a sidewalk meets a curb in an obvious crosswalk situation. An "obvious crosswalk situation" would be where a sidewalk intersects with the roadway, whether or not there are painted crosswalk lines or a traffic signal present.

6.08.05A Warrants for Curb Ramps and Curb Ramp Upgrades

Based on FHWA guidance, curb ramp construction and/or curb ramp upgrade be incorporated with new construction, and roadway alterations.

- **New Construction** refers to the initial construction of a new roadway facility on a new alignment for which new Right-of-Way is acquired. Curb ramp installation is required and new construction standards are fully enforced.
- **Alteration** refers to changes that affect or could affect the usability of an existing roadway facility. Curb ramp installation and upgrading is required prior to or at the time of a roadway alteration. New construction standards are applicable to the maximum extent feasible.
- **Maintenance** refers to maintenance activities that do not affect the usability of an existing road. Curb ramp accessibility upgrades are not required to be performed in conjunction with maintenance treatments.

The U.S. Department of Justice and the FHWA issued a joint Technical Assistance memo in 2013 to clarify which roadway treatments fall within the definition of an alteration and which are considered maintenance.

Alterations include**:**

- Reconstruction
- Rehabilitation – including cold milling & resurfacing, slab replacement, slab jacking, widening, adding pavement structural capacity.
- Open-Graded Surface Course (open graded friction course)
- Micro-surfacing (includes rut filling)
- Double Chip Seal
- HMA Overlay (regardless of thickness)
- Cape Seal - (Chip seal capped with a slurry seal, micro-surface or other treatment to fill voids in a chip seal).
- In-Place Asphalt Recycling

Other conditions requiring accessibility upgrading include:

- Altered crossings through driveways. See Section 6.08.05F for driveway applications.
- Independent shared use path crossing are treated the same as sidewalks with regard to accessible roadway crossings.
- Installation of pedestrian signals. See Section 6.08.05G.
- Existing curb ramps without detectable warnings but otherwise compliant must be retrofitted with detectable warnings in conjunction with alterations to an existing roadway.

Maintenance includes:

- Crack Filling and Sealing
- Surface Sealing (liquid sealant)
- Chip Seals
- Slurry Seals
- Fog Seals
- Scrub Sealing
- Joint Crack Seals
- Joint Repairs
- Dowel Retrofit
- Spot High Friction Treatments
- Diamond Grinding
- Pavement Patching

Other routine operations where curb ramp upgrades are not required include:

- Signing, pavement marking projects.
- Guardrail/Safety upgrade projects.
- Landscape/Streetscape projects (except where an existing sidewalk or curb ramp is altered)
- Independent Utility Work/Maintenance (except where an existing sidewalk or curb ramp is altered or when work is extensive such that an entire crosswalk is reconstructed)

Two or more maintenance treatments may be combined and still be considered a maintenance treatment. However, if more than one of those treatments contains aggregate and/or filler, the combination will be considered an alteration.

For example a cape seal is an integrated system comprised of two maintenance treatments, a chip seal and a slurry seal. The slurry seal includes aggregate and filler to fill the voids of the aggregate in the chip seal. They combine as an alteration.

6.08.05B Scoping Considerations

If the projects limits include only a portion of an intersection, all ramps within the intersection shall be evaluated for compliance and the project limits extended to include all ramps.

Smaller scale projects such as CPM may still require a Right-of-Way phase to accommodate consent to tie into existing sidewalk outside the Right-of-Way. See Section 5.05.02 for more information on Right-of-Way requirements.

Alteration projects will likely require accurate contour and elevation information prior to designing compliant curb ramps.

6.08.05C Design Standards

Standard Plan R-28-Series details the requirements for ramp width, cross-slope, running slope, landings, curb transition, and detectable warning surfaces. Designers should investigate site conditions in order to determine and design the appropriate treatment for each curb ramp location. Where fully compliant curb ramps are infeasible, compliance is required to the maximum extent feasible. See Section 6.08.05E "Accessibility Constraints". This will require preliminary field work in order to design for maximum feasible compliance.

The curb ramp types detailed on Standard Plan R-28-Series represent some of the more conventional applications. Existing conditions may require variations not shown on the standard. The designer may need to combine the features of two or more ramp types to provide a compliant design.

There are several basic elements that should be incorporated into the design. These are:

1. **Minimum width** (5 feet). The minimum width of 5 feet allows side by side wheelchair passing and is consistent with most sidewalk widths. Sidewalks less than 5 feet wide require a 5 ft. x 5 ft. wide passing space every 200 feet or less. In order to accommodate unavoidable existing width restrictions the PROWAG allows a reduction to not less than 4 feet.

2. **Maximum running slope** (8.3%). The maximum running slope is absolute and therefore a target maximum of 5% to 7% is used to allow for construction inconsistencies. However, the running slope shall not require the ramp length to exceed 15 feet (See Section 6.08.05D "Meeting Existing Sidewalk Grades and Elevations").

3. **Maximum cross-slope** (2.1%). The maximum cross-slope is absolute for ramps at intersections except as stated below. Designers should use a target cross-slope less than the maximum to account for inconsistencies in concrete finishing.

   When resurfacing or reconstructing existing roadways, the ramp cross-slope may be blended to meet existing steeper roadway grades. Significant redesign of an existing cross road to accommodate a ramp cross-slope commonly exceeds the scope of a roadway alteration. The curb ramp cross-slope should be transitioned through the full length of the ramp to minimize abrupt changes. If opportunities within the roadway construction scope of work are available to achieve even partial compliance, they should be pursued.

   For new roadways, the cross-slope of the cross walk must not exceed 2.1% at stop controlled (stop sign) crossings and 5% at signalized and uncontrolled crossings. The cross-slope at mid-block crossings may follow the roadway grade.

4. **Landing -** 5 ft. x 5 ft. minimum, 2.1% max slope in the direction(s) of pedestrian travel. A landing is required at the top of perpendicular ramps. However, if the ramp running slope is less than 5%, it is considered a "blended transition" and does not require a landing. In order to accommodate unavoidable existing width restrictions, the PROWAG allows a reduction to no less than 4 ft. x 4 ft..

5. **Maximum Bottom Counter Slope -** (5% and flush with no vertical lip to the ramp). The maximum counter slope is provided to minimize wheelchair front caster snagging at the bottom of the ramp.

6. **Detectable Warning** - Detectable warnings are truncated domes that serve as surface tactile cues to alert persons with sight disabilities of an upcoming change from pedestrian to vehicular way. The dimensions and location are detailed on Standard Plan R-28-Series.

They are not intended as a way finding device. Square dome alignment within the boundaries of the detectable warning is detailed on the standard plan. However, orientation of the detectable warning surface is relative to placement location. Although preferable, it is not always relative to the direction of travel. Radial alignment is acceptable to match a radial curb alignment.

Detectable warnings are required at the intersection of sidewalks at streets regardless of whether the sidewalk is ramped or flush to the street or shoulder.

In addition to roadway intersections, detectable warnings are also required at mid-block crossings, sidewalk/railroad crossings, and the intersection of sidewalks with controlled commercial driveways (see Section 6.08.05F).

7. **Grade Break Orientation** – The grade break at the curb ramp terminals (top or bottom) should be flush and perpendicular to the direction of travel on the ramp. The objective is to provide a square approach to and from the ramp. The bottom grade break is generally located at the back of curb line for perpendicular ramps. However, it can be located up to 5 feet from one end of a radial curb line in order to maintain a perpendicular orientation (see Standard Plan R-28-Series).

8. **Flared Curb Ramps** - When a sidewalk or pedestrian circulation path laterally crosses the curb ramp, the sides of the curb ramp must be flared with a 10% maximum slope as shown in Standard Plan R-28-Series for Flared Curb Ramps.

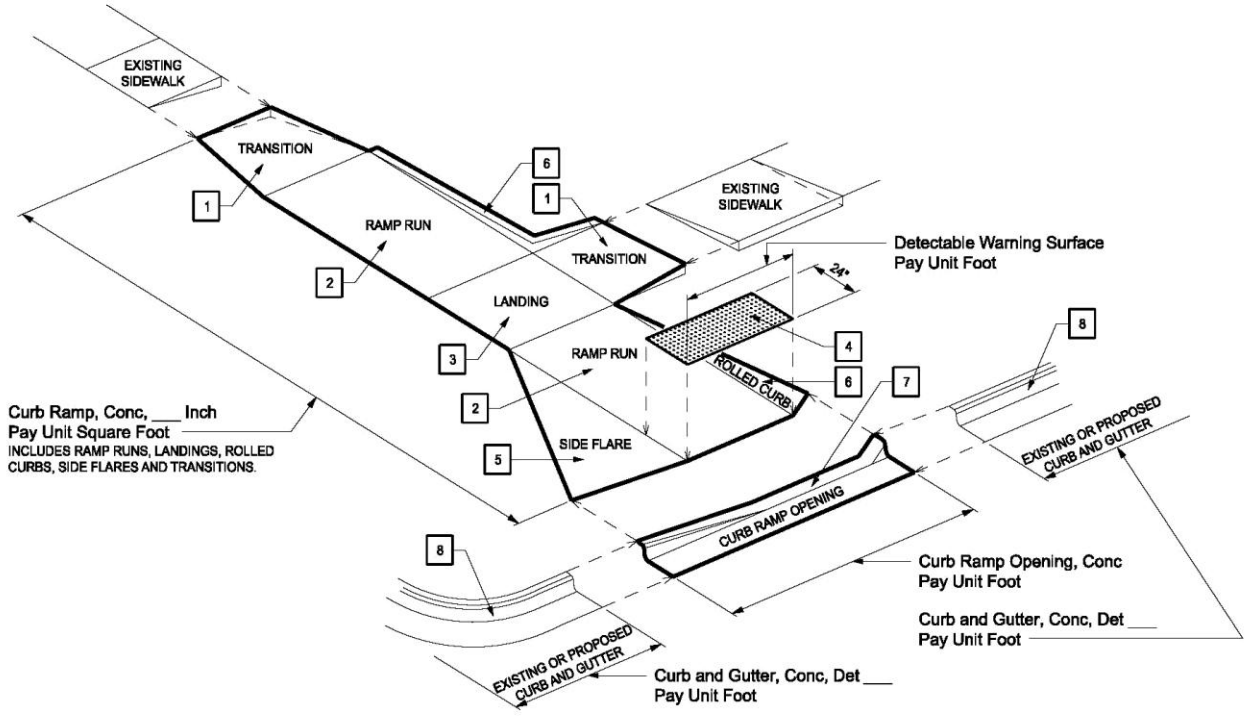
9. **Rolled Curb** - When the side of the ramp borders a non-walking surface such as grass or landscaping or a permanent obstruction, a rolled curb is permitted on the side of the ramp. Rolled curb is not defined as vertical faced or by a specified radius but rather curb not limited by the 10% maximum defined for flared curb. It can be as flat or steep as needed.

10. **Measurement and Payment** - When determining Curb and Gutter, and Curb Ramp Measurements and Payments the following illustration represents the various elements of a curb ramp. It illustrates the breakdown of pay items and their limits of payment.

MICHIGAN DESIGN MANUAL
ROAD DESIGN

Curb Ramp Measurement and Payment Illustration

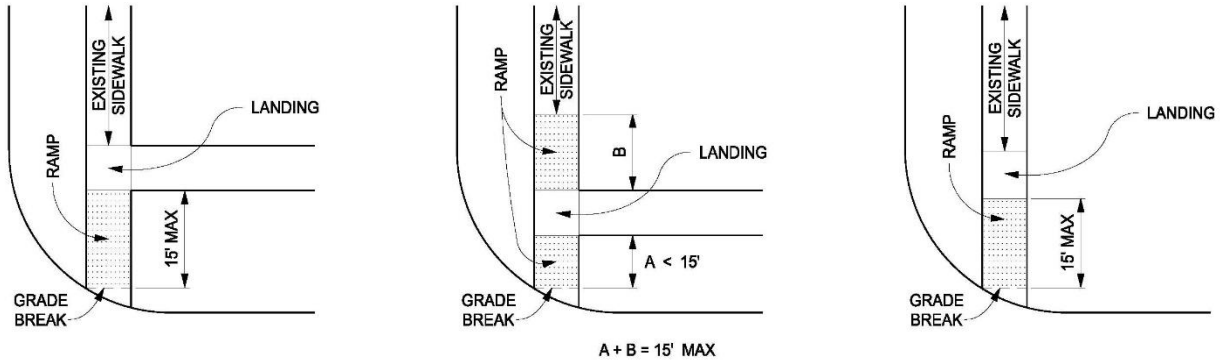
ID	ELEMENT	DESCRIPTION	PAY ITEM
1	TRANSITION	Slab used as needed to transition into existing dissimilar sidewalk cross section (width, depth, cross slopes, etc).	Curb Ramp, Conc, ___ Inch
2	RAMP RUN	Slab(s) carrying ramp running slopes. "RAMP RUN" slabs may combine for a total distance (not including landings and transitions) of at least 15ft. between the back of curb and an existing sidewalk.	Curb Ramp, Conc, ___ Inch
3	LANDINGS	Flat Slab required at the top of perpendicular ramp runs and the bottom of Type P, C and D ramps. See Standard Plan R-28-Series.	Curb Ramp, Conc, ___ Inch
4	DETECTABLE WARNING SURFACE	Truncated dome surface across full width of ramp and 24" minimum in direction of travel.	Detectable Warning Surface
5	SIDE FLARE	1:10 maximum transition flares along walkable surface perpendicular to ramp runs.	Curb Ramp, Conc, ___ Inch
6	ROLLED CURB	Rolled curb (no maximum rate) along non-walkable surfaces adjacent to ramp runs. Also used for ramp infield grading retention up to 18 inch height.	Curb Ramp, Conc, ___ Inch
7	CURB RAMP OPENING	Flattened curb and gutter at ramp opening including transitions to and from full height curb and gutter cross section.	Curb Ramp Opening, Conc
8	CURB AND GUTTER	Full height curb and gutter. Paid separately when called for on the plans.	Curb and Gutter, Conc, Det ___



6.08.05D Meeting Existing Sidewalk Grades and Elevations

Sidewalk grades generally tend to follow the grade of the bordering street. When the existing sidewalk grade is steep, it becomes more difficult to comply with the maximum curb ramp running slope of 8.3% without “chasing grade” to meet the existing sidewalk. In some cases it results in an infinite run. Excessive ramp runs might also result when the existing sidewalk is at a significantly higher elevation than the adjacent road.

When this occurs, the maximum running slope may be exceeded in order to limit the ramp length(s) to not more than 15 feet measured from the ramp grade break. The need to exceed the maximum slope must be documented (See Section 6.08.05E). The 15 feet limit on ramp length does not include the landing or transition slabs to tie into the existing sidewalk. Three examples are illustrated:



Unlike other maximum dimensions, the 15 feet limit is not absolute. If compliance with the maximum running slope (8.3%) can be achieved by extending the ramp by one or two flags of sidewalk beyond the 15 feet limit, it should be considered within feasible limits.

A landing is required at the top of perpendicular ramps. However, if the ramp running slope is less than 5%, it is considered a “blended transition” and does not require a landing.

6.08.05E Accessibility Constraints

When it is infeasible to meet all standard compliance elements, meet the standards to the maximum extent feasible. The curb ramp elements are not listed in any order of preference or importance. Order of importance may vary for each site location. Documentation of infeasibility is not applicable for new roadway construction where full standard compliance must be achieved.

A strict definition of “feasible” is not provided since the potential circumstances for each installation is limitless. Some circumstances of infeasibility are clear such as impacts on structural integrity of surrounding features, or an inability to adapt to existing immovable or unalterable conditions. Other circumstances such as real estate limitations and historic preservation can also represent infeasibilities.

While cost is not itself an acceptable argument for noncompliance, scope can be a prevailing factor. If certain significant efforts required to meet the standards are not otherwise called for in a project, it may be an infeasibility. Examples would be utility relocation or the acquisition of Right-of-Way for a roadway alteration project. If utility relocation or Right-of-Way acquisition is not required in the project for any other reasons, then it is preferred but not required that the same efforts be made solely for ADA compliance. See Section 5.05.02 for more information on fee, easement and consent requirements for sidewalks.

Provide safe refuge for the pedestrian (when possible) when full compliance is infeasible and compromises are necessary. Flush transitions and flatter entrances or a marked refuge area in the pavement allows persons in wheelchairs to leave the vehicular way prior to traversing possible steeper ramp grades or cross-slopes that result from infeasibility.

Follow engineering judgment when determining the correct balance to provide maximum extent feasible. Compromises may be needed for more than one standard element. If full compliance is infeasible, strive for maximum overall improved accessibility. Do not overcompensate to favor one element. Over emphasis on a single element may cause a reduction in overall accessibility in comparison to the original condition.

Document accessibility constraints using MDOT Form 0370 ADA Statement of Accessibility Constraints. The documentation should include location, non-compliant element(s), reason(s) for infeasibility and maximum extent feasible. Complete, review, and stamp the Form 0370 by the Designer (MDOT Design or a consultant) and the MDOT Project Manager, respectively, to document design decisions using the “Reviewed” stamp. Note: When this arrangement is unable to be facilitated, or when the Designer and MDOT Project Manager are the same individual, identify a different reviewer (i.e. the Associate Region Engineer – Development or the Project Manager’s supervisor) to stamp the form, as appropriate.

Retain Form(s) 0370 ADA Statement of Accessibility Constraints in the “ADA Documentation” folder within ProjectWise per MDOT record retention requirements as justification to address possible future inquiries and/or claims. Send an email (including the ProjectWise Project folder link) to MDOT-ProjectWise@michigan.gov requesting the “ADA Documentation” folder be created in ProjectWise. This folder will be utilized by MDOT teams and applicable external Design and Construction teams and has been configured to comply with the record retention schedule of all documents contained within. Place each Form 0370 within this folder with the following file name format: “0370_‘Location’_YYYY-MM-DD”. For example, “0370_28th St & M-96 SW_2020-07-13.pdf.”

6.08.05F Driveways

When project work alters a driveway that crosses a sidewalk or alters the sidewalk abutting a driveway, the crossing through that driveway must be ADA compliant. Sidewalks are normally continuous through residential driveways and don't require either curb ramps or detectable warnings. However, commercial driveways with curbed returns may present a barrier that requires a curb ramp.

Detectable warnings at commercial driveways are only used when the crossing is signalized or stop controlled with a regulatory stop sign. When this level of traffic control is needed, the driveway presents more of a street-like encounter for persons with sight disabilities and therefore warrants detectable warnings. Otherwise only the curb ramp is required. Overuse of detectable warnings cause misinformation for persons with sight disabilities.

The path crossing through the driveway must meet the standards for sidewalks including width, slope and cross-slope. If continuous sidewalk construction or reconstruction is not in the scope of work, a short transition may be required to meet the existing sidewalk cross-section at either end of the driveway crossing.

6.08.05G Curb Ramp Location

Federal Code 28 CFR, Part 36 states;

"4.7.1 Location. Curb Ramps complying with 4.7 shall be provided wherever an accessible route crosses a curb."

As stated earlier in this section, there are few permitted reasons not to provide curb ramps where a sidewalk crosses a curb. The absence of signals or marked crossings is not sufficient justification to exclude a curb ramp.

However, there are some circumstances, both obvious and obscure, that may affect the determination of curb ramp need and location.

- **Absence of Sidewalk**

  In most cases the absence of sidewalk (existing or planned) coincides with exemption from the requirement to provide curb ramps. The ADA does not require the installation of ramps or curb ramps in the absence of a pedestrian walkway with a prepared surface for pedestrian use. The ADA also does not require the provision of sidewalk where none currently exists. However, certain circumstances may require some minimum treatment for a quadrant without sidewalk.

  The installation or presence of a pedestrian signal (whether pedestrian activated or not) suggests implicit intent of pedestrian travel. Accessibility from the road to a pedestrian activated signal would be required despite the absence of sidewalk. This may include curb ramps and an accessible path to a level surface at the push button. Where signals are not pedestrian activated and sidewalks are not present, the vertical portion of any curb should be gapped to provide a minimum 5 feet wide clear opening to the implied path. See Section 6.08.05H for information on Traffic and Pedestrian Signals.

- **Evidence of Pedestrian Travel**

  Where sidewalk is not provided or planned at either side of a street crossing but there is evidence of pedestrian travel (worn path), a curb ramp is not required. However, the vertical portion of any curb should be gapped to provide a minimum 5 feet wide clear opening to the path.

- **Prohibited Crossings**

  Where a sidewalk meets a road and pedestrian crossing is prohibited, a curb ramp is not required at either side of the road. The end of the sidewalk should be delineated by both visible and tactile cues. A sign should be provided prohibiting crossing for all pedestrians. The tactile cue must be either detectable by cane or foot. A barrier approximately six inches in height can be detected by cane. Since a barrier is not always practical or context sensitive, a planted or gravel strip between the end of the sidewalk and the curb can serve as a tactile indication of the end of the pedestrian path. The strip should have a minimum dimension of two feet in the direction of travel.

- **Detrimental Crossings**

  As previously stated, the absence of cross walk markings or signals does not imply an exemption for the provision of curb ramps. However, even where crossing is not expressly prohibited but is clearly not intended, circumstances may make it prudent to exclude ramps leading to undesirable crossing points. As with prohibited crossings, it may be desirable to end the sidewalk by separating it from the curb with a planted or gravel strip to provide underfoot detection of the path's end.

  Examples of undesirable crossing situations are at mid-block locations or three legged intersections where crossings may lead to or near driveways. Turning traffic from driveways may not expect pedestrians where a crossing is not clearly marked. The same may also be true where cross roads are slightly jogged across the mainline roadway. An unmarked crossing that is offset too far from an intersection may cause a hidden vehicle/pedestrian conflict.

  Logical crossing opportunities should be selected at reasonable intervals that provide safer direct corner-to-corner crossing. It may be acceptable at times to direct pedestrians to a safer alternate quadrant or nearby intersection.

  When evaluating crossing intent, high consideration should be given to providing ramped crossings to public service destinations such as public transit stops, schools, hospitals, libraries, post offices, etc.

6.08.05H Traffic and Pedestrian Signals

While signal maintenance does not warrant a curb ramp upgrade, new signal installation might. Circumstances requiring curb ramp installation or upgrade in conjunction with signal installation include:

- Alteration to existing sidewalk/curb ramp.
- Absence of a curb ramp where a sidewalk is curbed at the street intersection.
- Absence of a curb ramp where a crossing is served by a pedestrian signal (with or without sidewalk).

See Section 6.08.05G for signal accessibility in the absence of sidewalk.

Existing ramps may remain in place without upgrade if they are not otherwise altered by the signal work.

For roadway alteration projects without signal work, consideration should be made to improve accessibility to push button signals. If the curb ramp is to be upgraded, designers are encouraged to extend paving to provide access to pedestrian activated signals where access is not currently provided.

Curb ramp construction should not reduce the existing level of accessibility of the existing pedestrian signal.

ADA requirements for pedestrian push button signals are addressed separately in Traffic and Safety standards and guidelines. ADA requirements for signal upgrading apply in conjunction with alterations to external components of the signal. Sidewalk or curb ramp construction alone does not activate a requirement to upgrade the signal.

6.08.06 Building Entrances

(revised 11-27-2023)

When constructing or reconstructing a public sidewalk, access to adjacent buildings might be impacted. Adjusting grade or cross-slope on the sidewalk can change or compromise connectivity to adjacent buildings.

Accessibility requirements and responsibilities differ between public and private entities. In general, access to buildings that abut or encroach on the public Right–of-Way is the responsibility of the building owner. The building owner is accountable for accessibility under Title III of the ADA if the building provides services or accommodations to the public. When constructing sidewalks, the Department’s responsibility is to construct sidewalks and street crossings compliant with the ADA under Title II. Private residences that do not serve the public are not regulated by the ADA.

While the building owner is responsible for ADA compliance, the building owner may be entitled to restitution or compensation under the Uniform Relocation Act (URA) of 1970. When obtaining the Consent to Construct Sidewalk, Region Real Estate should discuss both temporary and permanent access with the property owners. See Section 5.05.02.

6.08.06A Building Access Alterations

When steps or ramps are removed or altered by sidewalk construction, The Department will offer to reconstruct or restore them. To promote accessibility, the proposed replacement will be one that is compliant with ADA Title III to the extent feasible. The designer should consult the Roadside Development Unit for ADA building access requirements and accessibility options. The work necessary to make the facility accessible is eligible for federal participation.

The Department is not a Title III enforcement agency. If a property owner refuses a compliant replacement, the Department will honor the owner's preference and document the refusal. When an owner's preference of steps over ramps is accommodated, ADA guidelines for steps will be followed to the extent feasible.

The feasibility of accommodating private access will be based largely on structural and spatial limitations. If the installation of an ADA-compliant private access compromises the accessibility of the sidewalk, this may be a basis for a determination of infeasibility for full compliance of the building access.

In all cases, replaced access to a building entrance must not be made less accessible than the previous existing condition. If restoration to the existing level of accessibility is infeasible, the building owner may be entitled to compensation for the loss of the entrance. The compensation would be a Real Estate action and ADA compliance remains the owner's responsibility.

Existing building access can also be replaced by the property owner, under the provisions of existing permits, without action by MDOT. New installation of stairs/ramps undertaken by the property owner in public Rights-of-Way would require a permit. In all cases, stairs/ramps once constructed become the responsibility (ownership and maintenance) of the private property owner.

6.08.06B Historic Buildings and Districts

Historic Preservation laws must be taken into consideration when altering access to a building entrance. The replaced access must not threaten or destroy the historic significance of buildings or districts. Historic preservation requirements supersede ADA requirements and may constitute an ADA compliance technical infeasibility.

Obtaining permanent easement or fee purchase in order to meet ADA requirements in an historic district is considered a threat to historic significance. Therefore, any alterations must be made within the Right-of-Way or by obtaining consent to construct sidewalk. See Section 5.05.02 for consent to construct sidewalk.

If buildings appearing to be 50 or more years in age are located on the project, contact the appropriate Historian in the Bureau of Development Environmental Services Section early in the planning/scoping process. If the Historian verifies historic properties or districts are present, a determination of impact will be made. Designers should work with the MDOT Historian and the Roadside Development Unit to ensure the viability of alternatives and to gain consensus on the strategy to maximize accessibility. An on-site review with all stakeholders held early in the process can expedite the resolution of conflicts. Depending on the severity of the impact, the Historian may need to subsequently coordinate with the State Historic Preservation Officer (SHPO) to assess the impact and discuss alternatives.

6.09 PAVEMENT CROWNS AND CROSS-SLOPES

6.09.01 Department Practice

The Department uses the 2% crown slope shown on Standard Plan R-107-Series, with the high point of pavements located as follows:

- 2 or 4 lanes undivided locate at center
- 5 lanes undivided locate at the edge of an inside lane
- 4 or 6 lanes divided locate one lane in from the outside
- one way (ramp) locate at one edge

The same crown is used for both concrete and HMA pavements.

Occasionally, a local agency will request a different crown for a road that will eventually be under its jurisdiction. The Department attempts to comply with these local agency requests.

Bridges are normally crowned at the same cross-slope as the road, subject to local preference, when applicable.

The high point should always be at a lane line. Designers working on projects involving some older freeways built in the era from the middle 'fifties to about the middle 'sixties will encounter the high point in the middle of a lane. (Some 24-foot pavements had the high point located 6 feet from the median edge, a provision for the addition of a future third lane on the median side.)

6.09.02 Crown Modification in Urban Areas

Sometimes, in the reconstruction of urban streets, it is necessary to tilt the pavement to meet sidewalks and other side controls. Or, when the area is very flat, the pavement cross-slope must be varied to achieve minimum gutter grades steeper than the nominal grade of the road centerline. The following basic approaches are available to avoid causing flat spots.

The crown can be modified by offsetting the high point from the centerline to another point on the cross-section. The cross-slope can be varied according to Section 3.04. The HMA pavement can be milled or partially milled to establish the desired crown. Or, a combination of these methods may be used.

In any case, the designer should study the independent gutter grades and other side controls to determine the best method of modification to the crown. Consult the Geometrics section of the Design Division for crown modification.

6.09.03 Crown in Superelevation

Crown in superelevation should be modified as shown on Standard Plan R-107-Series. Generally, crown or adverse cross-slope is eliminated in superelevation. Many older pavements, particularly those of concrete, will be encountered where the crown was retained throughout the curve. This was a concession to paving equipment of the era that did not possess the capability of in-motion adjustment of the screed.

6.10 PAVEMENT SURFACE TEXTURE

6.10.01 Friction Number

The Department has a program for testing the friction levels of all state trunkline pavements, with particular attention given to those locations experiencing a greater than normal rate of wet pavement crashes. Testing is done by using a calibrated trailer, usually traveling at 40 mph, with brakes locked, on a wetted surface. Results are in the form of a friction number that may vary between the approximate extremes of 0.10 and 0.80, the higher values representing higher friction levels.

Generally, friction numbers from different states cannot be directly compared, although they will appear to be similar. The FHWA has made an attempt at standardization by constructing a field test and evaluation facility in Ohio, to which the states are invited to bring their equipment for calibration.

6.10.02 Conventional Methods of Creating Pavement Texture

Concrete pavements were formerly textured by means of a burlap drag during the paving process. This texture did not last long so the current method of transverse wire tining evolved, though burlap or Astroturf may still be used ahead of the tining. The rather deep grooves lengthen the effective life of the texturing.

For vehicles traveling at low speeds, the most skid resistant HMA pavements are those having a "sandpaper" texture obtained by using hard, sharply pointed fine and coarse aggregate. Unfortunately, these materials are not plentiful, so trade-offs are made incorporating coarse aggregates for durability and locally available fine aggregates for economy. Coarse aggregates with a high tendency to polish are avoided for top course surfaces on high-traffic volume HMA pavements. (See Section 6.03.10D) For vehicles traveling at highway speeds, both sandpaper and coarse textures are important. Coarse texture is provided by control of aggregate gradation.

6.10.03 Pavement Grooving

(revised 9-27-2021)

Sawed pavement grooves 0.12 inch (±0.03 inch) wide by 0.16 inch (±0.03 inch) in depth and 0.75 inch (±0.05 inch) apart may be either transverse or longitudinal. The problem that they are to alleviate determines the groove direction. Although the tendency to hydroplane may be reduced by grooves oriented in any direction, longitudinal grooves are almost always used because of their lower cost. The grooves provide space for water to exit under pressure of the vehicle tire, in effect compensating for the lack of tread on a smooth tire. Transverse grooves are used principally at signalized or "stop" intersections to provide a better gripping surface. They also produce a different tire noise that serves as an audible warning to the driver, at the approach to the intersection.

A special provision 20SP-603A is available that uses the pay item "Longit Grooving of Conc Pavt", measured in square yards, based on the full width of the pavement.

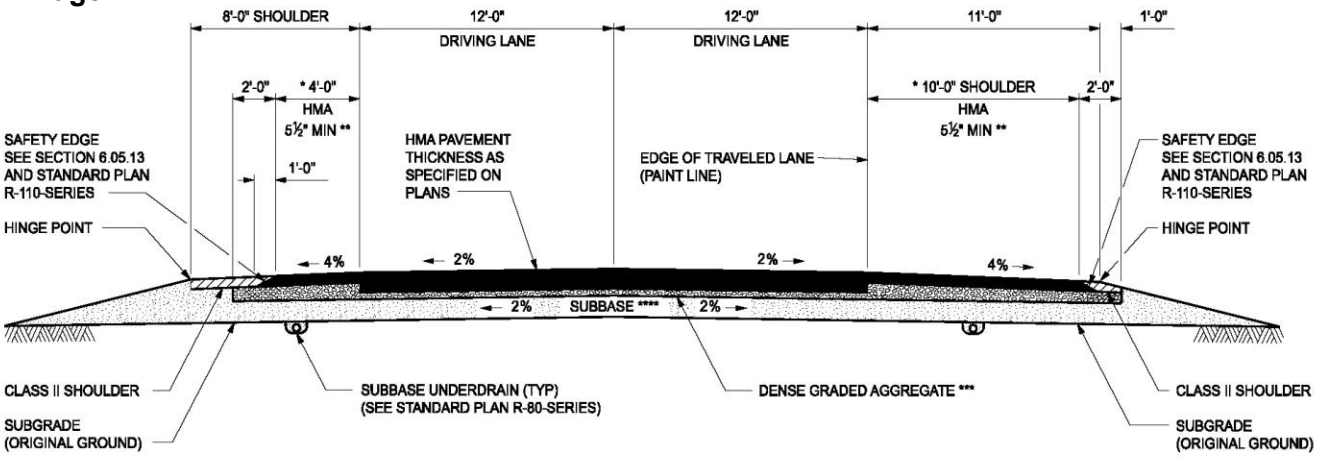
6.10.04 Cold Milling / Diamond Grinding

(revised 9-27-2021)

Skid resistance can be improved by cold milling HMA pavement or diamond grinding concrete pavement, removing only enough material to roughen it. The cost effectiveness of cold milling HMA pavements, for the purpose of increased skid resistance can vary but is usually low because of the "healing" properties of asphalt. Therefore, cold milling of HMA pavements for texture is a treatment MDOT no longer performs. If a friction issue exists on a HMA pavement it should be addressed with a micro-surface or other surface treatment.

APPENDIX 6-A

Page 1



* SEE CHAPTER 3, APPENDIX 3A FOR LEFT (MEDIAN) AND RIGHT (OUTSIDE) SHOULDER WIDTH GUIDELINES.

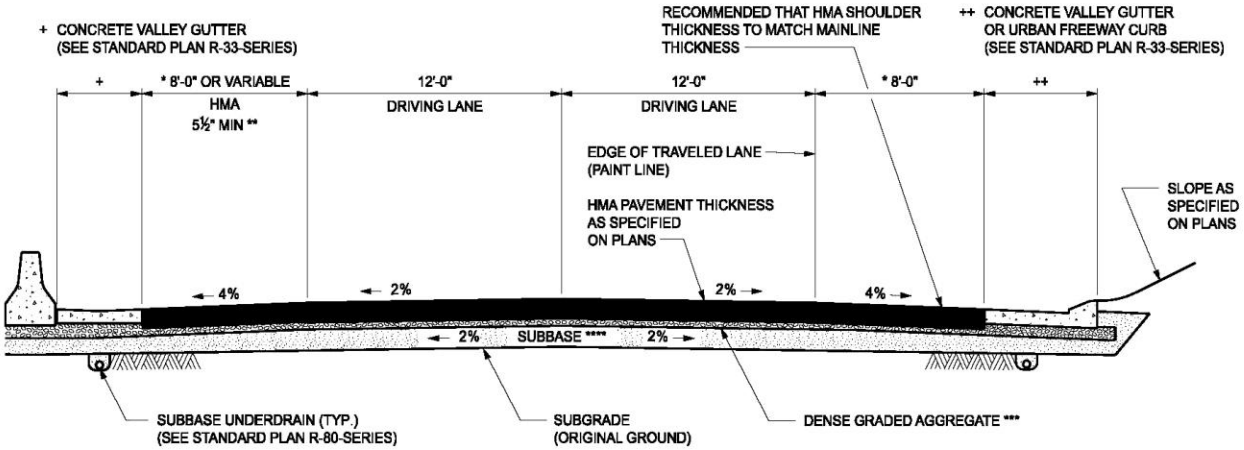
** SHOULDER THICKNESS DETERMINATION MUST ALSO FOLLOW OTHER DEPARTMENT GUIDELINES INCLUDING THE HMA MIXTURE AND SELECTION GUIDELINES.

*** TYPICALLY, 6" DENSE GRADED AGGREGATE OR 16" OPEN-GRADED DRAINAGE COURSE IN METRO REGION.

**** TYPICALLY, 18" SAND SUBBASE OR 8" SAND SUBBASE IN METRO REGION.

RURAL FREEWAY WITH HMA PAVEMENT

(SHOWN WITH OPEN DRAINAGE AND PARTIAL DEPTH SHOULDERS)



* SEE CHAPTER 3, APPENDIX 3A FOR LEFT (MEDIAN) AND RIGHT (OUTSIDE) SHOULDER WIDTH GUIDELINES.

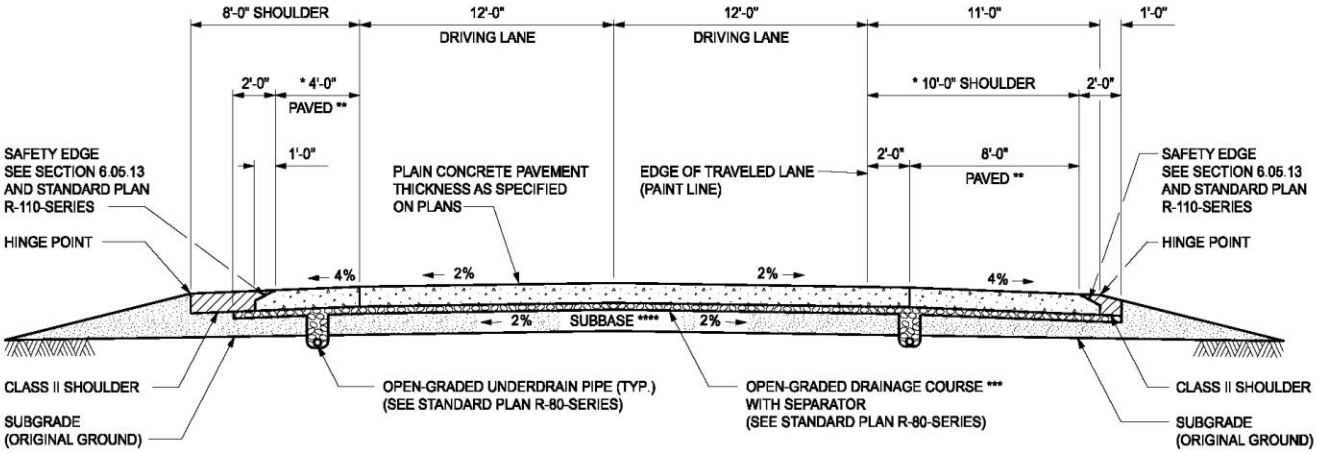
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URBAN FREEWAY WITH HMA PAVEMENT

(SHOWN WITH ENCLOSED DRAINAGE SYSTEM, CONCRETE MEDIAN BARRIER INSIDE AND URBAN FREEWAY CURB OUTSIDE)



* SEE CHAPTER 3, APPENDIX 3A FOR LEFT (MEDIAN) AND RIGHT (OUTSIDE) SHOULDER WIDTH GUIDELINES.

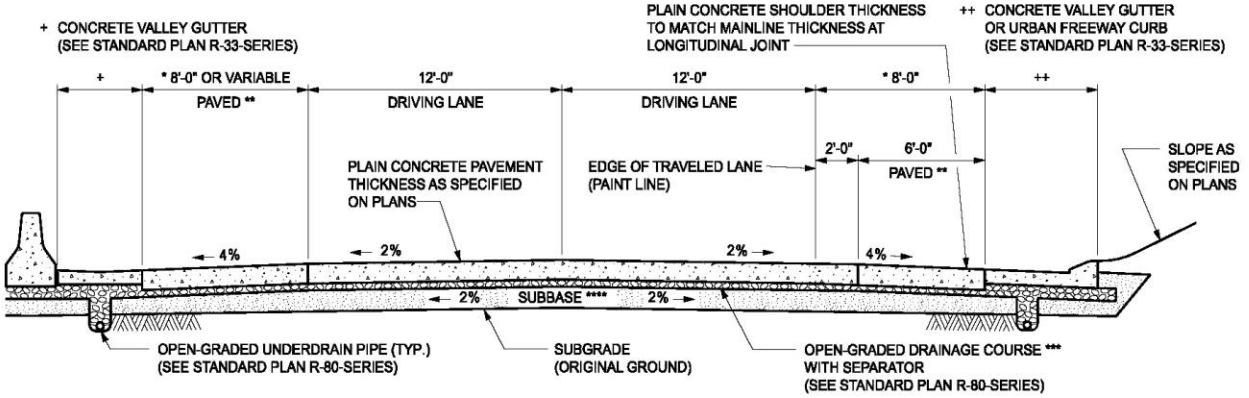
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**** TYPICALLY, 10" SAND SUBBASE OR N/A IN METRO REGION.

RURAL FREEWAY WITH PLAIN CONCRETE PAVEMENT

(SHOWN WITH OPEN DRAINAGE, WIDENED SLAB, AND FULL-DEPTH SHOULDERS



* SEE CHAPTER 3, APPENDIX 3A FOR LEFT (MEDIAN) AND RIGHT (OUTSIDE) SHOULDER WIDTH GUIDELINES.

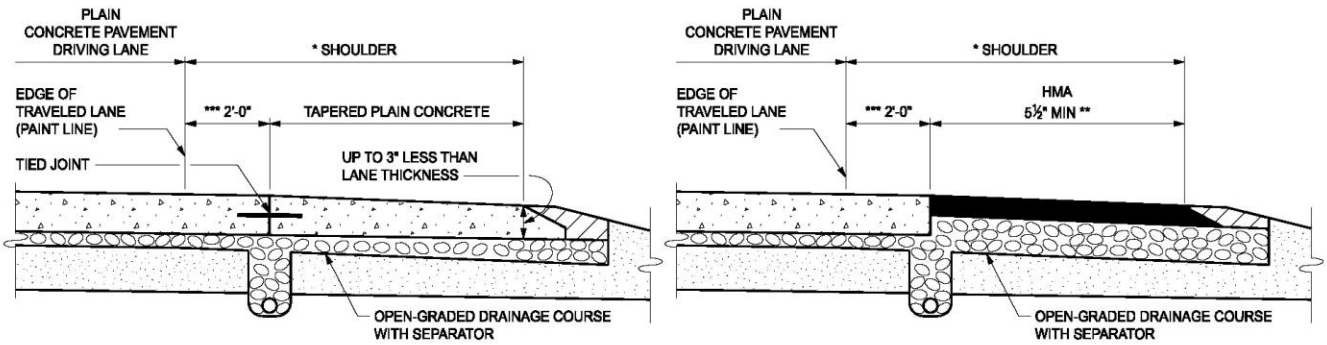
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URBAN FREEWAY WITH PLAIN CONCRETE PAVEMENT

(SHOWN WITH ENCLOSED DRAINAGE SYSTEM, WIDENED SLAB, FULL-DEPTH SHOULDERS, CONCRETE MEDIAN BARRIER INSIDE AND URBAN FREEWAY CURB OUTSIDE)



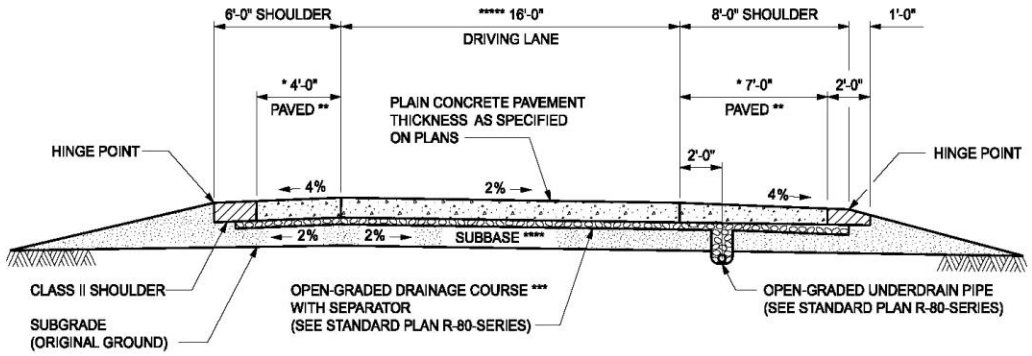
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WIDENED SLAB FREEWAY SHOULDER OPTIONS

(OUTSIDE SHOULDER SHOWN WITH PARTIAL DEPTH SHOULDERS)



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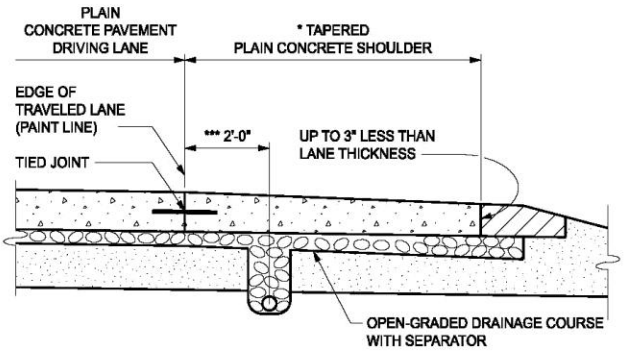
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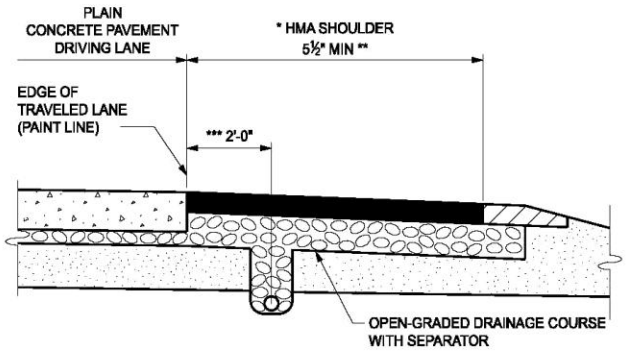
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**** TYPICALLY, 10" SAND SUBBASE OR N/A IN METRO REGION.

***** FOR LOCATION OF LONGITUDINAL JOINT, SEE STANDARD PLAN R-42-SERIES. TYPICALLY, 10" SAND SUBBASE OR N/A IN METRO REGION.

RAMP WITH PLAIN CONCRETE PAVEMENT
(RURAL AND URBAN)



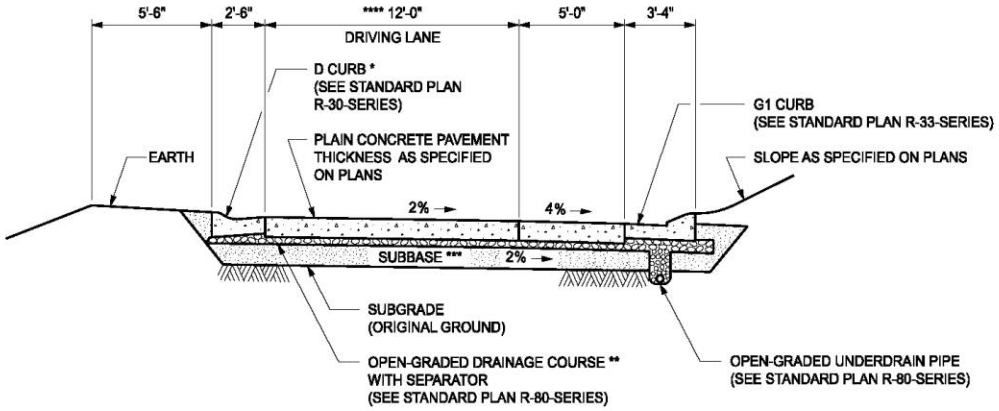


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FREEWAY RAMP SHOULDER OPTIONS
(OUTSIDE SHOULDER SHOWN WITH PARTIAL DEPTH SHOULDERS)



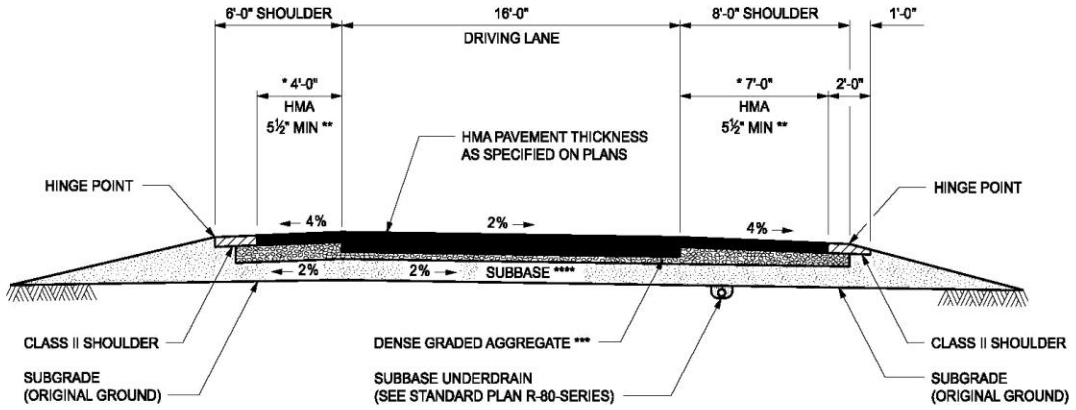
* IF A SLIP RAMP APPROACHES A SLIP RAMP STRUCTURE, TRANSITION TO G1 OR G2 CURB TO MATCH BRIDGE SHOULDER WIDTH.

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URBAN SLIP RAMP WITH PLAIN CONCRETE PAVEMENT



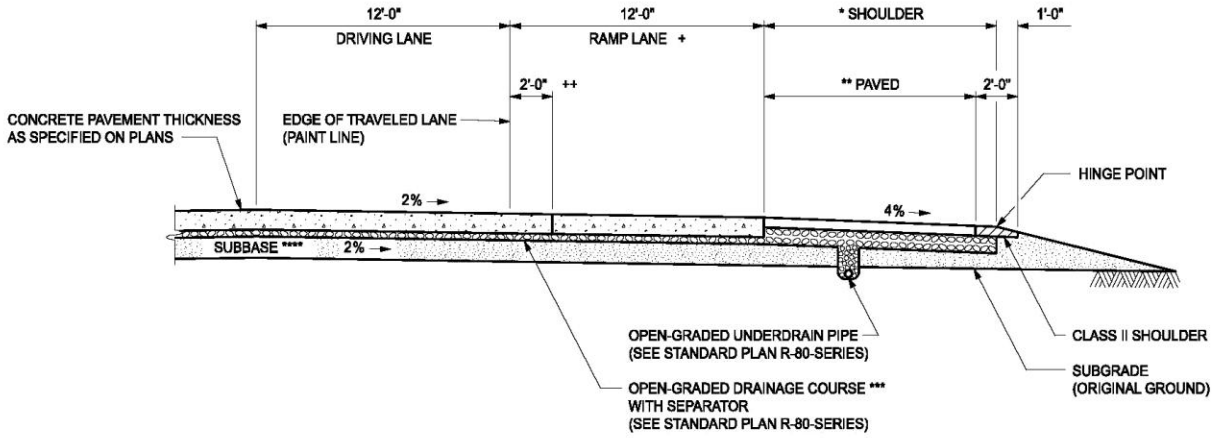
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RAMP WITH HMA PAVEMENT
(RURAL AND URBAN)



* SEE CHAPTER 3, APPENDIX 3A FOR LEFT (MEDIAN) AND RIGHT (OUTSIDE) SHOULDER WIDTH GUIDELINES.

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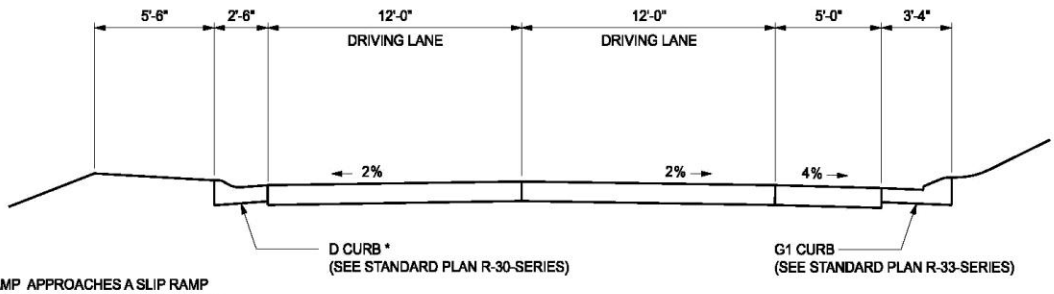
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FREEWAY WITH PLAIN CONCRETE PAVEMENT AND RAMP LANE
(RURAL AND URBAN)

† RAMP (ACCELERATION / DECELERATION) LANES ARE DESIGNED ACCORDING TO THE DEPARTMENT'S GEOMETRIC DESIGN GUIDES. THE RIGHT EDGE OF THE FREEWAY DRIVING LANE IS CONSIDERED TO BE THE EDGE OF TRAVELED LANE (PAINT LINE) WHEN REFERRING TO THE GEOMETRIC DESIGN GUIDELINES.

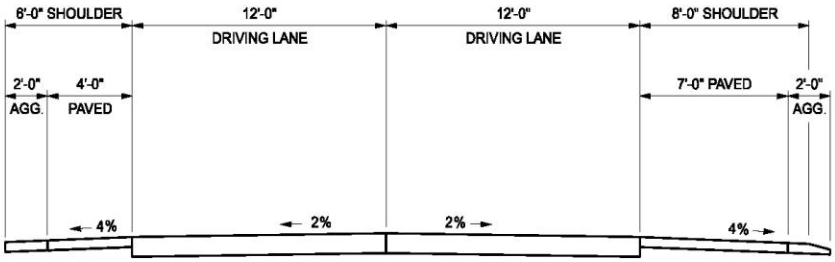
†† SLAB EXTENSION 0'-0" TO 2'-0". SEE SECTION 604.04F(6) FOR AUXILARY LANES.



* IF A SLIP RAMP APPROACHES A SLIP RAMP STRUCTURE, TRANSITION TO G1 OR G2 CURB TO MATCH BRIDGE SHOULDER WIDTH.

DIMENSIONS FOR A TWO LANE SLIP RAMP

(SEE SINGLE LANE SLIP RAMP DRAWING OF APPROPRIATE PAVEMENT TYPE FOR OTHER DETAILS)



DIMENSIONS FOR A TWO LANE RAMP (RURAL AND URBAN)

(SEE SINGLE LANE RAMP DRAWING OF APPROPRIATE PAVEMENT TYPE FOR OTHER DETAILS)

NOTES:

THIS GUIDE FOR FREEWAYS SETS GUIDELINES FOR FREEWAY CROSS SECTIONS. THE ACTUAL DESIGN AND MATERIAL USED TO CONSTRUCT THE COMPLETE ROADWAY SECTION WILL BE ACCORDING TO THE PLANS AND CURRENT SPECIFICATIONS.

SEE STANDARD PLAN R-107-SERIES FOR CROSS SLOPES ON SUPERELEVATED PAVEMENTS.

SHOULDER CORRUGATION CROSS-SECTIONS AND LOCATION SHALL BE AS DETAILED ON STANDARD PLAN R-112-SERIES.

FOR URBAN ROADWAYS, IF THE CURB & GUTTER IS RESTRAINED ON THE OUTSIDE BY A RETAINING WALL, ABUTMENT, OR SLOPE PAVING HEADER, PLACE A 1" EXPANSION JOINT FILLER BETWEEN THE CURB & GUTTER OR VALLEY GUTTER AND THE STRUCTURE. SEE STANDARD PLAN R-33-SERIES.

WHEN CONCRETE SHOULDERS ARE CAST SEPARATELY FROM MAINLINE CONCRETE PAVEMENT, A KEYWAY MAY BE USED TO FACILITATE THE PLACING OF LANE TIES. WHEN A KEYWAY GROOVE IS USED, IT SHALL BE CONTINUOUS AND UNIFORM.

THE LOCATION OF TRANSVERSE JOINTS IN CONCRETE SHOULDERS SHALL MATCH THE LOCATION OF ADJACENT TRANSVERSE PAVEMENT JOINTS.

CORRESPONDING TRANSVERSE JOINTS IN PLAIN CONCRETE SHOULDERS TIED TO PLAIN CONCRETE PAVEMENT SHALL BE (C3p) SHOULDER WITH (Cp) PAVEMENT, (C4) SHOULDER WITH (C2) PAVEMENT, (E4) SHOULDER WITH (E2) PAVEMENT, AND (E3) BEING THE SAME IN BOTH SHOULDER AND PAVEMENT.

SEE STANDARD PLAN R-39-SERIES FOR DETAILS OF TRANSVERSE PAVEMENT JOINTS.

ALL CONCRETE SHOULDER SLABS ADJACENT TO BRIDGE STRUCTURES SHALL BE REINFORCED AS SPECIFIED ON STANDARD PLAN R-45-SERIES.

MICHIGAN DESIGN MANUAL
ROAD DESIGN

CHAPTER 7

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CHAPTER 7

APPURTENANCES

7.01

ROADSIDE SAFETY BARRIERS

7.01.01 (revised 4-24-2023)

References

A. ***A Guide to Standardized Highway Barrier Rail Hardware***, AASHTO-AGC-ARTBA Joint Committee, 1995

B. ***Roadside Design Guide,*** AASHTO, 2011, 4th edition

In addition, there are a number of National Cooperative Highway Research Program (NCHRP) research publications and reports of the major research and testing agencies that are available either within the Design Division or in the Transportation Library.

7.01.02 (revised 10-22-99)

Application of Section 7.01

In writing this portion of Chapter 7 it should be noted that the concepts presented will not necessarily be considered as absolutes to be rigidly adhered to, but will be considered as an aid to enhance the engineering judgement of the designer. Even when the word "should" is used, it is recognized that there may be circumstances unique to a situation that will suggest, or even dictate, alteration of a recommended treatment.

It is also intended that the barrier treatments recommended will be applicable to state trunkline projects and not necessarily to local government projects, except as local agencies wish to incorporate them.

7.01.03 (revised 8-21-2017)

History of Guardrail and Barrier in Michigan

The practice of placing an artificial obstruction to prevent an errant vehicle from going down a steep embankment or into an area of water probably originated in the 1920's in the form of a line of posts placed at the edge of the shoulder. At some point in time the system was improved by the addition of connecting planks, which in turn were replaced by a more maintenance-free system of two steel cables. This design is illustrated on the old E-4-A-75 Series of standard plans. Following World War II some metal beam designs were introduced. One that found limited use in Michigan was the Tuthill Highway Guard, a convex smooth steel beam, 12" wide, fastened to spring steel supports, which were mounted on either wood or steel posts. In the early 1950's the concept of a metal beam was further refined with the introduction of the W-beam with the two corrugations that are essentially what we are familiar with today.

7.01.03 (continued)

History of Guardrail and Barrier in Michigan

Initially, the W-beam was not galvanized and had to be painted. The next step was to galvanize it for more economical maintenance.

The first installations of W-beam rail involved attaching the beam element directly to posts placed 12'-6" on centers, at a top of rail height of 24". This design later became known as our Beam Guardrail - Type A. Research and crash testing in the late 1950's and early 1960's, principally by the state of California and by General Motors at its Milford Proving Grounds, produced the recommendations of closer post spacing, (6'-3"), blocking out the beam from the post, and a higher top of rail mounting height. This resulted in Michigan's development of our Beam Guardrail - Type C in 1965, and Beam Guardrail - Type B in 1966. A significant change in guardrail type in Michigan occurred in 1984 with the adoption of thrie beam, now called Guardrail, Type T. The most recent change occurred in 2017 with the adoption of the MASH-compliant, non-proprietary, 31" tall w-beam guardrail system with 8" offset blocks, called Guardrail, Type MGS-8.

Until 1995, four basic end treatments had been used in conjunction with steel beam guardrail. Initially, a curved end shoe was placed on both ends of the run. The concept of turning down or burying the ending to form an anchorage was developed about 1966. The first standard plan to be approved by what was then the Federal Bureau of Public Roads was issued in 1968. A variation of the turned down ending, featuring the elimination of the first two posts (so the ending would collapse under impact) appeared in 1971 with the issuance of Standard Plan III-65A.

7.01.03 (continued)

The Breakaway Cable Terminal (BCT) ending was adopted in 1973 with the issuance of Standard Plan III-58A. After 22 years as the standard guardrail terminal in most states, the FHWA disallowed further installation of the BCT on the National Highway System (NHS) after December 31, 1995. This, along with the adoption of new crash testing criteria (NCHRP 350) ended the use of the BCT as well as other traditional un-patented endings.

This initiated the development and use of a number of proprietary terminals. The Department has divided these terminals into two basic categories of flared gating terminals and tangent terminals. Current standard designs are described in Section 7.01.25 along with other designs previously used.

Development of concrete barrier in this country, principally concrete median barrier having the concave safety shape, is generally attributed jointly to General Motors and to the state of New Jersey, both of whom conceived shapes that bear their names. Michigan's first concrete barrier was on the DeQuindre Yard bridge, on I-94 in Detroit, in 1965. Although the New Jersey shape was used in this initial installation, the GM shape was adopted as standard. In 1976 the New Jersey shape became the standard and was used until 2017 when the single slope shape was adopted.

7.01.04

Section deleted

7.01.05 (revised 4-24-2023)

Basic Concepts for Roadside Control

The following are basic concepts and design options for the use or non-use of roadside barriers. The primary sources of information for roadside control are found in the AASHTO documents listed in Section 7.01.01, "References".

A. A collision with a roadside barrier is considered a crash, because the barrier itself is a roadside obstacle.

B. A roadside barrier may increase the frequency of crashes, therefore a barrier should only be installed if it will reduce the severity of potential crashes.

C. When considering the design options for roadside treatment and the progression of design options basic concepts for roadside control should be as follows.

1. Remove the obstacle or redesign it so it can be safely traversed.

2. Relocate the obstacle to a point where it is less likely to be struck.

3. Reduce impact severity by using an appropriate breakaway or traversable device.

4. Redirect a vehicle by shielding the obstacle with a longitudinal traffic barrier and/or crash cushion.

5. Delineate the obstacle if the above alternatives are not appropriate.

D. Generally, a roadside barrier should be placed as far from the traveled way as conditions will permit. See Section 7.01.30G.

E. Compared to parallel guardrail installations, flared guardrail installations have the advantage of requiring less guardrail to effectively shield a hazard. However, guardrail installations have minimum grading requirements that must be met, and flared guardrail installations may not be economically feasible if extensive earthwork/slope flattening are required.

7.01.05 (continued)

Therefore, the decision to use a flared or parallel guardrail installation should be made on a case-by-case basis taking site-specific conditions into consideration.

F. To uniformly compute the length of need for roadside barriers, a guardrail worksheet has been developed and should be used on both new and upgrading projects. Computation methods used on this worksheet complies with the guidelines described in the ***Roadside Design Guide***. It still remains important that all designers become familiar with the "Guide" to understand the design process. For determining the length of need when non traversable embankments are the only obstacles of concern, see Section 7.01.30.

The worksheet shall be used by all designers, including consulting firms performing work for the Department, to compute guardrail length of needs.

The designer should fill in all data and compute each individual barrier run. This will assure proper compliance to standards and allow each barrier run calculation to be documented and checked for accuracy.

Construction field offices should be sent the completed worksheets for reference during project construction.

The worksheet does not cover all situations which may occur in the field, although it is expected to cover most installations. Any situation not covered by the worksheet shall be similarly documented, along with a sketch providing the details of the guardrail installation.

7.01.06 (revised 3-23-2026)

Guardrail Worksheet

The Guardrail Worksheet can be found on the MDOT Development Guide website published by the Design Services Section. To request access to the Development Guide, please contact MDOT-EngineeringSupportTraining@michigan.gov.

7.01.10 (revised 10-21-2013)

Clear Zone – History

For a number of years road designers and safety authorities considered 30' a desirable requirement for a safe roadside free of obstacles. This was based upon a study by General Motors in the early 1960's which revealed that of 211 cases at the proving grounds involving vehicles leaving the road, 80% did not travel more than 29' from the edge of pavement. The 1967 “Yellow Book” (***Highway Design and Operational Practices Related to Highway Safety***, AASHTO), page 20, rounded this distance off to 30'. The 2nd edition of the “Yellow Book”, published in 1974, reiterated the 30' distance, but called for an application of engineering judgement by emphasizing that the "30' distance is not a “magic number" (page 38). The 1977 Barrier Guide defined clear zone, in the glossary on page iv, as "That roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles. Establishment of a minimum width clear zone implies that rigid objects and certain other features with clearances less than the minimum width should be removed, relocated to an inaccessible position outside the minimum clear zone, or remodeled to make safely traversable, breakaway, or shielded."

The 1977 Barrier Guide introduced the concept that rate of sideslope, speed of traffic, horizontal curvature, and ADT would affect the width of clear zone. The 30' width was retained for 60 mph speed in combination with flat side slopes, tangent roadway alignment, and ADT exceeding 6,000. However, a graph on page 16 adjusts this basic 30' for traffic speed and rate of sideslope. These adjustments are both up or down (wider or narrower) for either descending or ascending slope. A formula on page 17 further adjusts the clear zone for horizontal curvature. Finally, a procedure shown on pages 60-65 adjusts the clear zone downward (narrower) for ADT's below 6,000. The Supplement to the 1977 Barrier Guide expanded on the clear

7.01.10 (continued)

zone criteria that begins on page 15 of the Barrier Guide by including a series of tables prepared by the state of Illinois that show clear zone requirements for various degrees of curve. These criteria have been criticized by a number of states because of the extreme clear zone widths, particularly for the combination of sharp curve, higher speed, high traffic volume and steep slope.

In anticipation of a proposed revision of the 1977 Barrier Guide, FHWA in April 1986 afforded the states a measure of relief with respect to clear zone requirements. It provided a formula for a curve correction factor that is based upon increasing the value for clear zone for a tangent section, obtained from the Barrier Guide. This new formula is more reasonable than the formula on page 17 of the Barrier Guide. It was adopted by the Department in July 1986. In 1989 the ***Roadside Design Guide*** was issued by AASHTO and adopted by MDOT as a guide. Updates to the ***Roadside Design Guide*** were published in 1996, 2002, 2006 and 2011.

7.01.11 (revised 9-22-2025)

Current Clear Zone Criteria

Virtually everyone agrees that a flat, smooth, unobstructed area adjacent to the driving lanes is highly desirable and significantly improves roadside safety. The only point of contention is how wide to make this area. The designer needs to understand that the clear zone distance is not an absolute number. Some designers have erroneously believed, that in all cases, the need for protecting motorists ends at the selected clear zone distance.

7.01.11 (continued)

Current Clear Zone Criteria

The Department measures the clear zone from the outer edge of the through lane. When determining clear zones in auxiliary lane areas, use the volume of the through lanes and the freeway design speed to obtain the clear zone distance. The resulting clear zone distance should be measured from the outer edge of the through lane and is not to be less than 23 ft out from the outer edge of the auxiliary lane.

The ***Roadside Design Guide*** defines the clear zone as a variable distance from the traveled way, depending on design speed, ADT, and embankment slope rate and direction.

The Clear Zone Distances Table presents a range of values that can be used for specific conditions. These numbers are based on limited data that was gathered under non-typical conditions and extrapolated to account for sloped roadsides. Also the values obtained from the Clear Zone Distances Table are based on an assumption of constant side slope throughout the clear zone. They must not be perceived as absolute. In situations where the side slope changes within the calculated clear zone, the clear zone may be recalculated based upon a weighted average calculation. An example of this procedure is shown in Section 13.02.08 of this manual.

However, there is no single method for establishing the clear zone, since site conditions must be considered when determining the clear zone at each location. Engineering judgment may need to be exercised when determining the clear zone. Contact the Geometric Design Unit - Design Division if there are any questions pertaining to determining clear zone values.

Application of the values in the Clear Zone Distances Table is dependent on the extent of work and the roadway classification. The higher values should be used on new construction, reconstruction and on all freeways.

7.01.11 (continued)

When evaluating existing conditions and when designing rehabilitation projects, we should attempt to use the higher values; however, economics, existing field conditions, and other restraints may justify using the lower values.

Clear zone for non-freeway Construction on Existing Road project types must be selective and generally "fit" conditions within the existing right-of-way and character of the road. Some roadside improvements that should be considered may include removal, relocation, or shielding of such obstacles as culvert headwalls, utility poles, and bridge supports that are within the selective clear zone.

The designer should also be aware that current clear zone distances and guidelines serve as general guidance for Heritage Routes (See Section 3.09). Narrow pavement, narrow shoulders, winding and/or rolling alinement, steep side slopes, roadside obstacles and narrow right-of-way are common characteristics of Heritage Routes that sometimes prevent the use of even the lower range of the Clear Zone table. Where economic or environmental concerns are great, and there is no history of crash concentration, shorter clear zone distances may be considered to preserve the characteristics of the Heritage Route. Some areas of concern may be addressed with appropriate traffic signing. When distances below the ranges offered in the Clear Zone Distances Table are used, the rationale for the alternative treatment should be noted in the project file.

Tree removal should be considered as stated in Section 3.09.03C. Some alternatives are also offered in the next two sections (7.01.11A and 7.01.11B).

7.01.11 (continued)

Current Clear Zone Criteria

A. Treatment/Consideration of Obstacles Outside the Calculated Project Clear Zone

Occasionally, there may be opportunities to improve the roadside safety on a project for a small cost by addressing a few obstacles outside the determined clear zone. Examples of these opportunities are as follows:

1. When installing landscape items: Since we have control over the location of new items, we can provide additional protection to the motorist by applying a more generous clear area to these items. For instance, our freeway guideline for a long time has been to plant trees at least 50 feet off the edge of traffic lanes.

2. When isolated trees, volunteer growth, utility poles, etc. are present: Depending on aesthetic concerns, it may be possible to offer the motorist a very generous clear area (beyond that required by the Clear Zone Distances tables) by simply removing or relocating a few isolated obstacles.

3. Obstacles near the bottom of a ditch are more likely to be hit by an errant vehicle since the ditch tends to funnel the vehicle. Relocating the obstacle further up the back slope, or even slightly up the front slope (closer to road but still outside the clear zone limit), would usually be preferable.

4. A clear runout area beyond the toe of a traversable (smooth and free of fixed objects) but non-recoverable (between 1:4 and 1:3) foreslope is desirable since vehicles traversing this steep slope are likely to continue to the bottom. The extent of this clear runout area can be determined by subtracting the distance between the edge of traveled way and the breakpoint of recoverable foreslope from the clear zone distance. This distance should be at least 10' if feasible.

7.01.11 (continued)

B. Treatment/Consideration of Obstacles Inside the Calculated Project Clear Zone

Where the following conditions exist, it may be necessary to retain trees that otherwise would be considered for removal.

1. At landscaped areas, parks, recreation or residential areas or where the functional and/or aesthetic values will be lost.

2. Exceptional or unique trees (because of their size, species, or historic value).

3. On designated heritage roads and low speed roads (including low speed urban areas).

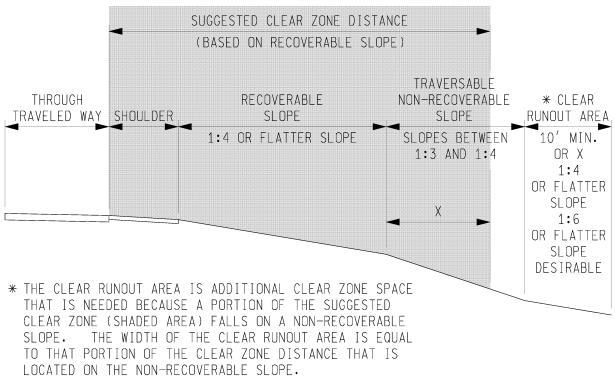
4. At locations where cumulative loss of trees would result in a significant change in character of the roadside landscape.

5. Behind nontraversable backslopes.

6. Behind vertical curbs, particularly in low speed areas.

7. Where shrubs and/or ornamental trees exist that would have a mature diameter of 4" or less at 4'-6" above ground line.

8. Where removal would adversely affect endangered/threatened species, wetland, water quality, or result in significant erosion/sedimentation problems.



7.01.11 (continued)

Current Clear Zone Criteria

C. Clear Zone Distance Chart

**CLEAR ZONE DISTANCES
(IN FEET FROM EDGE OF DRIVING LANE)**

DESIGN SPEED	DESIGN ADT	FILL SLOPES			CUT SLOPES		
		1:6 OR FLATTER	1:5 TO 1:4	1:3	1:3	1:4 TO 1:5	1:6 OR FLATTER
40 mph or Less	under 750	7 - 10	7 - 10	**	7 - 10	7 - 10	7 - 10
	750 - 1500	10 - 12	12 - 14	**	10 - 12	10 - 12	10 - 12
	1500 - 6000	12 - 14	14 - 16	**	12 - 14	12 - 14	12 – 14
	over 6000	14 - 16	16 - 18	**	14 - 16	14 - 16	14 – 16
45-50 mph	under 750	10 - 12	12 - 14	**	8 - 10	8 - 10	10 - 12
	750 - 1500	14 - 16	16 - 20	**	10 - 12	12 - 14	14 - 16
	1500 - 6000	16 - 18	20 - 26	**	12 - 14	14 - 16	16 - 18
	over 6000	20 - 22	24 - 28	**	14 - 16	18 - 20	20 - 22
55 mph	under 750	12 - 14	14 - 18	**	8 - 10	10 - 12	10 - 12
	750 - 1500	16 - 18	20 - 24	**	10 - 12	14 - 16	16 - 18
	1500 - 6000	20 - 22	24 - 30	**	14 - 16	16 - 18	20 - 22
	over 6000	22 - 24	26 - 32*	**	16 - 18	20 - 22	22 - 24
60 mph	under 750	16 - 18	20 - 24	**	10 - 12	12 - 14	14 - 16
	750 - 1500	20 - 24	26 - 32*	**	12 - 14	16 - 18	20 - 22
	1500 - 6000	26 - 30	32 - 40*	**	14 - 18	18 - 22	24 - 26
	over 6000	30 - 32*	36 - 44*	**	20 - 22	24 - 26	26 - 28
≥ 65 mph	under 750	18 - 20	20 - 26	**	10 - 12	14 - 16	14 - 16
	750 - 1500	24 - 26	28 - 36*	**	12 - 16	18 - 20	20 - 22
	1500 - 6000	28 - 32*	34 - 42*	**	16 - 20	22 - 24	26 - 28
	over 6000	30 - 34*	38 - 46*	**	22 - 24	26 - 30	28 - 30

* Where a site-specific investigation indicates a high probability of continuing or higher than expected crashes, or such occurrences are indicated by crash history, the designer may provide clear zone distances greater than 30 feet as indicated. Clear zones may be limited to 30 feet for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

** Since recovery is less likely on the unshielded, traversable 1:3 slopes, fixed objects should not be present in the vicinity of the toe of these slopes.

7.01.11 (continued)

Current Clear Zone Criteria

D. Curve Correction Factors Table

The Curve Correction Factors Table shown below shall be applied to horizontal curves with radii less than or equal to 2950 ft. The curve correction factor (Kcz) shall be applied to the outside of curve only. The inside portion of the curve will be treated as a tangent section.

CURVE CORRECTION FACTORS (Kcz) CZ corr = Kcz *x* CZ

Radius (ft)	DESIGN SPEED (mph)						
	40	45	50	55	60	65	70
2950	1.1	1.1	1.1	1.2	1.2	1.2	1.2
2300	1.1	1.1	1.2	1.2	1.2	1.2	1.3
1970	1.1	1.2	1.2	1.2	1.3	1.3	1.4
1640	1.1	1.2	1.2	1.3	1.3	1.3	1.4
1475	1.2	1.2	1.3	1.3	1.4	1.4	1.5
1315	1.2	1.2	1.3	1.3	1.4	1.4	
1150	1.2	1.2	1.3	1.4	1.5	1.5	
985	1.2	1.3	1.4	1.5	1.5	1.5	
820	1.3	1.3	1.4	1.5			
660	1.3	1.4	1.5				
495	1.4	1.5					
330	1.5						

7.01.11 (continued)

E. Other Controlling Factors

For free access highways, the clear zone should ideally be the same as for controlled access highways, but often this is impossible as it would require complete reconstruction of the highway, and destruction of the existing roadside features. Clear zone may often be restricted by drives, intersections, ditches, narrow R.O.W., and other features. While it may be argued that the dynamics of a vehicle running off the road are no different on a free access road than they are on a limited access facility, it remains as a fact of life that there will always be obstacles of some description on free access roads - mailboxes, driveway embankments, trees, buildings, etc. Enormous numbers of these obstacles occur on the trunkline system.

7.01.11 (continued)

Continued efforts should be made to reduce these obstacles as finances permit, even though some cannot be removed without great difficulty, because of socio-environmental considerations, e.g., mature shade trees in a west-facing front yard. However safety considerations should overrule, and if need be, even these mature shade trees may have to be removed.

The designer should note that the presence of an up-slope significantly reduces the clear zone width required. It is therefore seldom necessary to remove a tree or to shield an obstacle that is located at the top of a cut-slope if the elevation of the top of slope is approximately 5'-0" to 6'-0" higher than the edge of pavement. These situations should always be checked, however.

7.01.12 (revised 11-22-2021)

Types of Guardrail Used in Michigan

There are seven standard types of steel beam guardrail in addition to cable barrier found on Michigan highways. The term "Current Use" means "currently proposed for use", not necessarily what may be found existing in the field.

A. Type A (Standard Plan R-60-Series)

Description: W-beam attached directly to posts, Terminal End Shoes on ends. 12'-6" post spacing, 28" height to top of rail.

Current Use:
1. Cul-de-sacs
2. Limited to locations not exposed to through traffic.

B. Type B (Standard Plan R-60-Series)

Description: W-beam guardrail, 8" offset blocks. 6'-3" post spacing, 28" height to top of rail.

Current Use:
1. Updating existing Type B guardrail on free access trunklines when the entire run of guardrail is not being removed and replaced.
2. May be used at the discretion of local agencies on local non-NHS roads.

C. Type BD (Standard Plan R-60-Series)

Description: Type B with W-beam on both sides of the post, 8" offset blocks.

Current Use:
1. Updating existing Type BD guardrail in medians on free access trunklines when the entire run of guardrail is not being removed and replaced.

7.01.12 (continued)

D. Type T (Standard Plan R-60-Series)

Description: Offset thrie beam rail, 8" offset blocks, 6'-3" post spacing, 34" height to top of rail.

Current Use:
1. Updating existing freeways and ramps when the entire run of guardrail is not being removed and replaced.

E. Type TD (Standard Plan R-60-Series)

Description: Similar to Type T except beam elements and offset blocks are installed on both sides of the post.

Current Use:
1. Used to update existing Type TD guardrail when the entire run of guardrail is not being removed and replaced.

F. Type MGS-8
(Standard Plan R-60-Series)

Description: W-beam guardrail meeting MASH criteria, 8" offset blocks, standard 6'-3" post spacing, and 31" height to top of rail. Beam element splices occur between standard 6'-3" post spaces.

Current Use:
1. Standard MASH-compliant guardrail for all freeways (including ramps) and free access trunklines.
2. All trunkline roads (NHS and non-NHS) and local, NHS roads. Recommended on local, non-NHS roads but not required (per local agency’s discretion).

7.01.12 (continued)

Types of Guardrail used in Michigan

G. Type MGS-8D
(Standard Plan R-60-Series)

Description: Type MGS-8 with W-beam guardrail and 8" offset blocks on both sides of the post.

Current Use:
1. In all roadway medians, freeway and free access, when median guardrail is recommended and a MASH-compliant guardrail system is desired. On projects let after December 31, 2017, Type MGS guardrail systems will be required for new guardrail installations on all freeways (including ramps) and free access roadways.

H. Cable Barrier (See Section 7.01.55C)

Description: Three or four steel cables mounted on steel posts, anchored and tensioned.

Current Use:
1. Medians where crash history indicates cross median crashes and rigid barrier is not warranted.

2. Special situations where up to 90 degree impacts can be expected and larger deflections can be tolerated.

7.01.13 (revised 4-24-2023)

Curved Beam Elements

Curved steel beam elements having a radius of 150' or less must be shop bent. W-beam and thrie-beam guardrail can be shop bent. However, thrie-beam transition panels, both symmetrical and asymmetrical, cannot be shop bent. Shop bent guardrail beam elements can be curved concave (inward) or convex (outward) as required. The radius for curved guardrail beam elements should be reported in increments of 5 feet. The smallest radius for curved guardrail is 5 feet, although guardrail with very small radii should only be used when necessary. Designers should try to be as accurate as possible when specifying a radius for curved rail, as it is time consuming and expensive returning elements to the shop for re-bending. When shop bent rail will be required, the following note should be included on the plans: "Shop bent curved guardrail elements shall not be ordered until the radius has been field verified by the Engineer."

7.01.14 (revised 12-22-2011)

Guardrail Surface Finish

A. Galvanized

For a short time in the early to mid-1950's, the first steel W-beam guardrail was not galvanized and therefore had to be painted. Subsequently, galvanized beam elements were supplied and have been used ever since except, of course, for the use of weathering steel. The galvanizing coating is considered to have a service life of at least 25 years under average conditions before exhibiting significant rusting. Some of the earlier accepted galvanized rails were "pre-galvanized" and had very thin zinc coatings. These have rusted at a considerably premature age. From that time, a heavier galvanizing was applied by hot dip method after forming. This exhibited good durability. The industry asked for reconsideration of the pre-galvanized method in 1995. The Construction Field Services Division performed a study to determine the weather resistance of pre-galvanized rail. The results of an accelerated weathering simulation were acceptable. The specifications now allow for either method of galvanizing.

7.01.14 (continued)

B. Unpainted Corrosion-Resistant

Atmospheric corrosion resistant guardrail (sometimes referred to as "weathering" or "rusty steel" guardrail) was first installed in Michigan, at 3 test sites, in 1963. It was adopted as standard by the Department in late 1971. If galvanized beam was desired, and it was in certain locations where visibility was especially needed, then it had to be specified on the plans and in the pay item. The theory behind the development of this material was that, being uncoated, it would oxidize rather quickly to a uniform brown color, the chemistry of the steel causing the surface rust to be dense and adherent. After the initial surface rust had formed, it was thought that further oxidation would proceed very slowly as the oxides would form a protective coating, making painting unnecessary. Initially, the buffered endings were galvanized, but in 1976 it was decided to specify corrosion resistant steel for them as well. In early 1980 a moratorium was placed on the use of weathering steel, requiring all new guardrail be galvanized according to the former requirements. The moratorium was prompted by the discovery that, when chloride contamination occurred, oxidation of the metal did not slow up after the initial rusting, and crevice corrosion accelerated the attack on the overlapped surfaces. Concerns were expressed that the useful life of the rail would be considerably less than that originally anticipated. The moratorium led to a permanent discontinuation of the use of weathering steel.

7.01.14 (continued)

Guardrail Surface Finish

C. Corrosion-Resistant Guardrail Replacement Policy

The Engineering Operations Committee, meeting on January 20, 1989, decided that all existing corrosion resistant, or "rusty steel", guardrail encountered on proposed Interstate resurfacing or reconstruction projects should be removed and replaced as part of the project. On projects involving bridges only, the nominal provisions of the approach guardrail anchorage shall be replaced if the rail elements are rusty steel. Where guardrail at the bridge approaches is part of a more extensive installation, the decision to replace will be made on the merits of the specific project. See Section 7.01.44 for upgrading local roads.

7.01.15 (revised 9-28-2020)

Guardrail Terminals

Use the identified guardrail terminal types as indicated below.

A. Guardrail Departing Terminal, MGS (Standard Plan R-66-Series)

Current Use:

1. Departing end of Guardrail, Type MGS-8, on one-way roadways.
2. Departing end of Guardrail, Type MGS-8, on two-way roadways when located outside the clear zone.

B. Guardrail Approach Terminal, Type 2M (Standard Plan R-62-Series)

Current Use:

1. On one or both ends of Guardrail, Type MGS-8 located within the clear zone of approaching traffic.
2. May also be used on one or both ends of Guardrail, Type T or Guardrail, Type B with an appropriate transition section (refer to Standard Plan R-60-Series).

7.01.15 (continued)

C. Guardrail Departing Terminal, Type B (Standard Plan R-66-Series)

Current Use:
As recommended by the Geometric Design Unit where Guardrail Departing Terminal, Type MGS is not practicable for the departing end of Guardrail Type B on;

1. one-way roadways.
2. two-way roadways when located outside the clear zone.
3. other applications as recommended by the Geometric Design Unit.

D. Guardrail Departing Terminal, Type T (Standard Plan R-66-Series)

Current Use:
As recommended by the Geometric Design Unit where Guardrail Departing Terminal, Type MGS is not practicable for the departing end of Guardrail Type T on;

1. one-way roadways.
2. two-way roadways when located outside the clear zone.
3. other applications as recommended by the Geometric Design Unit.

7.01.15 (continued)

E. Guardrail Approach Terminal, Type 1B (Request Special Details from the Design Standards Unit)

Current Use:
As recommended by the Geometric Design Unit for use in special cases where a Type 2M guardrail approach terminal is not practicable, and a Type 1 (flared) guardrail approach terminal is necessary on;

1. one or both ends of Guardrail, Type B and Guardrail, Type MGS-8 located within the clear zone of approaching traffic.

F. Guardrail Approach Terminal, Type 1T (Request Special Details from the Design Standards Unit)

Current Use:
As recommended by the Geometric Design Unit for use in special cases where a Type 2M guardrail approach terminal is not practicable, and a Type 1 (flared) guardrail approach terminal is necessary on;

1. one or both ends of Guardrail, Type T located within the clear zone of approaching traffic

7.01.16 (revised 4-24-2023)

Guardrail Attachment to Bridges and Walls

The following guardrail anchorage details are in current use for new construction and where specified for upgrading and are detailed on Standard Plans R-67-Series, B-22-Series, B-23-Series:

A. Guardrail Anchorage, Bridge, Details M1 & M4 (See Standard Plan R-67-Series)

Current Use:
When connecting Guardrail, Type MGS-8 to Bridge Railing, 2-Tube, 4-Tube, Aesthetic Parapet Tube, 3 Tube with Pickets, Concrete Block Retrofit, Type 6, Type 7, or Single Face Concrete Barrier without expansion at backwall (M1) or with expansion at backwall (M4).

B. Guardrail Anchorage, Bridge, Details M2 & M5 (See Standard Plan R-67-Series)

Current Use:
When connecting Guardrail, Type T to Bridge Railing, 2-Tube, 4-Tube, Aesthetic Parapet Tube, 3 Tube with Pickets, Concrete Block Retrofit, Type 6, Type 7, or Single Face Concrete Barrier without expansion at backwall (M2) or with expansion at backwall (M5).

C. Guardrail Anchorage, Bridge, Details M3 & M6 (See Standard Plan R-67-Series)

Current Use:
When connecting Guardrail, Type B to Bridge Railing, 2-Tube, 4-Tube, Aesthetic Parapet Tube, 3 Tube with Pickets, Concrete Block Retrofit, Type 6, Type 7, or Single Face Concrete Barrier without expansion at backwall (M3) or with expansion at backwall (M6).

7.01.16 (continued)

D. Guardrail Anchorage, Bridge, Details M7, M8 & M9 (See Standard Plan R-67-Series)

Current Use:
When connecting Guardrail, Type MGS-8 (M7), Type T (M8) or Type B (M9) to Filler Wall.

E. Guardrail Anchorage, Bridge, Detail A3 (See Standard Plans B-22-Series and B-23-Series)

Current Use:
When connecting Guardrail, Type MGS-8 to Bridge Railing, Thrie Beam Retrofit.

F. Guardrail Anchorage, Bridge, Detail A4 (See Standard Plans B-22-Series and B-23-Series)

Current Use:
When connecting Guardrail, Type T to Bridge Railing, Thrie Beam Retrofit.

G. Guardrail Anchorage, Bridge, Detail A5 (See Standard Plans B-22-Series and B-23-Series)

Current Use:
When connecting Guardrail, Type B to Bridge Railing, Thrie Beam Retrofit.

H. Need for Additional Expansion

The Guardrail Anchorage, Bridge details on Standard Plan R-67-Series will accommodate thermal deck movement up to about 4". If the expected thermal deck movement will exceed 4", the Road designer should consult with the Bridge designer to decide the method for providing the additional expansion required in the guardrail.

7.01.16 (continued)

Guardrail Attachment to Bridges and Walls

I. Curved Guardrail Bridge Anchorages

While not desirable, in some cases it may be necessary to curve a guardrail bridge anchorage. This is commonly the case when there is an intersecting driveway or street located near a bridge, and the intersecting driveway or street cannot be closed or relocated. It is acceptable to curve only a portion of the guardrail anchorage.

If guardrail panels must be curved to a radius of 150' or less, use the Guardrail Anch Bridge, Det __, Curved pay item. Also, note that thrie-beam transition panels, both symmetrical and asymmetrical, cannot be shop bent. So designers need to select guardrail anchorage details that do not have thrie-beam transition panels within the curved section when dealing with radii of 150 feet or less.

7.01.17 (revised 4-24-2023)

Strength Requirements of Steel Beam Guardrail

The Standard Specifications reference material requirements for steel beam guardrail and associated hardware to AASHTO Specification M 180, which requires 70,000 psi tensile strength in the base metal.

Crash testing of roadside safety devices, such as guardrail and other barriers, is standardized according to procedures outlined in *National Cooperative Highway Research Program Report 350* (NCHRP 350) and the *Manual for Assessing Safety Hardware* (MASH), respectively.

MASH contains the current guidelines for testing and evaluating roadside safety devices, thereby superseding NCHRP 350. As of January 1, 2011, newly tested or modified roadside safety devices must be evaluated using MASH criteria.

7.01.17 (continued)

There are up to six test levels in NCHRP 350 and MASH, respectively, depending on the feature being evaluated. All six test levels apply to longitudinal barriers. Test levels 2 and 3 apply to breakaway features and test levels 1, 2, and 3 apply to crash cushions and end treatments.

Fundamentally, guardrail is intended to redirect the impacting vehicle, not stop it. Energy absorption and vehicle deceleration are the functions of an impact attenuator (or a Type 2 terminal, under certain conditions). For this reason, 25 degrees is the maximum angle used in testing for guardrail strength.

The designer will occasionally encounter situations where a broad area must be shielded. These may be areas wide enough to allow a vehicle to exceed 25 degrees in approach angle and too wide to make an impact attenuator feasible. These situations must be studied. The solution will usually involve guardrail placed in a curving configuration or the use of cable barrier if there is room for the deflection that is characteristic of a cable barrier.

NCHRP 350 Test Level	Vehicle	Impact Conditions	
		Nominal Speed (km/h)	Nominal Angle (deg)
1	2000P (2000 kg pick up truck)	50	25
2	2000P (2000 kg pick up truck)	70	25
3	2000P (2000 kg pick up truck)	100	25
4	8000S (8000 kg single unit truck)	80	15
5	3600V (3600 kg tractor van trailer)	80	15
6	3600T (3600 kg tractor tanker-type trailer)	80	15

7.01.17 (continued)

Strength Requirements of Steel Beam Guardrail

MASH Test Level	Test Vehicle Designation and Type	Impact Conditions		
		Vehicle Weight Kg (lbs)	Speed km/h (mph)	Angle Degrees
1	1,100C (Passenger Car) 2,270P (Pickup Truck)	1,100 (2,420) 2,270 (5,000)	50 (31) 50 (31)	25 25
2	1,100C (Passenger Car) 2,270P (Pickup Truck)	1,100 (2,420) 2,270 (5,000)	70 (44) 70 (44)	25 25
3	1,100C (Passenger Car) 2,270P (Pickup Truck)	1,100 (2,420) 2,270 (5,000)	100 (62) 100 (62)	25 25
4	1,100C (Passenger Car) 2,270P (Pickup Truck) 10,000S (Single Unit Truck)	1,100 (2,420) 2,270 (5,000) 10,000 (22,000)	100 (62) 100 (62) 90 (56)	25 25 15
5	1,100C (Passenger Car) 2,270P (Pickup Truck) 36,000V (Tractor-Van Trailer)	1,100 (2,420) 2,270 (5,000) 36,000 (79,300)	100 (62) 100 (62) 80 (50)	25 25 15
6	1,100C (Passenger Car) 2,270P (Pickup Truck) 36,000T (Tractor-Tank Trailer)	1,100 (2,420) 2,270 (5,000) 36,000 (79,300)	100 (62) 100 (62) 80 (50)	25 25 15

7.01.18 (revised 10-21-2013)

Suggested Shy Line Offset Values

Shy line offset is the distance from the edge of traveled way in which a roadside object will not be perceived as an obstacle or result in the driver reducing speed or changing the vehicle's path of travel.

Design Speed (mph)	Shy Line Offset (L_S) (ft)
80	12
75	10
70	9
60	8
55	7
50	6.5
45	6
40	5
30	4

7.01.19 (revised 6-28-2021)

Suggested Runout Lengths for Barrier Design

Runout length is the distance from the object being shielded to the point the vehicle is assumed to depart from the roadway. Interpolation between runout length values is recommended when dealing with intermediate design speeds.

	Traffic Volume (ADT) veh/day			
	Over 10,000	Over 5,000-10,000	1000-5000	Under 1000
Design Speed (mph)	Runout Length L_R (ft)	Runout Length L_R (ft)	Runout Length L_R (ft)	Runout Length L_R (ft)
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

7.01.20 (revised 4-24-2023)

Guardrail Deflection

Both steel beam guardrail and cable barriers are expected to deflect under impact. This deflection is a result of deformation of the beam element or stretching of the steel cable, fracturing of the post (if wood) or bending of the post (if steel), and lateral displacement of the post in the soil. It is therefore necessary that room for deflection be provided between the back of the rail system (e.g. back of posts) and the object or area being shielded. For design purposes, use the chart at the end of this section for the recommended minimum design offset distances of the various guardrail systems. Refer to Section 7.01.55C, "Cable Barrier", for expected deflections and offset recommends of cable barrier systems.

7.01.20 (continued)

It should be noted that the recommended offset distances should not be treated as absolute values, since guardrail deflection may vary for different impact conditions, soil types and moisture contents, thawed or frozen ground, different types of posts, different types of anchorages, and differing lengths of installation. Therefore, the recommended offset distances should be treated as minimums, and larger offset distances between the back of the rail system (e.g., back of posts) and the object or area being shielded should be provided where feasible. In general and, where feasible, the offset should be increased by 12 inches or more beyond the recommended minimum value. If specific site conditions are such that it is predictable that greater deflection values may occur, and space for deflection is restricted, then shorter post spacing should be considered. Shorter post spacing is only effective, however, if the full effect of proper post embedment is realized. See Section 7.01.41D, "Guardrail Posts at or near the Shoulder Hinge Line". See also Section 5.5.2, 2011 AASHTO Roadside Design Guide.

7.01.20 (continued)

Guardrail Deflection

Guardrail	Post Spacing	Minimum Design Offset *
Type T	1'-6¾"	1'-2"
Type T	3'-1½"	1'-8"
Type T	6'-3"	2'-0"
Type B	1'-6¾"	1'-6"
Type B	3'-1½"	2'-0"
Type B	6'-3"	3'-0"
Type MGS-8	1'-6¾"	2'-5"
Type MGS-8	3'-1½"	2'-11"
Type MGS-8	6'-3"	3'-6"
Type MGS-8 Adjacent to Curb	6'-3"	4'-1"
Type MGS-8 Near Shoulder Hinge Point **	6'-3"	4'-1"

* An additional 12" or more is desirable where feasible

** Less than 2'–8" from the shoulder hinge point to the face of guardrail post

The Zone of Intrusion (ZOI) is the region measured above and behind the face of a barrier system where an impacting vehicle or any major part of the system may extend during an impact. For a typical TL-3 system, the ZOI extends between 18" and 30" behind the traffic side face of the barrier. Where practical, the designer should keep objects out of this area. See Section 5.5.2, 2011 AASHTO Roadside Design Guide, for additional ZOI guidance.

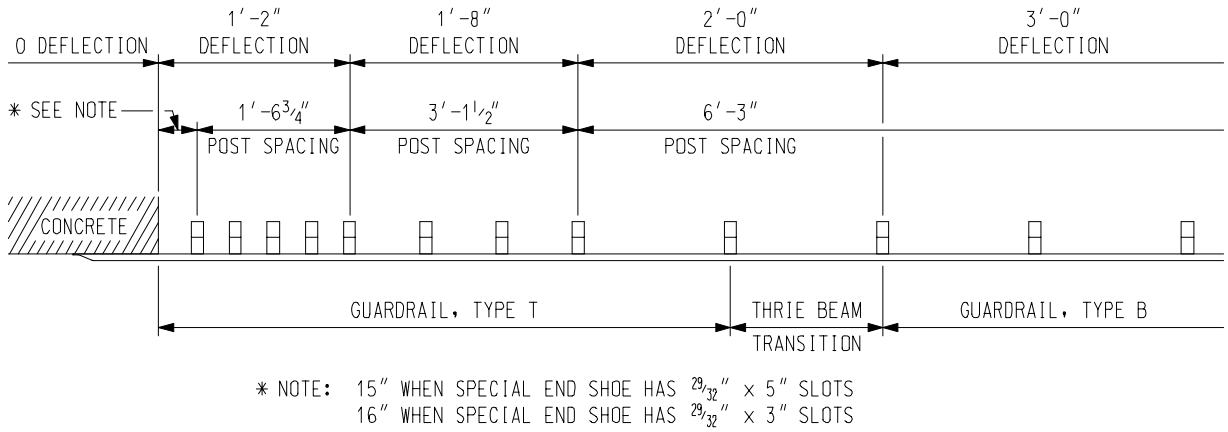
7.01.21 (revised 10-21-2013)

Guardrail Strength Transitions

Sudden and significant changes in lateral stiffness of a barrier system may cause an impacting vehicle to pocket, if it proceeds from a weaker system to a stronger system. A gradual modification of the deflection characteristics of the barrier is therefore needed. This may be achieved by closer post spacing, heavier barrier elements, larger posts or a combination of these. Illustrated below is

7.01.21 (continued)

a typical transition from Guardrail, Type B to a concrete barrier, filler wall, or barrier railing. The 2011 AASHTO, ***Roadside Design Guide*** (page 7-15) advocates that the transition length between joining barrier types should be approximately 10 to 12 times the difference in dynamic deflection. For a difference in deflection of 12", the transition stiffening length should occur in one effective beam element length or 12'-6". See Section 7.01.20 for dynamic deflections.



7.01.22 (10-22-99)

Minimum Guardrail Lengths and Gaps

A free-standing section of guardrail (one not attached to a bridge or other structure) should be at least 100' in length. Greater lengths are recommended; lesser lengths maybe acceptable under low speed conditions. A gap of less than approximately 200' between barrier installations should be avoided. Usually this will require filling in the gap with connecting barrier. An exception would be the unique situation where an approach and trailing ending, separated by a gap, can be buried in a cut slope, and the consequences of a vehicle encroaching on the cut slope would be less than hitting the guardrail filling the gap.

7.01.23 (revised 4-24-2023)

Function of Guardrail Components

It is essential that the designer understand the function of the various components of a guardrail system and some of the principles underlying barrier design details.

Beam height – The top of rail height is essential for proper barrier performance (28" for Type B, 31" for Type MGS-8, and 34" for Type T).

7.01.23 (continued)

Function of Guardrail Components

Offset block - Serves two principal purposes, 1) locates beam farther from the post to minimize the possibility of wheel snagging on the post and pocketing in the guardrail, and 2) maintains top of rail height momentarily longer as the post rotates backward under impact, reducing the probability of the vehicle vaulting over the rail. (See page 5-16, 2011 AASHTO, ***Roadside Design Guide***)

Round washer - Provides an even bearing surface around holes that are often field-drilled and rough.

Post bolt washer - Used in earlier guardrail systems to prevent the head of the post bolt from pulling through the beam element. However, it was later determined that allowing the post bolt head to pull through the beam element during a crash was better from a guardrail performance standpoint. Therefore, all current guardrail types used by MDOT do not call for the use of post bolt washers. Washers are now recommended only on the end post of the SRT, or on the end post in a Departing End Terminal.

Rail splice - Splices, of course, are unavoidable. They should be at least as strong as the rail itself; all eight connection bolts (twelve in thrie beam) are needed to distribute the load throughout the rail section. Lapped splices are usually such that the outer rail overlaps in the downstream direction, to reduce the potential of vehicle snagging.

7.01.24

Accommodation of Expansion

Provision must be made for the movement of guardrail beam elements caused by thermal expansion and contraction. The movement in rail elements is accomplished by means of oblong slots at the splices. Additional expansion at structures is obtained by means of longer slots in the Special End Shoes and Thrie Beam Expansion Section illustrated on Standard Plan R-67-Series (see Section 7.01.16I).

7.01.25 (revised 4-24-2023)

Guardrail Approach Terminals

Crashworthy end treatments are critical to guardrail installations. An approach terminal is designed to redirect an impacting vehicle and to reduce the occurrences of a vehicle being penetrated, rolled, or vaulted in an end on hit. The following section describes the characteristics and uses of approved standard treatments.

A. Type 1 Terminals

Type 1 guardrail approach terminals are flared gating terminals used only in special cases at locations where a Type 2M guardrail approach is not feasible, and a Type 1 guardrail approach terminal is necessary. This is the design formerly preferred when grading limits allow for the appropriate 4'-0" offset of the terminal end from the tangent extension of the standard line of guardrail run. When the Type 1 terminal is called for on the plans by special detail, the contractor may use one of the approved terminal options. The special detail is available by request from the Design Standards Unit.

Consult with the Geometrics Design Unit, Design Division, when considering use of a Type 1 guardrail approach terminal.

7.01.25 (continued)

B. Type 2 Terminals

Type 2 terminals are tangent, energy absorbing terminals which require less grading than the Type 1 terminals. There is currently only one subcategory under the Type 2 terminal category; Type 2M.

1. Type 2M Terminals

Type 2M terminals are MASH-compliant tangent guardrail approach terminals. They are specified in Standard Plan R-62-Series and by special provision. Type 2M terminals are required for new installations and when updating guardrail approach terminals, except in special cases. These terminals are intended to be attached directly to Type MGS-8 guardrail. Therefore, designers will need to include an appropriate transition section for connecting a Type 2M guardrail terminal to either Type B or Type T guardrail (refer to Standard Plan R-60-Series). Current Type 2M terminals available for use are the MSKT, the Soft-Stop, and the MAX-Tension. Refer to Standard Plan R-62-Series for the overall length, recommended offset, and grading requirements of each terminal.

Contact the Geometrics Design Unit, Design Division, for additional information regarding MASH-compliant guardrail terminals.

2. Minimum Offset

The original intent of the Type 2 terminals was to provide endings that required no offset. This was the orientation used in the crash tested system. However, all three approved Type 2M approach terminals (MSKT, Soft-Stop, and Max-Tension) may be installed with an offset between 0 and 2 feet. A 1’-0” offset was adopted in Standard Plan R-62-Series in order to minimize the number of nuisance accidents that may occur when the impact head was located close to or encroaching on the shoulder.

7.01.25 (continued)

Guardrail Approach Terminals

C. Function of the Various Guardrail Terminal Components

It is important that designers, as well as construction and maintenance personnel, understand the function of the components that make up guardrail terminals.

Please note that guardrail terminals are comprised of a wide variety of different components, and each guardrail terminal has its own set of unique parts and assembly requirements. Therefore, the following is not intended to be a comprehensive list of all guardrail terminal components. Contact the Geometric Design Unit - Design Division if there are any questions related to guardrail terminal components and their function.

Bearing plate - Distributes the forces in the cable to the post.

Terminal End Shoe - This feature absorbs some of the impact forces, spreading them over a wider area, to reduce the potential for the end of the beam element to penetrate the vehicle passenger compartment. This feature is found on guardrail departing terminals and certain guardrail approach terminals, such as the SRT and BCT.

Impact head - The impact head, like a terminal end shoe, helps spread the forces over a wider area. Some impact heads are designed to extrude or compress the guardrail as the head gets pushed along the guardrail by an impacting vehicle, thereby absorbing energy from the impact. With some terminals, the rail element passes through the impact head and is extruded away from the impacting vehicle.

The physics and overall function of each terminal, including the function of the impact head, varies by terminal brand.

7.01.25 (continued)

Cable Assembly - For downstream impacts, transfers tensile forces from the beam to the base of the end post, allowing the full redirective strength of the rail system to be developed at the third post. For ending impacts the cable is released and serves no purpose. However, not all terminals utilize cable assemblies. For example, the Soft-Stop does not require a cable assembly, since the guardrail end is bolted to a post in a manner allowing all tensile forces in the guardrail to be transferred to the post.

Channel or Angle Strut - This strut and yoke distributes the load from the tensioned cable between the first and second post. The strut also contributes to the collapse of the second post during an end on impact. Please note, not all terminals utilize a channel or angle strut.

Controlled release terminal (CRT) post - CRT posts are 6" x 8" wood posts with two 3½" diameter holes drilled through the post. One hole is placed at the ground line and the other 1'-4" below the ground, to facilitate fracture of the post during end-on impacts.

Holes in the two end posts - These holes are used to weaken the end posts and to allow them to break off close to the ground, when the guardrail ending is struck by an end impacting vehicle. The guardrail ending will likely collapse, thereby reducing spearing and vaulting. The holes have no function for downstream impacts.

Pipe Insert - No function for ending impacts. For downstream impacts, distributes vertical component of forces in the cable to the post.

7.01.25 (continued)

Guardrail Approach Terminals

***Slotted Rail Element (SRT)* -** The first two panels of rail in the SRT are slotted to provide controlled dynamic buckling. Rail buckling in the SRT is controlled by the length and location of the slots. The controlled buckling of the rail element reduces the potential for the rail to directly impact or penetrate the vehicle occupant compartment.

***Slot guard (SRT)* -** Slot guards are installed on the SRT at the downstream end of each set of rail slots. It prevents the bumper or other parts of the impacting vehicle from intruding into and extending the slots.

***Soil plate* -** Inhibits movement of the post in the soil; aids in keeping the post from pulling out of the ground.

***Steel sleeves* -** For ending impacts, reduces tendency for the post to rotate in the soil; aids in resisting movement so the post will break off at the weakening hole. For downstream impacts, distributes loads from the post to the soil.

D. Guardrail Full Strength Point

When a standard guardrail terminal is used, the length of need is calculated to a point where the guardrail run develops the full strength of the system. This is typically known as the beginning length of need (BLON) point. It should be stressed that most guardrail approach terminals are gating terminals, meaning the BLON point is located beyond the nose of the terminal. Designers need to take this into consideration when performing length of need calculations. The deduction values in the MDOT guardrail worksheet have taken the BLON points into consideration.

7.01.25 (continued)

E. Clear Area Behind Guardrail Terminals

When determining the length of need of a guardrail run, the designer should verify that there will be no obstacle behind or to the behind side of a guardrail terminal that would prevent gating.

The area behind should be traversable for the vehicle after it passes through the terminal. The minimum recovery area behind and beyond a terminal should be an obstacle free area approximately 75' long and 20' wide. If it appears that the area behind will not be traversable, then the guardrail run will probably have to be extended to a point where the area behind the terminal is clear.

F. Burying Ending in a Backslope

Occasionally high cut slopes adjacent to the traveled roadway do not provide sufficient clear area behind the terminal to allow gating, or adequate site conditions may exist making a buried-in-backslope terminal desirable.

In these cases, the designer should consider terminating the guardrail inside the backslope. The designer or project manager can obtain a special detail for this treatment from the Design Standards Unit.

G. Slope Under Guardrail Terminals

The area under the terminal should be graded to a 1:10 slope or flatter from the edge of the traveled lane and extend at least 2'-0" behind the back of posts. In addition, the terminal details include required grading in advance of the terminal approach. The designer should consider these required limits when estimating grading and earthwork quantities. See the appropriate guardrail approach terminal Standard Plans for grading details.

7.01.29 (revised 4-24-2023)

Guardrail Flare

When designing guardrail, the designer should take advantage of opportunities to flare the installation. This reduces the required length of need. It also places the guardrail terminal farther from the traveled lane, thus reducing the potential for nuisance hits.

A. Flare Rate

The maximum recommended flare rate is dependent on barrier type and design speed. Maximum flare rates are provided to minimize impact severity, since a barrier flared toward traffic in the downstream direction will result in a larger impact angle between the impacting vehicle and the barrier, and this will increase the impact severity. Consequently, the maximum flare rates for rigid barriers, such as concrete barriers, are typically less than those for semi-rigid barriers, such as guardrail.

The specified flare rates are maximums, and shallower (flatter) flare rates may be used.

Larger flare rates may be considered in certain cases, such as barrier sections flared away from traffic in the downstream direction, where the resulting angle between an impact vehicle and the barrier would be less than expected compared to a non-flared barrier installation.

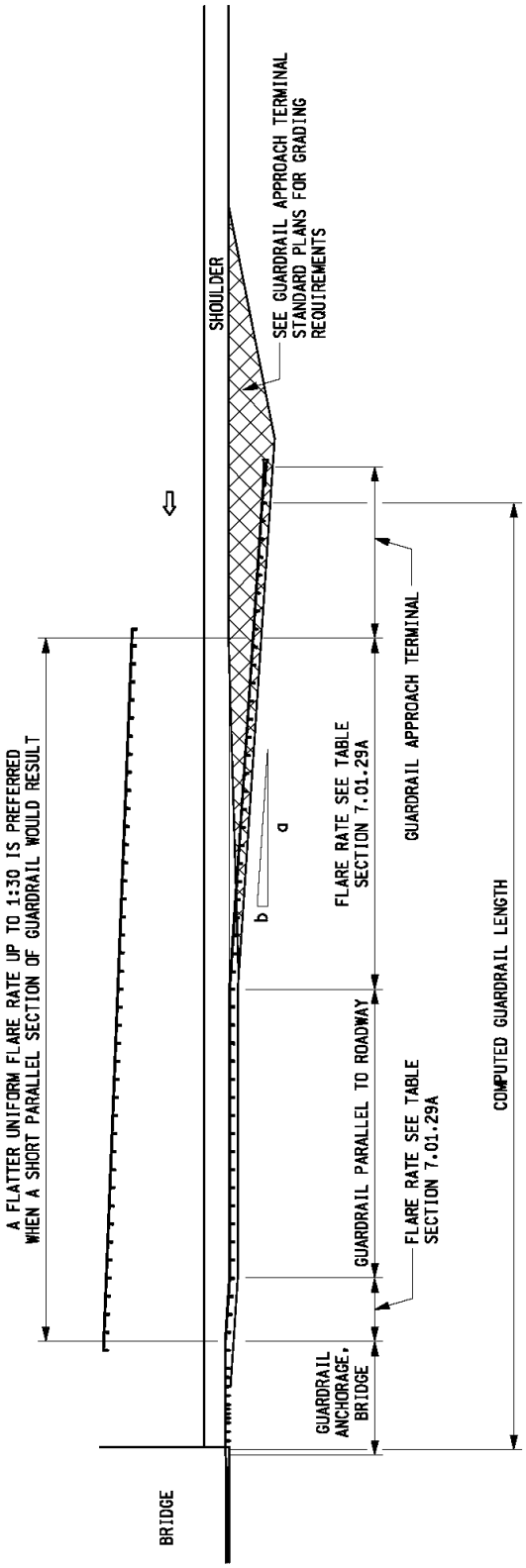
Design Speed (mph)	Flare Rate (b/a) for	
	Concrete Barriers	Guardrail
70	1:20	1:15
60	1:18	1:14
55	1:16	1:12
50	1:14	1:11
45	1:12	1:10
40	1:10	1:8
30	1:8	1:7

7.01.29 (continued)

Guardrail Flare

B. Uniform Flare from Structures

Guardrail may need to be flared inward to meet the bridge barrier railing of bridges with narrow shoulders. When the guardrail length at a structure is increased, such as for an embankment, a uniform guardrail flare rate (not flatter than 1:30) may be substituted for the combined short parallel section and the two flared sections. The Illustration at right shows this situation on a left approach rail. When the shielded area in advance of the bridge rail is a steep embankment, the length of need is determined as outlined in Section 7.01.30E. A uniform flare can then be constructed between the guardrail anchorage and the guardrail approach terminal.



7.01.30 (revised 4-24-2023)

Guardrail at Embankments

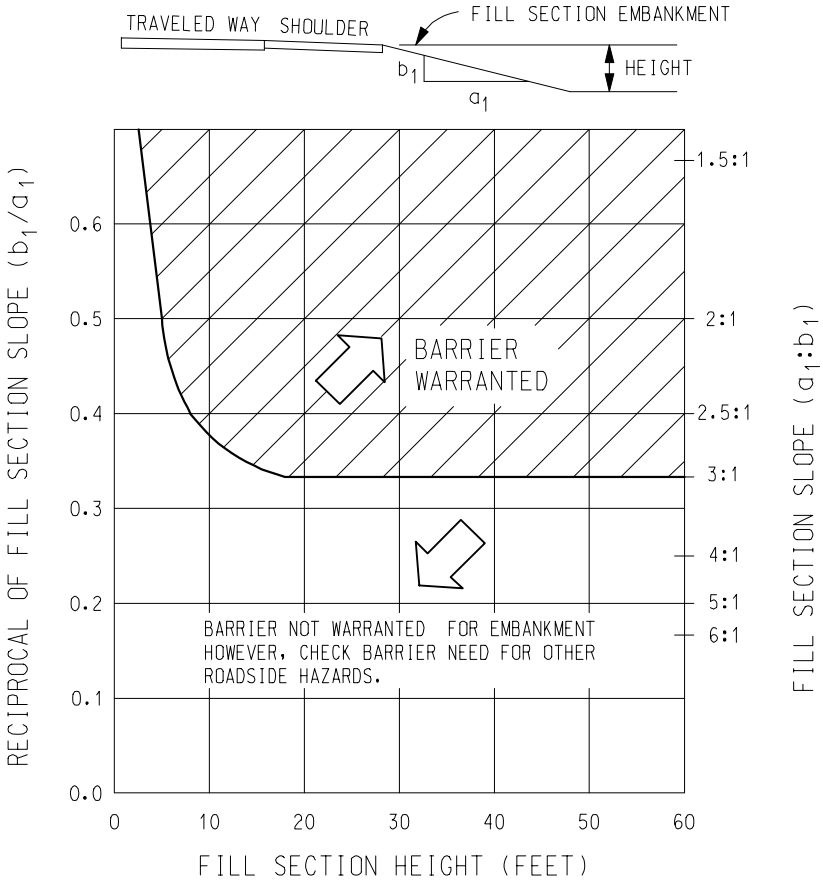
As a general rule, a barrier should be placed to protect a vehicle from going down an embankment only if the barrier itself is the least severe of the two features. Such a comparison must of necessity be very subjective because of the many variables involved. The Department generally follows the criterion that, if the fill slope is 1:3 or flatter, no barrier is required. For slopes of 1:3 or flatter, the height of fill does not increase severity.

7.01.30 (continued)

The economics of earthwork obviously dictate that all slopes cannot be 1:6, regardless of fill height. As the fill becomes higher, more consideration must be given to steepening the slopes, which in turn may call for a decision relative to placing a barrier.

Slopes intended to be traversable, i.e., one flat enough that a barrier can be omitted but still perhaps 1:3, should be relatively free of discontinuities that might "trip up" a vehicle. Plans should note that half-buried boulders and large rocks should be removed as part of the final trimming operation. Also, a clear runout area with a 10' minimum width should be provided at the bottom of traversable, non-recoverable slopes.

A. Height-Slope Guidelines

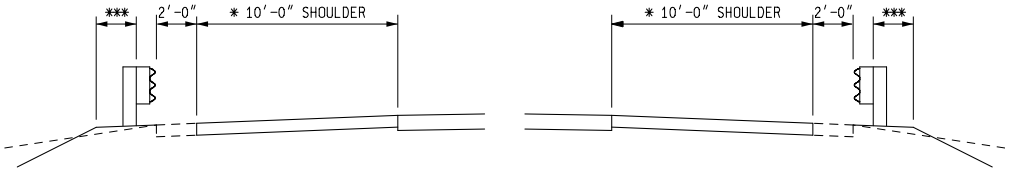


7.01.30 (continued)

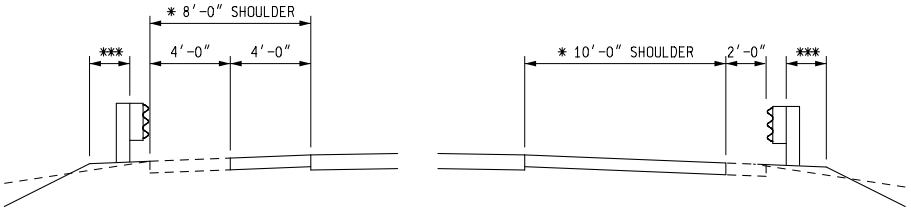
Guardrail at Embankments

B. Location on Fill Sections (New Construction)

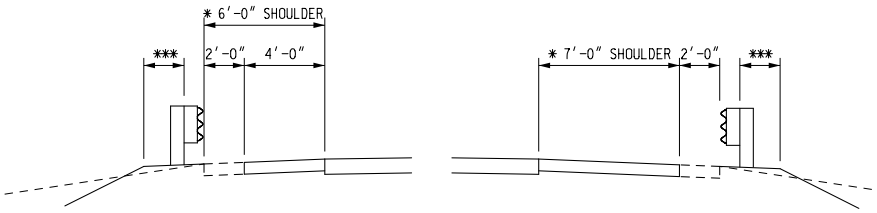
The following shoulder sections with guardrail are shown to clarify and standardize the location of guardrail. Divided highway sections illustrate guardrail on left and right shoulders of each roadway.



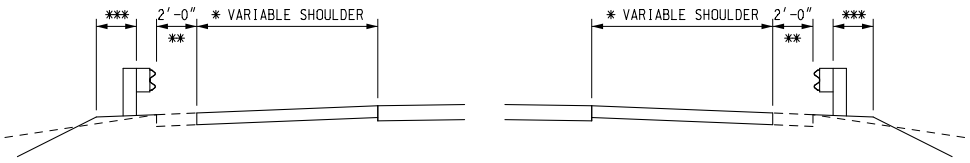
DIVIDED, 3 OR MORE LANES IN ONE DIRECTION



DIVIDED, 2 LANES IN ONE DIRECTION AND 2 LANE RAMPS



16' RAMPS



TWO-WAY ROADWAYS

Note: These sections should be used strictly for locating guardrail in relation to the edge of shoulder and are not intended to determine shoulder paving or shoulder widening requirements.

***** See Section 6.05.04D for paved shoulder widening at guardrail sections.

****** The 2' offset from face of guardrail to edge of shoulder should not be used if the paved shoulder width is at least 12'.

******* 2'-0" (min) with Guardrail Types B and T. 2'-8" (min) with Guardrail, Type MGS-8. Longer guardrail posts are required if the minimum offset requirements cannot be achieved. Refer to Standard Plan R-60-Series for guardrail post length and offset from shoulder hinge point requirements.

7.01.30 (continued)

Guardrail at Embankments

C. Maximum Height of 1:2 Slope Without Barrier

Barrier is not warranted on 1:2 fill slopes up to about 5' height. See Section 7.01.30A, Height-Slope Guidelines.

D. Flattening Slopes to Eliminate Guardrail

On limited access projects, guardrail may be eliminated if the fill slopes are flattened to 1:4 or flatter. In order to eliminate guardrail on free access projects, the fill slope should also be flattened to 1:4 or flatter, unless additional R.O.W. would be required. If there are no obstacles or severe inclined slopes within the clear zone or at the toe of the fill slope, a 1:3 slope or flatter may then be considered.

E. Length of Barrier at Embankments (New Construction)

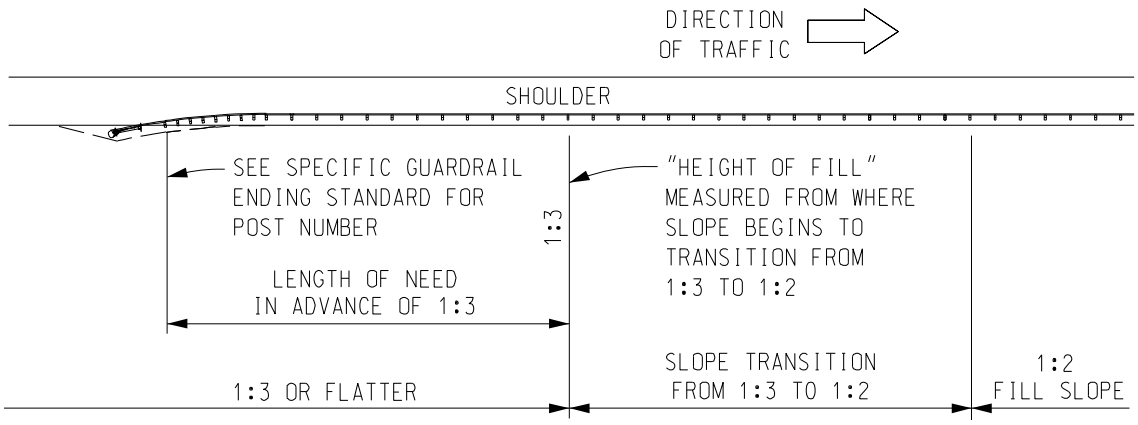
When determining the length of barrier required to shield an embankment slope (does not apply to barn roof sections), the designer must first determine the beginning of the 1:4 slope and where the slope steepens to 1:3. Using Standard Plan R-59-Series, which shows flared installations, the limits of the endings can be determined. Field personnel should check the length and slope rate of the fill section and make any necessary adjustments; sometimes the length will be adequate, but it may be necessary to "slide" the barrier one way or the other to fit actual conditions.

7.01.30 (continued)

F. Length of Barrier at Embankments (Upgrading Projects)

When a flared guardrail installation is not feasible and a parallel guardrail installation must be used, the following chart and diagram should be used to determine the length of barrier needed in advance of a 1:3 slope.

GUARDRAIL AT EMBANKMENTS (PARALLEL INSTALLATIONS)				
HEIGHT OF FILL AT 1:3 (ft)		LENGTH OF NEED IN ADVANCE OF 1:3 (ft)		
OVER	TO	70 mph	60 mph	50 mph
5	10	147	121	100
10	12	197	171	122
12	14	235	205	153
14	16	269	238	179
16	18	296	262	198
18	20	316	280	212
20	22	331	294	223
22	24	343	305	231
24	25	349	309	235



7.01.30 (continued)

Guardrail at Embankments

G. Placing Beam Guardrail on a Downslope

Usually the greater the distance from the roadway that a barrier can be placed, the less chance there is of it being struck and less barrier length will be needed to shield the object. However, placing a barrier on a downslope close to the shoulder hinge point (approximately 12'-0" or less) introduces the potential for the barrier to be less effective because of the tendency for a vehicle, leaving the shoulder, to vault over it. The following guidelines therefore apply:

1. Beam guardrail may be placed on a slope, beyond the shoulder point, if the slope is 1:10 or flatter.

2. Generally, a 1:10 or flatter slope should not be constructed specifically to locate the barrier farther out.

3. The placement of Type MGS-8 guardrail on 1:8 slopes should be confined to the applications specified in Section 7.01.32.F.

4. Usually, the installation of guardrail on a 1:6 slope is not recommended for new installations.

7.01.30 (continued)

H. Guardrail Placed near Intersecting Streets and Driveways

An intersecting street or driveway located near a roadside object or feature may prevent installation of the full length of barrier required along the main road. An example of this would be a bridge on a main road with an intersecting driveway located near the bridge.

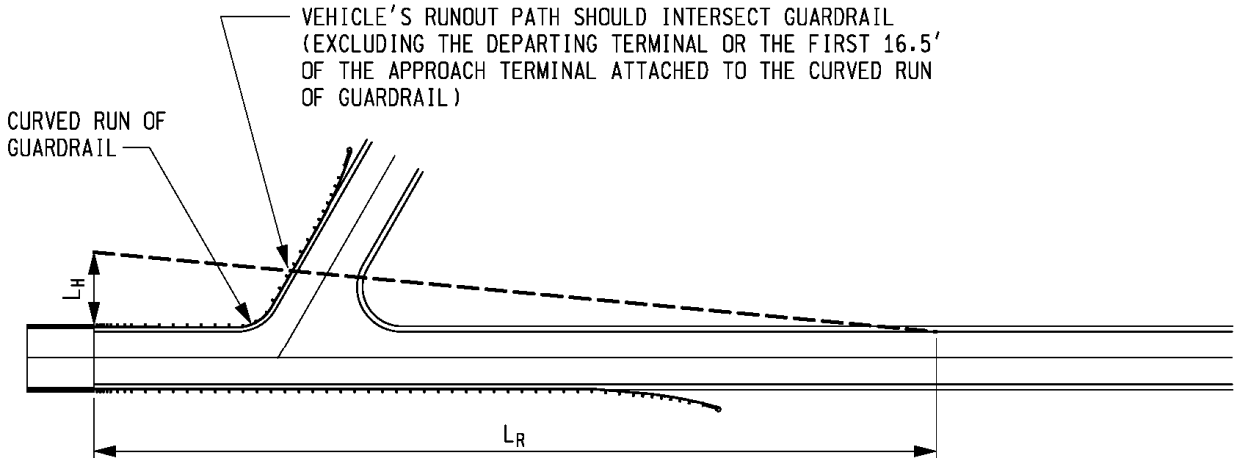
The preferred solution is to close or relocate the intersecting street or driveway in order to install the full length of barrier required along the main road. A crash cushion or other impact attenuating devices may be used to shield a fixed object such as a bridge railing end, however, this may not provide the length of need required to shield other roadside objects or features in the vicinity.

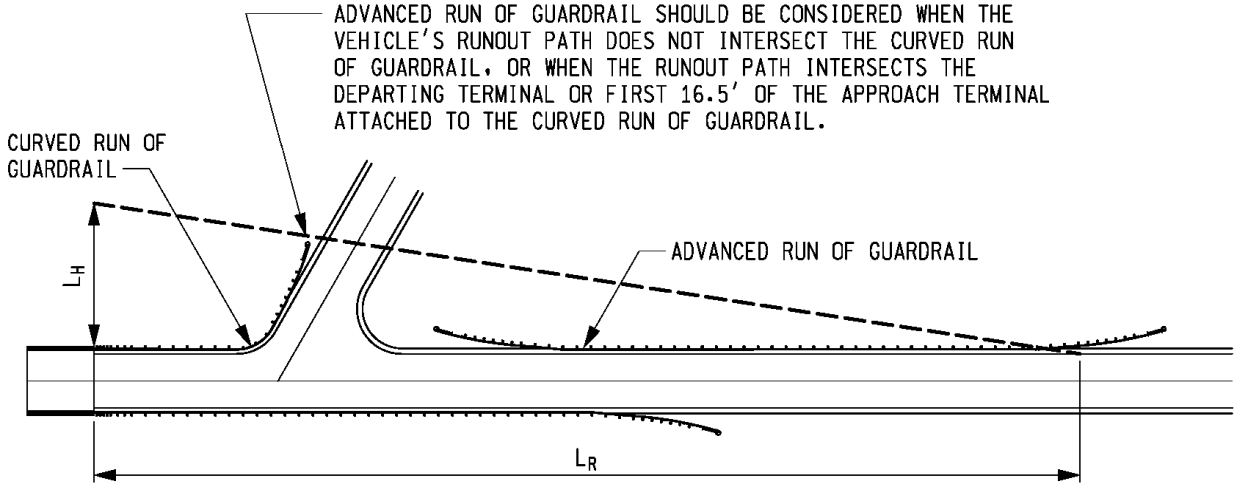
When closing or relocating the intersecting driveway or street is not feasible, two possible solutions are given in the accompanying sketches. A second guardrail run in advance of the intersecting street or driveway should be considered when the vehicle's runout path does not intersect guardrail, or when the runout path intersects the departing terminal or the first 16.5 feet of the approach terminal attached to the curved run of guardrail. See Special Detail 21 for installing a curved guardrail run near an intersecting street or driveway. Also, graphical design methods are suggested when utilizing the proposed solutions depicted in the accompanying sketches.

Site-specific constraints must be taken into consideration when designing guardrail near intersecting streets and driveways. Examples of these constraints include limited intersection sight distance, right-of-way limitations, and the presence of multiple intersecting driveways in close proximity to each other. In addition, the use of excessively short advanced guardrail runs should be avoided. Questions regarding guardrail installations near intersecting streets and driveways should be directed to the Geometric Design Unit of the Design Division.

7.01.30 (continued)

Guardrail at Embankments





7.01.31 (revised 4-24-2023)

Shielding Bodies of Water

Warrants for shielding streams or permanent bodies of water are judgement decisions based on location and depth of water and likelihood of encroachment (page 5-9, 2011 AASHTO, ***Roadside Design Guide***). Streams or permanent bodies of water more than 2'-0" in depth will usually require shielding by a barrier if within the clear zone. Barrier may also be required for bodies of water beyond the clear zone if, in the judgement of the designer, there is greater than usual potential for an errant vehicle to enter the water. An exception may be water close to the road for a considerable distance (a causeway is a case in point). In this case, speeds may have been correspondingly reduced because the roadside might be heavily used for recreational access to the water and for fishing. An intermittent barrier leaves many exposed endings to treat and space may not be available for proper flaring of the ends. After all factors are taken into consideration, it may be decided that the disadvantages of a barrier outweigh the advantages.

7.01.32 (revised 4-24-2023)

Barrier at Bridge Approaches (Over and Under)

Besides shielding embankments, the other most common use of a roadside barrier is shielding massive structural components. These fall into two general categories, the overpassing structure (approaches and railings) and the under passing structure (piers, drainage structures, and abutments).

A. Attachment to Barriers and Closer Post Spacings

Guardrail beam elements fastened to concrete structures should overlap the concrete sufficiently to place the end bolts as shown in Standard Plan R-67 Series. This is necessary to ensure proper guardrail anchorage to the concrete structure.

All of the guardrail anchorage, bridge attachments specified on Standard Plans R-67-Series, B-22-Series and B-23-Series increase in lateral stiffness. This is done to keep an impacting vehicle from displacing the guardrail and pocketing against the rigid bridge structure. The transition for lateral stiffness of guardrail is described in Section 7.01.21. Additionally, heavier 10 gage (0.135") thrie-beam elements and nested 12 gage (0.105") beam elements, consisting of two stacked beam elements, are used to increase barrier strength to reduce the possibility of rail rupture.

7.01.32 (continued)

Barrier at Bridge Approaches (Over and Under)

B. Relationships Between Bridge Sidewalk and Approach Guardrail

Any guardrail run leading up to a bridge must be properly anchored to a bridge railing. Refer to Standard Plans R-67-Series, B-22-Series and B-23-Series. If curbs are present, the guardrail in conjunction with curb guidelines described in Section 7.01.34 should be followed when site conditions allow. Contact the Geometric Design Unit, Design Division if there are any questions regarding specific situations.

7.01.32 (continued)

C. Barrier at the Trailing End of Overpassing Structures

The departing end of a bridge railing on a bridge carrying one-way traffic is generally not considered a hazard. However, there could be other hazards beyond the bridge, such as a slope steeper than 1:3, that may justify guardrail installation on the departing end of a bridge railing carrying one-way traffic.

Where a roadway carries two-way traffic, guardrail may be needed on the trailing end of the bridge railing because the trailing end for one direction of traffic is the approach end of the other. The designer should determine if the opposite side railing and any roadside hazards are within the clear zone, measured from the centerline in the case of a two-way, two-lane roadway.

If one or more downspout headers are required on the departing end of a one-way bridge, it will be necessary to shield it with guardrail. This guardrail should extend a minimum length of the Guardrail Departing Terminal beyond the last downspout header.

When a major railing or bridge reconstruction project is programmed, existing 12" high approach curbs on the departing ends of one-way bridges should be removed and replaced with a reduced height curb, unless shielding with a T-Series guardrail bridge anchorage. See current Standard Plans R-32 Series and R-67 Series for bridge approach curb and gutter requirements.

7.01.32 (continued)

Barrier at Bridge Approaches (Over and Under)

D. Shielding Requirements at Bridge Underpasses

The clear zone criteria presented in Section 7.01.11 is the primary source of information used in determining whether bridge columns or abutments require shielding. Because a clear zone distance cannot always be determined precisely, it may happen that a fixed object thought to be outside the clear zone may need shielding. When this occurs, the designer must determine a method to shield them. Accepted methods for shielding are specified on the standard plans. If the only requirement is to shield the bridge pier or abutment, the barrier length should be calculated using the information found in Section 7.01.05F.

Current bridges are usually designed with longer spans, so that bridge columns and abutments can be placed outside the clear zone. Even when spans are increased, not all bridge columns and abutments can be located outside clear zones. An example might be where a widened clear zone results from a bridge being located over a curved roadway.

Currently, the approach bridge fill, behind the abutment, is designed to have a 1:6 slope facing oncoming traffic on the road below. However, when the approach slope is not 1:6 or flatter, additional barrier may be required to obtain the required runout length used in the above formula.

7.01.32 (continued)

E. Guardrail Median Object Protection

Standard Plan R-56-Series illustrates an enclosed guardrail system for shielding objects such as bridge piers and sign supports in medians 36’ to less than 70’ in width. The system encloses the median objects between two parallel runs of guardrail converged and terminated at each end with a Type 3 approach terminal (Standard Plan R-63-Series). Details are provided for both Type T and Type MGS-8 guardrail (see Standard Plan R-60-Series). Therefore, it is necessary to specify the guardrail type to be used at each location. This design replaces the past versions of Standard Plan R-56-Series featuring the Minnesota Bullnose design. The current standard also provides details for a direct connection to filler walls. This connection detail requires construction of concrete end walls and reduces the overall guardrail length required.

Standard Plan R-56-Series also details a treatment for shielding the opening between twin-bridge approaches. For wider medians at twin bridge approaches, the barrier length should be calculated using the information found in Section 7.01.05F.

It is necessary to ensure the minimum offset is provided from the edge of pier or median objects to the back of guardrail posts, while ensuring there is adequate space from the face of guardrail to the edge of shoulder. In cases where the minimum offset from the edge of pier or median objects to the back of guardrail posts cannot be satisfied, it may be possible to stiffen the guardrail system by decreasing the post spacing (see Section 7.01.20, “Guardrail Deflection”). However, in cases where it is impossible to meet the minimum offset from the edge of pier or median objects and/or provide adequate space between the guardrail and the shoulder, concrete barrier should be considered for shielding the bridge piers or median objects. Consult with the Geometric Design Unit, Design Division for guidance.

7.01.32 (continued)

Barrier at Bridge Approaches (Over and Under)

F. Bridge Columns and Foundations in 70’ Medians

Bridge columns and sign support foundations located in the center of 70’ medians were once considered outside the clear zone. Shielding is now required and should be included in any programmed project upgrading.

The treatment for shielding columns and foundations for new construction and reconstruction projects should be according to the enclosed system designs shown on Standard Plan R-56-Series, Guardrail Median Object Protection.

In addition to the enclosed systems discussed in the previous section, an open system is detailed in Standard Plan R-56-Series for other than new construction and reconstruction projects with 70’ medians and existing fill slope rates of 1:8 or flatter. This detail features twin parallel guardrail runs that shield the median objects independently for each direction of traffic. This option offers the advantage of better accessibility for maintenance equipment to service the median or sign foundations. It is intended only for the conditions stated above.

7.01.33 (revised 4-24-2023)

Maintaining Guardrail Strength When One or More Posts Must Be Omitted

A. Downspout Headers

Standard Plan R-32-Series, under "Notes", advises field personnel to determine the location of proposed guardrail posts prior to locating the spillway or downspout header(s). If this is done, there will be no conflict. There are occasions however, when miscalculation in construction layout or when upgrading guardrail, that an existing downspout header will prevent a post from being placed at the proper spacing. Downspout headers that were constructed prior to 1970 and according to Standard Plan E-4-A-144 series, are an example. These downspouts had deeper throats and were designed to fit 12'-6" post spacing. When a post cannot be properly placed, Standard Plan R-72-Series, "Guardrail Long Span Installations" should be considered.

B. Wide Culverts

Maintaining the continuity of the barrier strength is also necessary when a run of guardrail spans a wide culvert and the proper embedment of a guardrail post(s) cannot be obtained. When the spanning of a wide culvert requires the omission of one or two posts, Standard Plan R-72-Series, "Guardrail Long Span Installations" should be used. Where no barrier wall exists and the span is over 25’-0” Standard Plan R-73-Series, "Guardrail over Box or Slab Culverts" may be considered.

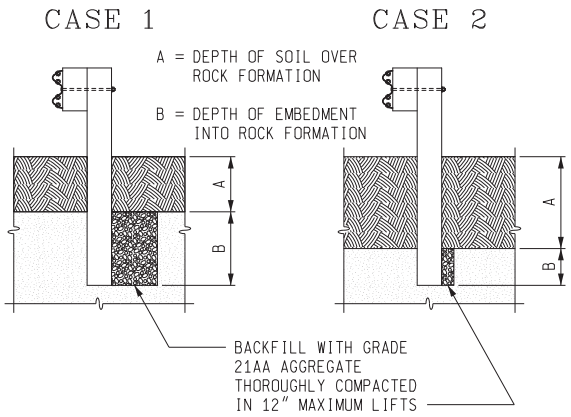
7.01.33 (continued)

Maintaining Guardrail Strength When One or More Posts Must Be Omitted

C. Placing Guardrail in Rock

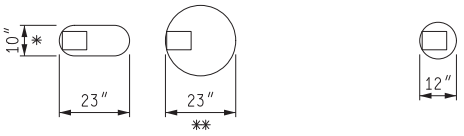
Rock formations, which occur more frequently in the Upper Peninsula, may prevent the full embedment of guardrail posts. When only a partial embedment of posts can be obtained, backing the guardrail according to the method illustrated in Standard Plan R-72-Series is an option to individually drilling each hole. If the number of post locations in the influence of the rock formation would force the length of the backed guardrail section to exceed that allowed in the standard, the affected posts holes will have to be drilled. If the depth of soil overlying the rock formation is 18" or greater, the hole diameter required for steel posts is 8" (12" for wood) and full post embedment depth is required. If the depth of soil overlying the rock formation is less than 18", the hole diameter required for steel posts is 21" (23" for wood) and a 24" embedment depth into the rock is required. A strong-post W-beam guardrail exhibits better performance if the post is allowed to rotate in the soil. Thus, the post should not be placed in the center of the hole, but at the front, so the backfill is behind the back of the post. This work should be included by special provision.

7.01.33 (continued)

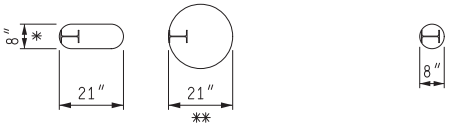


* WIDTH MAY BE INCREASED TO 15" TO ACCOMMODATE CONSTRUCTION TOLERANCES.

** 24" DIAMETER HOLE MAY BE USED.



WOOD POST PLAN VIEWS



STEEL POST PLAN VIEWS

FOR OVERLYING SOIL DEPTHS (A) RANGING FROM 0 TO 18". THE DEPTH INTO ROCK (B) IS EQUAL TO 24".

FOR OVERLYING SOIL DEPTHS (A) RANGING FROM 18" TO FULL POST EMBEDMENT DEPTH. THE REQUIRED DEPTH INTO ROCK (B) IS EQUAL TO FULL POST EMBEDMENT DEPTH MINUS (A).

7.01.33 (continued)

Maintaining Guardrail Strength When One or More Posts Must Be Omitted

D. Guardrail Posts through Paved Surfaces

Guardrail posts embedded into paved surfaces present a problem similar to that of guardrail posts in rock formations. The paved surface will not allow the posts to rotate in their embedment (to distribute vehicle loads through the post into the embedment material) prior to breaking. Thus, an area of pavement around the post know as "leave out" must be omitted to allow the post to rotate. For both steel and wood posts, the size of the leave out should be an area of about 15" x 15" (square or round). The most critical measurement is the distance from the back of post to the back edge of the leave out, which should be a minimum of 7". After post installation, patching material is generally placed around the guardrail post in the "leave out" area. This work should be included by special provision.

7.01.33 (continued)

E. Additional Blockouts on Guardrail Posts

Double blockouts (16" deep) may be used to increase the post offset to avoid obstacles such as curbs. Except at terminals, there is no limit to the number of posts in a guardrail run that use double blockouts. Under special circumstances, one or two posts in a run of guardrail may employ as many as four blockouts (up to 36") to provide proper clearance. There should be no voids between blockouts when using double or multiple blockouts. Furthermore, for aesthetic reasons, double or multiple blockouts should be installed without creating sudden changes in guardrail alignment.

When using double or multiple blockouts, steps must be taken to prevent the placement of guardrail posts on steep fill slopes beyond the shoulder hinge point. Placing conventional length guardrail posts on steep fill slopes may result in posts having insufficient soil embedment depth, thereby reducing the post's strength to resist overturning. See Section 7.01.41.D, 8'-0" Posts, for guardrail post length requirements when placing guardrail at or near the shoulder hinge line.

7.01.34 (revised 10-21-2013)

Guardrail in Conjunction with Curb

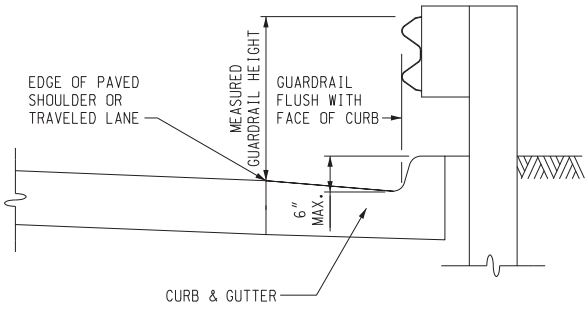
When a vehicle strikes a curb, the trajectory of that vehicle depends upon several variables including the size and suspension characteristics of the vehicle, its speed and angle of impact, and the height and shape of the curb itself. Generally, the use of curb on high speed roadways (design speed greater than 50 mph) is discouraged.

If guardrail/curb combinations are used when design speeds are less than 45 mph, the curb height should be 6" or less, with the face of guardrail being located either flush with the face of curb or at least 8' behind it.

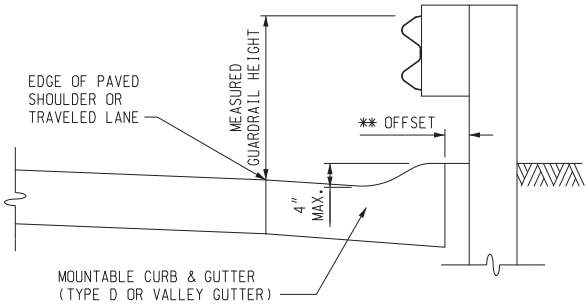
For design speeds of 45 mph or 50 mph, a 6" curb (or less) may be used if the guardrail is located flush with the face of curb. If an offset from the curb is desired, the curb height should be 4" or less with the guardrail being located at least 13' behind the curb.

If guardrail/curb combinations are necessary when the design speed is greater than 50 mph, a mountable curb (Type D curb or valley gutter) should be used, and the curb height should be 4" or less, with the face of guardrail being located flush with the face of curb. .

When guardrail is located flush with the face of curb, the rail height should be measured from the front edge of the gutter pan, which is the point on the gutter pan that is closest to the edge of the traveled lane. At greater distances (typically 8'-0" to 13'-0") the rail height should be measured from the ground just in front of the guardrail.

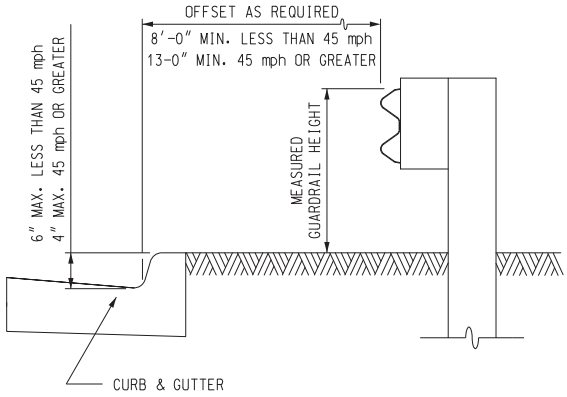


GUARDRAIL WHEN CURB IS ADJACENT TO
EDGE OF PAVED SHOULDER OR TRAVELED LANE
(DESIGN SPEED 50 mph OR LESS)



** 2″ WHEN CURB IS PLACED NEXT TO SHOULDER
10″ WHEN CURB IS PLACED NEXT TO TRAVELED LANE

GUARDRAIL WHEN CURB IS ADJACENT TO
EDGE OF PAVED SHOULDER OR TRAVELED LANE
(DESIGN SPEED GREATER THAN 50 mph)



GUARDRAIL - CURB OFFSET
WHEN GUARDRAIL IS PLACED AWAY FROM CURB

7.01.40

Guard Posts for Roadside Control

Barrier systems should not be used merely for roadside control. Where it is impractical to use curb for this purpose, wooden posts without connecting beam elements will suffice. These posts should be weakened by adding two 3½" diameter holes, through the 8" face and 6" apart, with the bottom one about 1" above the ground. The holes should be perpendicular to traffic. Posts may be about 5'-0" apart or as necessary to control traffic in the specific situation. See Standard Plan R-74-Series.

7.01.41 (revised 9-22-2025)

Upgrading and Replacement of Guardrail

The upgrading and replacement of existing guardrail runs is a leading construction item in Michigan. Two principle reasons for updating are an obsolete design or because of changed conditions, e.g., a guardrail made too low by resurfacing the shoulder.

A. Guidelines for Upgrading or Replacing Guardrail

1. If entire runs of guardrail must be replaced because the guardrail is out of specifications or cannot be adjusted to meet specifications, then the guardrail should be replaced following the current MDOT recommendations as called for in Section 7.01.12.

2. Height adjustment may be made on existing guardrail posts that pass a thorough inspection for soundness. Existing beam elements should be evaluated for expected life and may be used if they meet current design standards. If the existing guardrail cannot be made to meet these conditions, then the entire run should be replaced with new guardrail using the recommended type from Section 7.01.12.

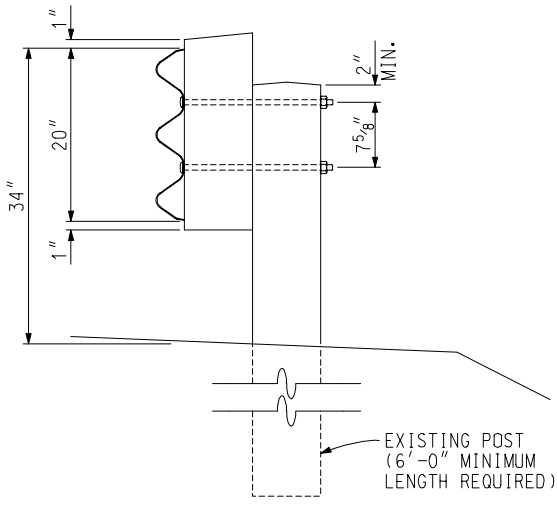
7.01.41A (continued)

Upgrading and Replacement of Guardrail

3. When replacement of the existing guardrail on freeway ramps is necessary, use Type MGS-8. If a continuous guardrail run is needed up to and along the crossroad, with Type B guardrail along the crossroad, transition Type MGS-8 to Type B at a point 50'-0" minimum from the edge of the crossroad for a "T" intersection ramp terminal. For a continuous run through a free-flow ramp, with Type B guardrail along the free-flow ramp, transition to Type B opposite the 2'-0" point in the gore. This should be done at both on and off ramp terminals.

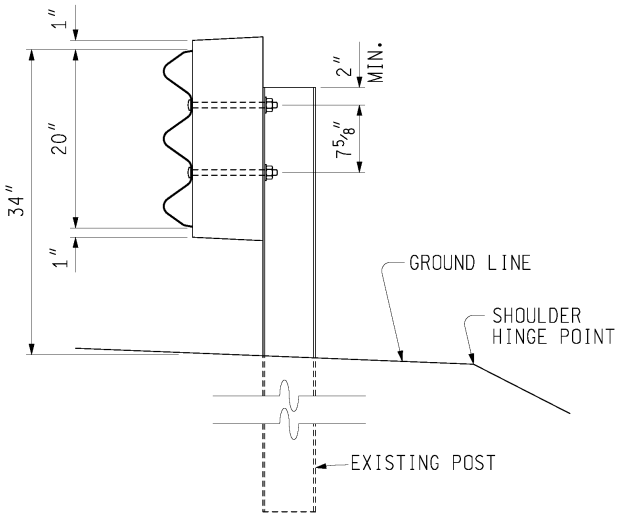
4. Height adjustments may be made to guardrail meeting the conditions stated in 2 of this section. If the existing posts are too low to allow the thrie beam rail to be placed at the proper height, then new guardrail should be installed.

   The placing of the upper bolt shall not be closer than 2" from top of wood or steel posts. See the following illustrations.



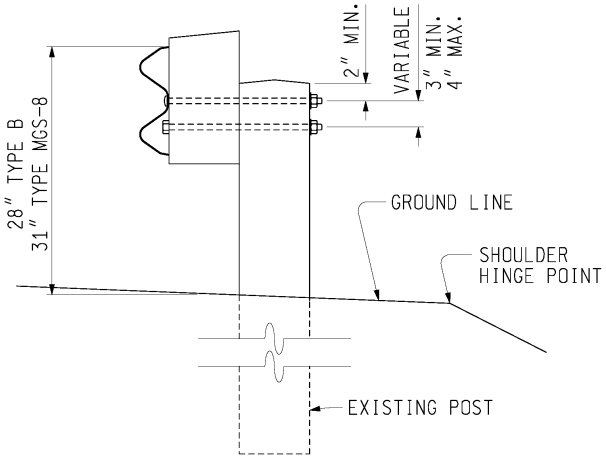
ADJUSTING THRIE BEAM GUARDRAIL
HEIGHT ON EXISTING WOOD POSTS

7.01.41A (continued)



NOTE: HOLES IN STEEL POST SHALL BE DRILLED NOT BURNED.

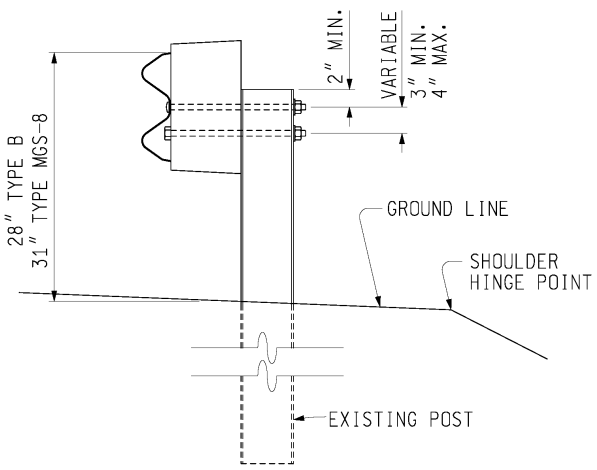
ADJUSTING THRIE BEAM GUARDRAIL
HEIGHT ON EXISTING STEEL POSTS



ADJUSTING TYPE B OR TYPE MGS-8
GUARDRAIL HEIGHT ON
EXISTING WOOD POSTS

7.01.41A (continued)

Upgrading and Replacement of Guardrail



ADJUSTING TYPE B OR TYPE MGS-8
GUARDRAIL HEIGHT ON
EXISTING STEEL POSTS

7.01.41 (continued)

B. Upgrading Guardrail Terminals

MDOT policy is to replace any Breakaway Cable Terminals (BCT) encountered on all trunkline projects, including all project types, NHS and non-NHS routes, all guardrail runs within the projects limits (both flared and non-flared), and regardless of whether guardrail work is included as part of the project. See Standard Plan R-62-Series for details of approved terminals.

These guidelines do not apply to Capital Preventive Maintenance (CPM) projects. Safety Criteria for CPM projects are covered under a separate agreement with the FHWA.

Maintenance forces are to replace a damaged BCT with an approved terminal from Standard R-62-Series.

7.01.41 (continued)

Upgrading and Replacement of Guardrail

C. Intermixing Wood and Steel Posts

At the present time, the Standard Specifications permit the use of either wood or steel guardrail posts. Both types of posts may be randomly intermixed in making repairs on Types A, B, T, and MGS-8 guardrail, but, for appearance, complete runs being reconstructed should utilize only one type of post.

Posts in terminals shall be the same as those specified on Standard Plans R-62-Series, R-63-Series, R-66-Series and the special provision which specifies the Type 2M endings. When the repair of an existing bullnose installation is necessary, wood posts shall be used.

D. Guardrail Posts at or near the Shoulder Hinge Line

Guardrail upgrading on local roads and trunklines sometimes requires setting the posts at or near the shoulder hinge line rather than 2'-0" (shoulder hinge point to front face of post) for Guardrail Types B and T, or 2’-8” (shoulder hinge point to front face of post) for Guardrail Type MGS-8, as specified on Standard Plan R-60-Series. Most of the time this condition occurs on a fill, which means that the soil support behind the post will be reduced because of the close proximity of the slope. In these cases, 8'-0" long posts should be specified for Guardrail Types B and T, and 9’-0” long posts should be specified for Guardrail Type MGS-8. If the ground does not fall away behind the guardrail, then conventional length posts are sufficient. These requirements also apply to double sided guardrail (Guardrail Types BD, TD, and MGS-8D).

7.01.41 (continued)

E. Allowable Variation from Standard Height

When evaluating existing guardrail to determine upgrading needs, variation from standard barrier height is a consideration. The allowable variation from standard height is a function of project type and guardrail type. The following height variations are applicable to 3R and 4R projects:

- Guardrail Types B and BD:
  -1.5/+2 inches
- Guardrail Types T and TD:
  -2/+2 inches
- Guardrail Types MGS-8 and MGS-8D:
  -3/+1 inches

These are considered functional variations for 3R and 4R projects. For projects that are classified less than 3R or 4R, such as CPM (Capital Preventive Maintenance), FRP (Freeway Resurfacing Project), and NFRP (Non-Freeway Resurfacing Project), these functional height variations are optional, although designers are encouraged to follow these guidelines on all projects when considering guardrail work.

If an existing guardrail is of the proper type, and after all phases of the proposed project are complete, the guardrail height should be within this limit. However, if any work must be done on a guardrail run, then the run should be brought up to standard. Before allowing such a run of guardrail to remain untouched, it should pass a thorough inspection for the soundness of posts and the expected remaining life of the beam elements. The timing of future road improvements should also be considered.

The height variations identified in this section are not intended to be height tolerances for construction purposes. Closer tolerances are expected for construction purposes.

7.01.41 (continued)

Upgrading and Replacement of Guardrail

F. Unpainted Corrosion Resistant Beam Elements

See Section 7.01.14B. The Engineering Operations Committee meeting on January 20, 1989 decided that all existing corrosion resistant, or "rusty steel", guardrail encountered on proposed Interstate resurfacing or reconstruction projects should be removed and replaced as part of the project.

On projects involving bridges only, the nominal provisions of approach guardrail (guardrail anchorage to bridge and approach terminal) shall be replaced if the rail elements are rusty steel. Where guardrail at the bridge approaches is part of a more extensive installation, the decision to replace will be made on the merits of the specific project.

G. Thick Shoulder Lifts

Rehabilitation of rural freeways often entails placing a new concrete pavement on top of the old, or placing a thick HMA overlay. This procedure also raises the shoulder elevation, thus causing the existing guardrail to be too low. When this occurs, the designer is reminded that provisions should be made to either reconstruct or upgrade the guardrail.

If reconstruction of the guardrail must precede the pavement lift by a year or so; the designer may be tempted to call for longer than normal posts, leaving them with tops protruding so that they will be long enough to fit the ultimate installation. This should not be done; crash test films frequently show the impacting vehicle laying over on the rail and sliding along it. Protruding post tops would thus have a detrimental effect on smooth redirection of the vehicle.

7.01.41 (continued)

H. Type A Guardrail Parallel to Continuous Abutment, Twin Overpassing Structures

It was practice for a number of years to place Type A guardrail in front of the opening between twin overpassing structures, parallel to the continuous abutment and about 4'-0" in back of it. Current standards provide either a length or a configuration of guardrail that eliminates the need for this transverse section of barrier. On an updating project, if this transverse barrier is still in place and in good condition, it may be left as a determent to persons or animals who could accidentally fall over the backwall. If the condition of the barrier warrants removal, replacement is not necessary. However, replacement may be considered if deemed essential to provide positive protection for mowing operations and/or other maintenance purposes.

I. Replacing with Thrie Beam Guardrail

Even though guardrail Type T and Type MGS-8 are the current standards for use on freeways, other guardrail types do not need to be replaced unless physical deficiencies exist.

7.01.43 (revised 9-28-2026)

Guidelines for Bridge Railing Replacement and Attached Approach and Trailing Guardrails

See Chapter 6 of the Bridge Design Manual.

7.01.44 (revised 9-28-2026)

Guardrail Upgrading on Local Roads

A. Guardrail Upgrading Guidelines on Local Roads (In Conjunction with Freeway Work)

In conjunction with work programmed on a freeway, the Department may have occasion to upgrade guardrail on roads that are under local jurisdiction. Generally, the guardrail will be constructed to "trunkline standards" with respect to the type of guardrail and the type of ending. Depending on site conditions, the location and configuration of the guardrail used on local roads may not necessarily be to "trunkline standards".

The Department attempts to prevent errant local road traffic from encroaching on the freeway and its appurtenances. The following guidelines have been established for upgrading guardrail on local roads over and under freeways.

1. If the major work is on the crossroad, the approach guardrail will be upgraded. For ADT less than 2000 and the operating speed 50 mph or less, 200' of approach guardrail can be considered as satisfying the runout length (L_R) from the bridge railing end, pier or abutment. See table for runout length (L_R) in Section 7.01.19. If the ADT on the crossroad exceeds 2,000 or the operating speed exceeds 50 mph, the type of guardrail shall be as specified in Section 7.01.12 and the lengths computed using the worksheet in Section 7.01.05F. If the total length of the existing run is not more than 100' longer than the computed length, then the entire run should be constructed. If the run is considerably longer, then simply connect the upgraded guardrail to the existing guardrail at the 200' cut-off point.

7.01.44A (continued)

2. If the major work is on the freeway, then no guardrail upgrading need be done on local roads, over or under, except in interchange areas. The limits of upgrading the guardrail in interchange areas should be between the crossroad ramp terminals.

3. When the major work is on the freeway, upgrading older local road bridge railings with guardrail retrofits or new railings will not be required. See Chapter 6 of the Bridge Design Manual for instructions on bridge rail upgrading.

4. A typical urban depressed freeway will generally not require a guardrail installation or upgrading because the local street is probably at grade with the service streets on each side of the freeway and the bridge railing endings are a short distance from the edge of the intersecting service streets. These local streets are usually curbed and traffic is restricted to speeds less than 50 mph (usually 25 mph to 35 mph). In addition, low crash frequency and possible obstruction to vision also works against the use of guardrail in this situation. This is not to prohibit the use of a barrier at such approaches if different circumstances suggest the need.

7.01.44 (continued)

Guardrail Upgrading on Local Roads

B. Cul-de-sacs

Provide 75' of Type A guardrail at cul-de-sacs when a rural freeway intersects a local road and no grade separation is provided. See Section 12.07.03 for a typical cul-de-sac. Terminal end shoes are placed at each end. The purpose of this guardrail is to alert the motorist using the local road that the road is not continuous.

C. Guardrail at Urban Service Road "T"

It was practice for many years to place a short section of guardrail adjacent to the fence opposite local streets dead-ending into urban service roads. This guardrail serves very little purpose because it will not stop a high-speed vehicle going through the intersection from the local street, and it is an additional obstacle for a vehicle to hit while traveling on the service road. It is therefore being omitted on new construction. Instead, a directional arrow sign is usually placed at the fence, and shrubs may be planted behind the fence to act as a screen or visual barrier.

D. Cable on Chain Link Fence

Cable on chain link fence consists of attaching 2 steel cables to a chain link fence. This treatment may be useful in urban freeway areas where a local street ends at a service road and where a chain link fence is located parallel between the freeway and service road. Its possible use might be at locations where there is greater than usual potential for an errant vehicle to go down onto the freeway. Details are available from the Standards Unit.

7.01.45 (revised 4-24-2023)

Alternative Barrier End Treatments

All the terminals discussed in this section have been crash tested as recommended by NCHRP Report 350 and approved by FHWA. As with all terminals where penetration behind and beyond the barrier can be expected, a traversable area, free of fixed objects, is recommended to aid post-crash vehicle stability. Alternative endings should be considered where restrictive site conditions exist, such as bi-directional traffic or two-sided directional traffic, and where the designer is unable to obtain the required offset, length, etc.

Note that this is not a comprehensive list of all alternative barrier end treatments, and future developments in the roadside safety industry will likely result in the availability of additional barrier end treatments. Consult with the Geometric Design Unit, Design Division, for additional information regarding alternative barrier end treatments.

7.01.45 (continued)

A. X-TENuator

The X-TENuator is an NCHRP 350, Test Level 3 compliant crash cushion manufactured by Barrier Systems (a Lindsay Corporation company), Vacaville, California. The X-TENuator may be used for both permanent and temporary applications, and may be used to terminate single-sided guardrail, double-sided guardrail, and concrete barriers. The X-TENuator is approximately 24'-9" long, and requires a concrete or asphalt base pad for installation. While the X-TENuator has a relatively low installation cost compared to other crash cushions, this device is considered to be a sacrificial unit that generally requires complete removal and replacement after a vehicular impact.

The X-TENuator may be desirable for restrictive site conditions, such as shielding concrete barrier or bridge railing endings at locations that prevent the installation of a traditional guardrail bridge anchorage and guardrail approach terminal. Designers should note that the X-TENuator requires 12'-6" of longitudinal clear space behind the unit on both sides of the object being shielded in order for the side panels of the X-TENuator to slide back and telescope when the unit is impacted.

Detailed information on design and installation is available from the Geometric Design Unit, Design Division.

7.01.45 (continued)

Alternative Barrier End Treatments

B. QuadTrend™

The QuadTrend system is a proprietary terminal manufactured by Energy Absorption Systems Inc. This device is for one-sided directional traffic and is intended for shielding concrete barrier endings, bridge railing endings, abutments, etc. This device can be attached directly to a rigid ending without a guardrail strength transition. Detailed design, construction and maintenance information is available from the Geometric Unit, Design Division.

7.01.45 (continued)

C. BEAT-SSCC

The BEAT-SSCC (Box Beam Bursting Energy Absorbing Terminal Single-Sided Crash Cushion) is an NCHRP 350, Test Level 3 compliant terminal manufactured by Road Systems Inc., Big Springs, Texas.

The BEAT-SSCC may be used for both permanent and temporary applications, and is intended for use as a single-sided terminal for shielding concrete barrier, bridge abutments/piers, and certain types of bridge railings. The BEAT-SSCC is available in the following lengths: 28', 32', 36', 40', and 44'. The BEAT-SSCC is available with driven (ground-mounted) posts or with surface-mounted posts for installation on a concrete surface. While the BEAT-SSCC has a relatively low installation cost compared to other crash cushions, this device is considered to be a sacrificial unit that generally requires complete removal and replacement after a vehicular impact.

The BEAT-SSCC may be desirable for restrictive site conditions, such as shielding concrete barrier or bridge railing endings at locations that prevent the installation of a traditional guardrail bridge anchorage and guardrail approach terminal.

Detailed information on design and installation is available from the Geometric Design Unit, Design Division.

7.01.50 (revised 5-22-2023)

Temporary Beam Guardrail

Beam guardrail may be used for temporary barrier applications when deemed appropriate based on intended usage, site conditions, and economic feasibility. Materials, including posts, may be of salvaged origin, and removal is included in the pay item. It is primarily used on construction projects where traffic is maintained along the existing road. While temporary concrete barrier is now used to a great extent, temporary guardrail may be a viable alternative provided proper guardrail installation is feasible based on site conditions. Temporary beam guardrail must be called for on plans when so requested by the Region/TSC. If specific installation locations are not shown on plans, a lump sum quantity and general note should be provided for the entire project on the Note Sheet, as follows:

Guardrail, Temp, Type __, __ inch Post __ ft
(To be used as directed by the Engineer)

In general, avoid estimating less than 200' total for a project, since a very small quantity may result in an exorbitant unit price.

Temporary beam guardrail has the same placement and installation requirements as permanent guardrail, but is usually not placed less than 6'-0" from the edge of traffic-carrying lanes. It may be used in areas where the pavement is located 20'-0" or less from the edge of excavations that exceed 5'-0" in depth, and which have a vertical face or slope of 1:2 or steeper.

7.01.50 (continued)

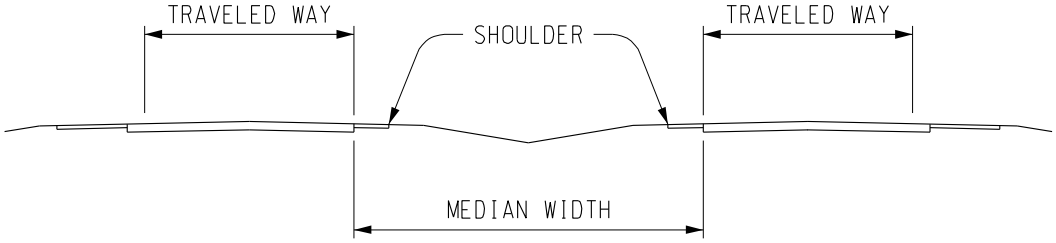
Temporary beam guardrail endings are handled in a similar manner as permanent guardrail endings. When a temporary beam guardrail ending is within the clear zone of approaching traffic, a crashworthy guardrail approach terminal or anchorage shall be used. Temporary guardrail departing terminals may be used when located beyond the clear zone of approaching traffic. Include the appropriate temporary guardrail approach terminal, departing terminal, and anchorage pay items and quantities, as needed. The temporary beam guardrail pay items are identified in Section 807 of the Standard Specifications for Construction.

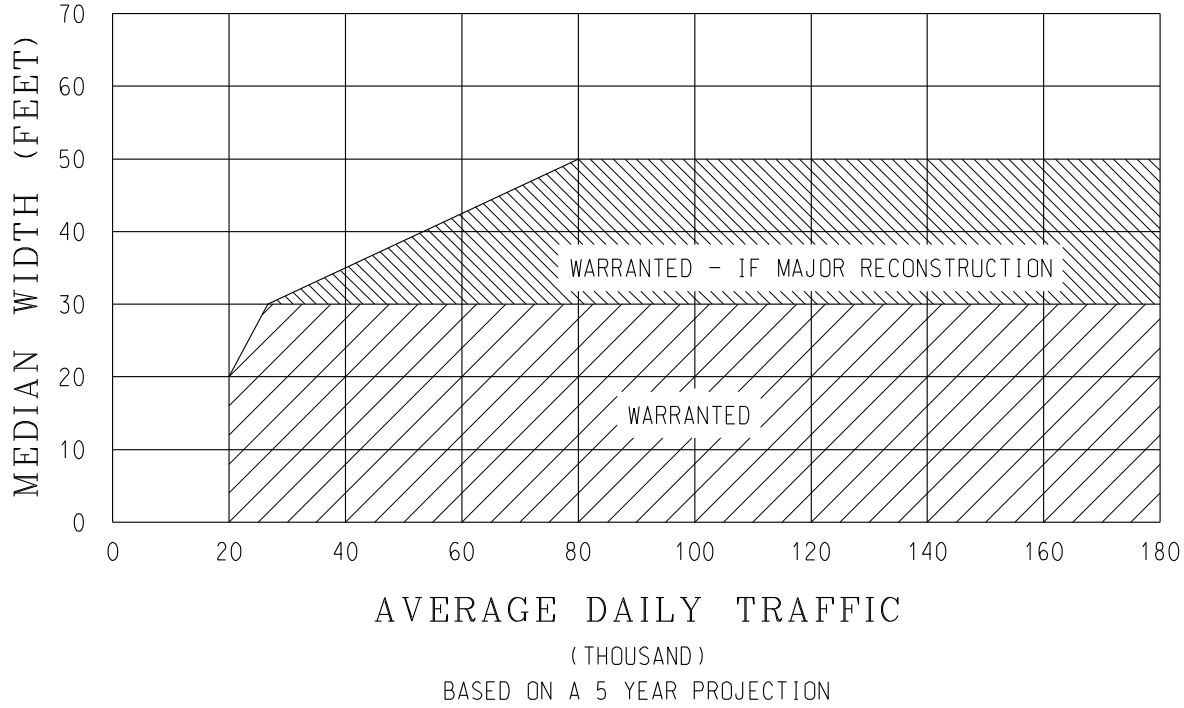
7.01.54 (revised 10-21-2013)

7.01.54 (continued)

Warrants for Median Barriers on Freeways

Double thrie and double W-beam steel guardrail (semi-rigid), concrete median barrier (rigid) and Cable (Flexible) are considered equally suitable for reducing cross-median crashes. However, each has its application and each has its advantages and disadvantages. The designer should be knowledgeable of these when making decisions relative to which type of barrier to call for. The most desirable system is the one that satisfies the performance requirement and costs the least to install and maintain. Section 5.2 of the 2011 AASHTO ***Roadside Design Guide*** summarizes the major factors which should be considered before making a final selection. The current median barrier warrants formulated for placing barrier in freeway medians were developed by the former Traffic and Safety Division, accepted by the Barrier Advisory Committee and approved by the Engineering Operations Committee at their February 4, 1992 meeting. The warrant table is shown below:





7.01.55 (revised 4-24-2023)

Median Barrier Types

Median barriers, when used, are employed almost exclusively on controlled access highways. If the road is free access, openings would have to be provided at intersections and crossovers. This means that the barrier must be terminated at these points with a crash worthy end treatment. The lengths of the end treatments must be added to the length of the opening thus increasing the length of unprotected median, as the end treatments provide only marginal median crossover protection.

Generally, the initial installation cost of concrete median barrier is about 10-15% more than a double-sided metal guardrail. (However, this comparison does not include the possible additional cost of drainage alterations, etc., that might be required in conjunction with concrete barrier.) Advantages and disadvantages for the three barrier systems are as follows:

A. Concrete Median Barrier

Advantages

1. Very low maintenance.
2. Relatively good visibility.
3. Less vehicle damage at low angles of impact.
4. Easier on which to affix glare screen (glare screen can be integrally cast)

Disadvantages:

1. Greater “snow fence” effect (wind cannot pass through)
2. Traps blowing paper and trash
3. Usually requires some form of internal drainage
4. May require extensive grading. In most cases, adjacent slopes should be 1:10 or flatter.

7.01.55 (continued)

B. Double Steel Beam Guardrail

Advantages

1. May be used in the wider medians (median width not a factor)
2. Less “snow fence” effect than concrete barrier
3. Lateral drainage can flow under
4. Performs better than concrete barrier for high angle impacts
5. When placed along the top of a V-ditch, guardrail may be installed adjacent to a 1:6 backslope (Type TD) or 1:8 backslope (Type MGS-8D).

Disadvantages:

1. Maintenance repair usually required after a hit
2. Harder to install in rock
3. No durable glare screen available for mounting on top

C. Cable Barrier

General Guidelines

- Cable median barrier is recommended on divided roadways where:
  1. Median crossover crashes have been reported, and
  2. Median barrier is not warranted based on Section 7.01.54 of the Michigan Road Design Manual.
- Median width should be a minimum of 30 feet.
- Median slopes shall be 1:4 or flatter.
- The cable barrier shall be placed at a location that permits the system to deflect unimpeded during a vehicular impact. The cable barrier shall not interfere with opposing traffic or other roadside objects during a vehicular impact. If a single run of cable barrier cannot satisfy the offset requirements, dual runs should be used.
- At locations where both NCHRP 350, TL-3 and TL-4 cable systems may be installed, NCHRP 350, TL-4 cable systems are preferred.

7.01.55C (continued)

Median Barrier Types

- The length of need (LON) for cable median barrier is based on engineering judgment. Consult with the Geometric Design Unit of the Design Division for additional information.
- Due to the advantages high-tension cable systems possess, high-tension cable systems are preferred over low-tension cable systems.

Approved Cable Median Barrier Systems

The following cable barrier systems are approved for use as median barrier. Questions regarding cable median barriers should be directed to the Geometric Design Unit of the Design Division.

A. Low-Tension Three-Cable Median Barrier (Type M Cable Barrier per Standard Plan R-70-Series)

This is a non-proprietary cable system that is described in the 2011 AASHTO ***Roadside Design Guide*** and MDOT Standard Plan R-70-Series. This design has been adopted by various agencies throughout the nation. The cable system and the end terminals have been successfully tested to NCHRP 350, TL-3.

Advantages:

1. Non-proprietary, usually less expensive than proprietary items
2. May be used on curved roadways with radii as low as 110 feet

Disadvantages:

1. Generally requires more maintenance than high-tension cable systems
2. System is usually inoperative after an impact (i.e., requires immediate inspection and maintenance after an impact)
3. Larger impact deflection compared to high-tension cable systems
4. Maximum length between terminals is considerably smaller than high-tension cable systems

7.01.55C (continued)

Table 1:

DESIGN CRITERIA FOR LOW-TENSION THREE-CABLE MEDIAN BARRIER		
Maximum Flare Rate	4:1	
Minimum Design Deflection Distance	16 feet	
Minimum Offset Between Median Ditch Line and Cable Barrier (Single Runs Only)	8 feet	
Maximum Length Between Terminals	2,000 feet	
Post Spacing and Roadway Curvature Requirements	**RADIUS**	**POST SPACING**
	Less than 110 feet	**CABLE BARRIER NOT RECOMMENDED**
	110 feet to 219 feet	6’-0”
	220 feet to 699 feet	12’-0”
	700 feet or more and Tangent Sections	16’-0”

7.01.55C (continued)

Median Barrier Types

B. High-Tension Cable Median Barrier

CASS Cable System
The CASS cable system is a proprietary, high-tension cable barrier manufactured by Trinity Industries, Inc. The system is available with I-shaped steel posts installed in concrete post foundations with a sleeve of steel, or a driven steel socket with a soil plate welded to the socket.

There are two versions of the CASS system in use on MDOT roadways.

The CASS 4:1 Slope cable barrier system is an NCHRP 350, TL-4 system when placed on 1:6 or flatter slopes. This system may also be placed on slopes steeper than 1:6, up to 1:4, and is NCHRP 350, TL-3 compliant under such conditions. This cable system consists of three 3/4" diameter pre-stretched cables, with the top and middle cables located in a slot in the middle of the post. The top and middle cables are separated by recycled plastic spaces. The bottom cable is placed on the side of the post and secured with J-hook fasteners. This is the most common version of the CASS system used on MDOT roadways.

The CASS TL-4 cable barrier system is an NCHRP 350, TL-4 compliant cable barrier system. This cable system consists of three 3/4" diameter pre-stretched cables, with all three cables located in a slot in the middle of the post and separated by recycled plastic spacers. This cable system can only be installed on 1:6 or flatter slopes. As a result of this limitation, it is used less often than the CASS 4:1 Slope cable barrier system.

In addition, the CASS cable terminal (CCT) is an NCHRP 350, TL-3 compliant end terminal for use with both CASS systems.

7.01.55C (continued)

Gibraltar Cable System
The Gibraltar cable system is a proprietary, high-tension cable barrier manufactured by Gibraltar Global, LLC. The system consists of steel posts installed in concrete post foundations with a sleeve of steel or a driven steel socket with a soil plate welded to the socket. Even though Gibraltar manufactures several cable barrier systems, the three-cable, Gibraltar TL-4 cable barrier system is the system commonly used on MDOT roadways. It meets NCHRP 350, TL-4 when placed on 1:6 or flatter slopes, but also meets NCHRP 350, TL-3 on slopes steeper than 1:6, up to 1:4. Furthermore, the Gibraltar cable terminal is an NCHRP 350, TL-3 compliant end terminal for use with the Gibraltar cable system. ¾" diameter prestretched cables are attached to the posts and kept at the appropriate height by devices called "hairpins," which are unique to Gibraltar. The cables are tensioned according to cable temperature.

7.01.55C (continued)

Brifen Cable System

The Brifen cable system is a proprietary, high-tension cable barrier manufactured by Brifen USA, Inc. The system consists of steel posts installed in concrete post foundations with a sleeve of steel, or a driven steel socket with a soil plate welded to the socket, and four ¾" pre-stretched cables. Three of the four cables are woven on alternating sides of sequential posts over the entire segment length. The cables are tensioned according to cable temperature.

The Brifen cable system used on MDOT roadways meets NCHRP 350, TL-4 when placed on 1:6 or flatter slopes, and also meets NCHRP 350, TL-3 when placed on slopes steeper than 1:6, up to 1:4. In addition, the Brifen WRGT end terminal is an NCHRP 350, TL-3 compliant end terminal for use with the Brifen cable system.

7.01.55C (continued)

Median Barrier Types

Advantages:

1. Typically impact deflection is 10 feet or less
2. Generally requires less maintenance than low-tension cable systems
3. Compared to low-tension cable barrier, high-tension cable barrier has a much higher probability of remaining operative after an impact

Disadvantages:

1. Systems are proprietary; more expensive than low-tension cable systems
2. System may be inoperative after an impact (i.e., usually requires immediate inspection and maintenance after an impact)
3. System is limited to curved roadways with radii of 650 feet and greater

7.01.55C (continued)

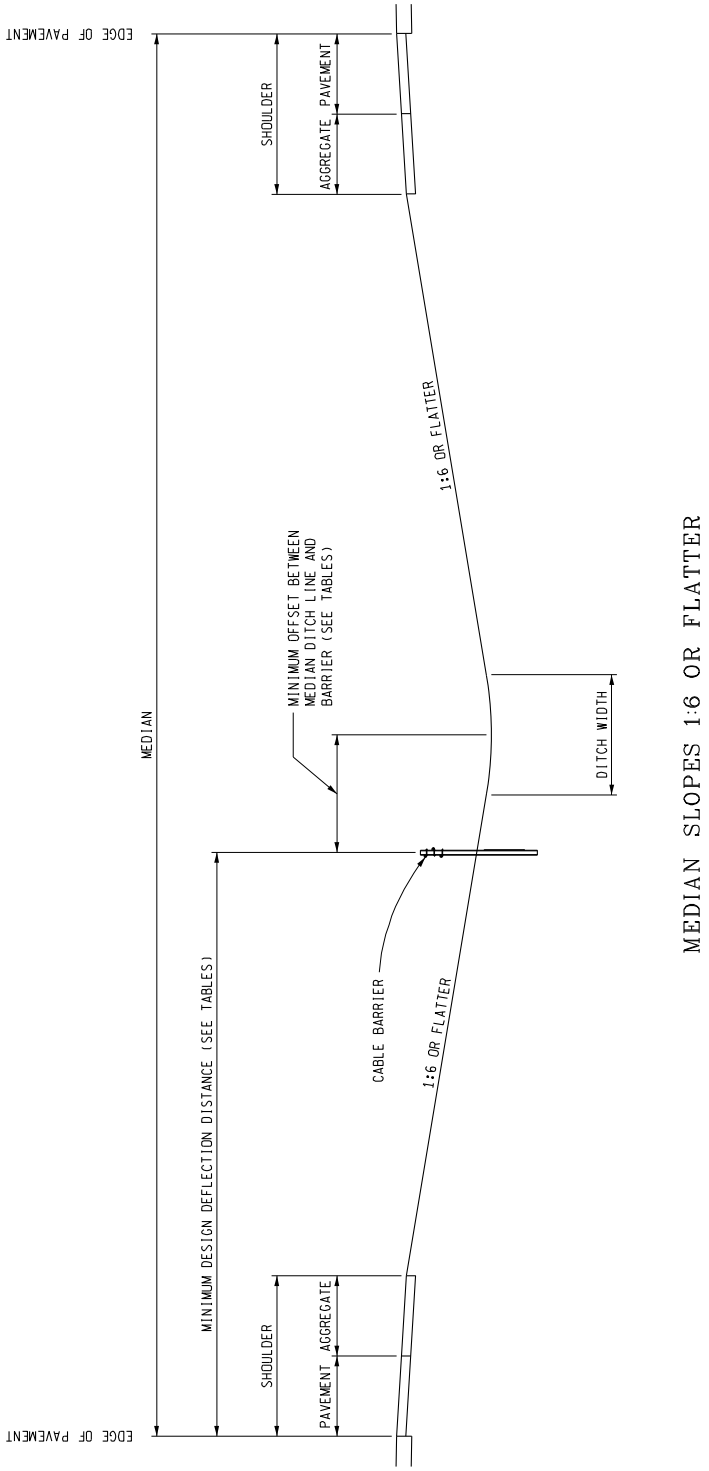
Table 2:

DESIGN CRITERIA FOR HIGH-TENSION CABLE MEDIAN BARRIER		
Maximum Flare Rate	30:1	
Minimum Design Deflection Distance	12 feet	
Minimum Offset Between Median Ditch Line and Cable Barrier (Single Runs Only)	10 feet	
Maximum Length Between Terminals	10,560 feet (2 miles) *	
Post Spacing and Roadway Curvature Requirements	**RADIUS**	**POST SPACING**
	Less than 650 feet	**CABLE BARRIER NOT RECOMMENDED**
	650 feet and greater	See Manufacturer's Specifications

* 2 miles is a suggested operational value, but longer runs are possible if the local TSC deems it acceptable.

7.01.55C (continued)

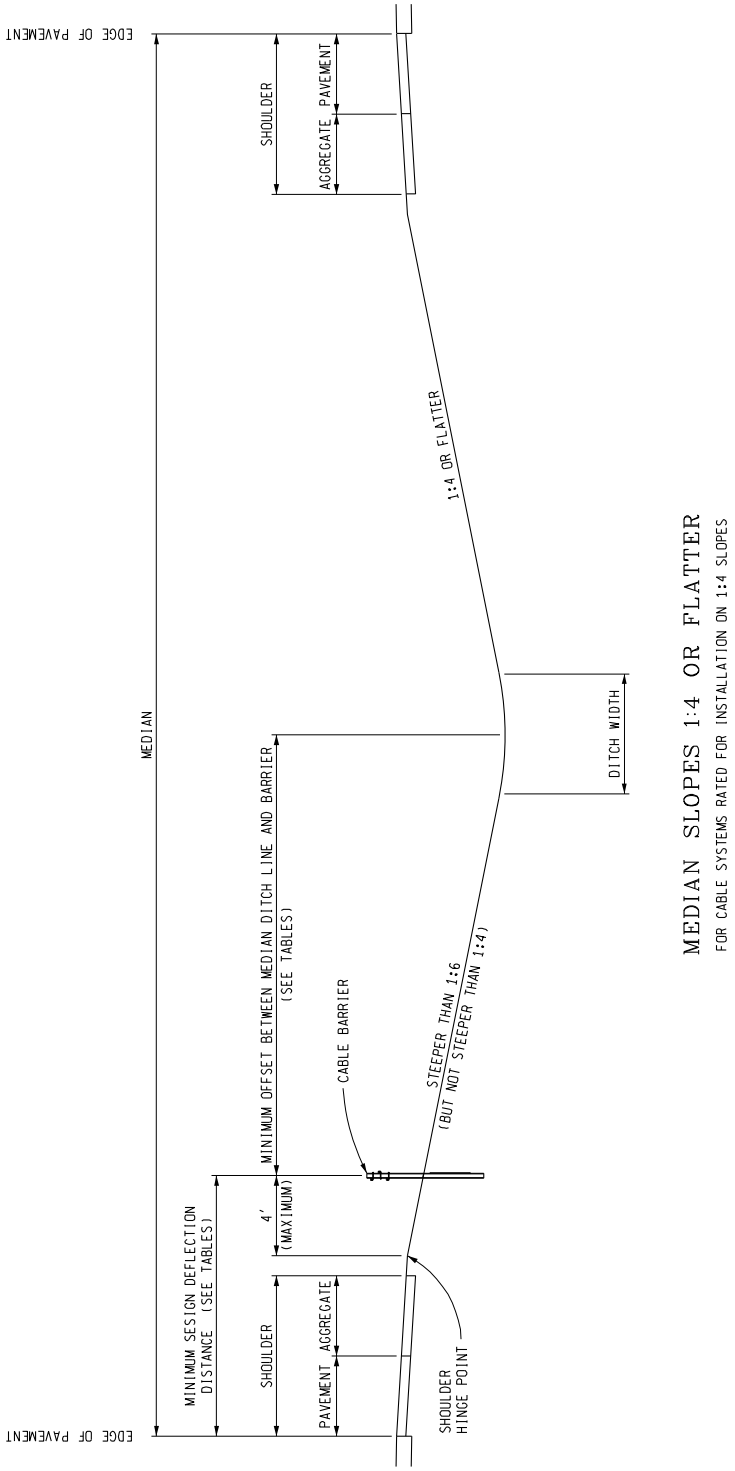
Median Barrier Types



MEDIAN SLOPES 1:6 OR FLATTER

7.01.55C (continued)

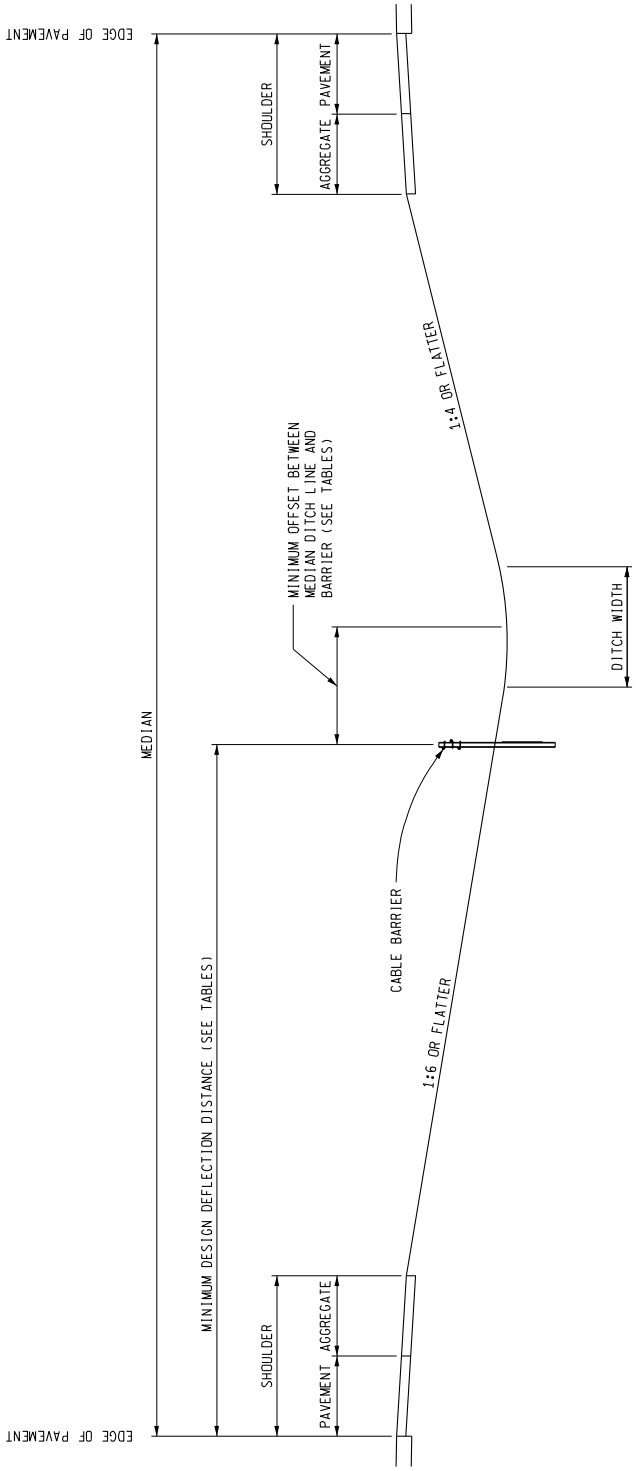
Median Barrier Types



MEDIAN SLOPES 1:4 OR FLATTER
FOR CABLE SYSTEMS RATED FOR INSTALLATION ON 1:4 SLOPES

7.01.55C (continued)

Median Barrier Types

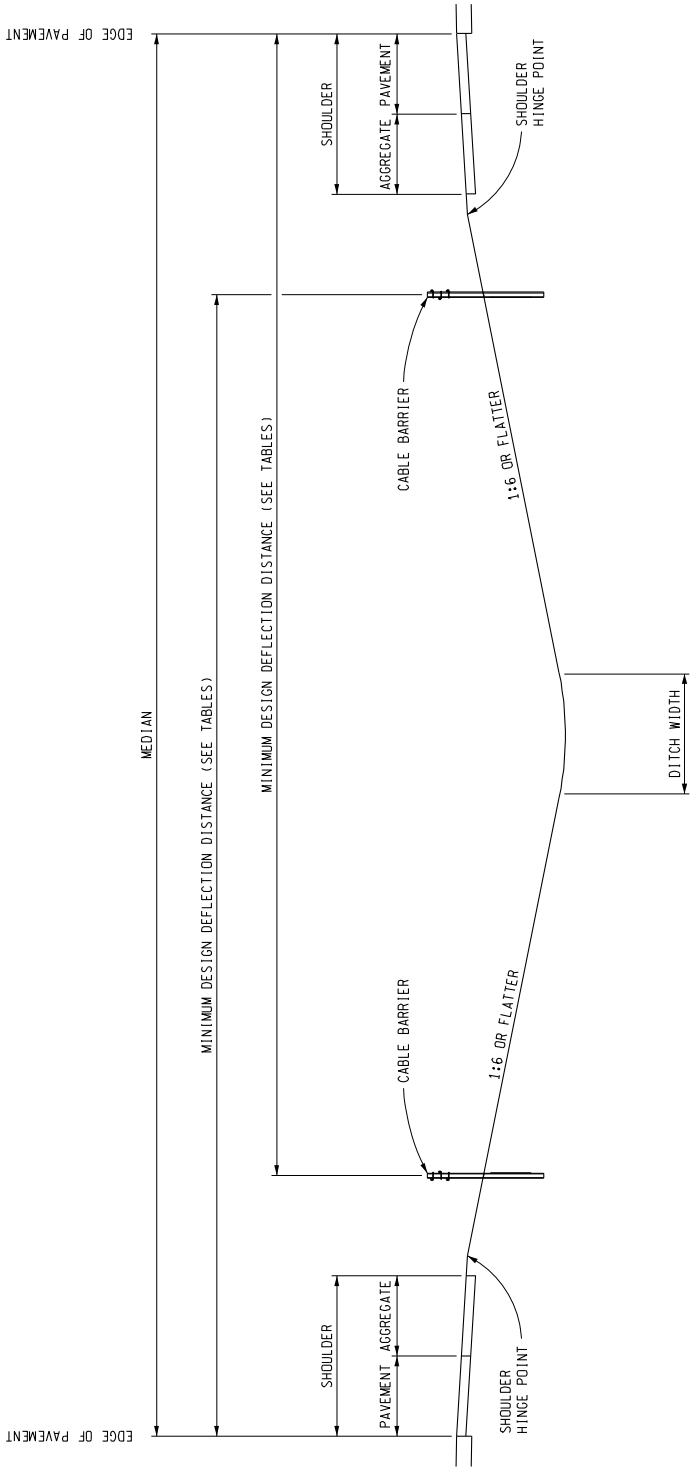


MEDIAN SLOPES 1:6 OR FLATTER ON ONE SIDE AND STEEPER THAN 1:6 ON THE OTHER

LOW TENSION CABLE BARRIER OR HIGH TENSION SYSTEMS RATED FOR 1:6 SLOPES OR FLATTER

7.01.55C (continued)

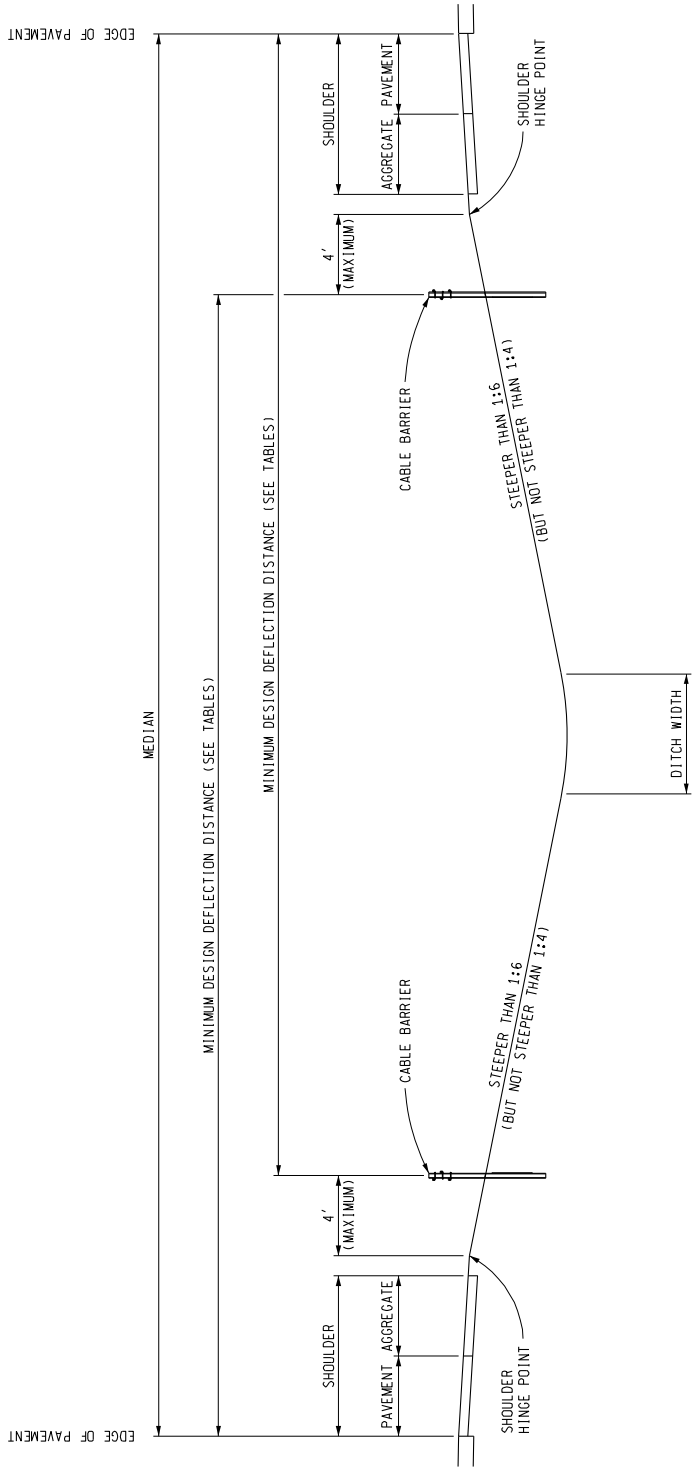
Median Barrier Types



DUAL RUNS ON MEDIAN SLOPES 1:6 OR FLATTER

7.01.55C (continued)

Median Barrier Types

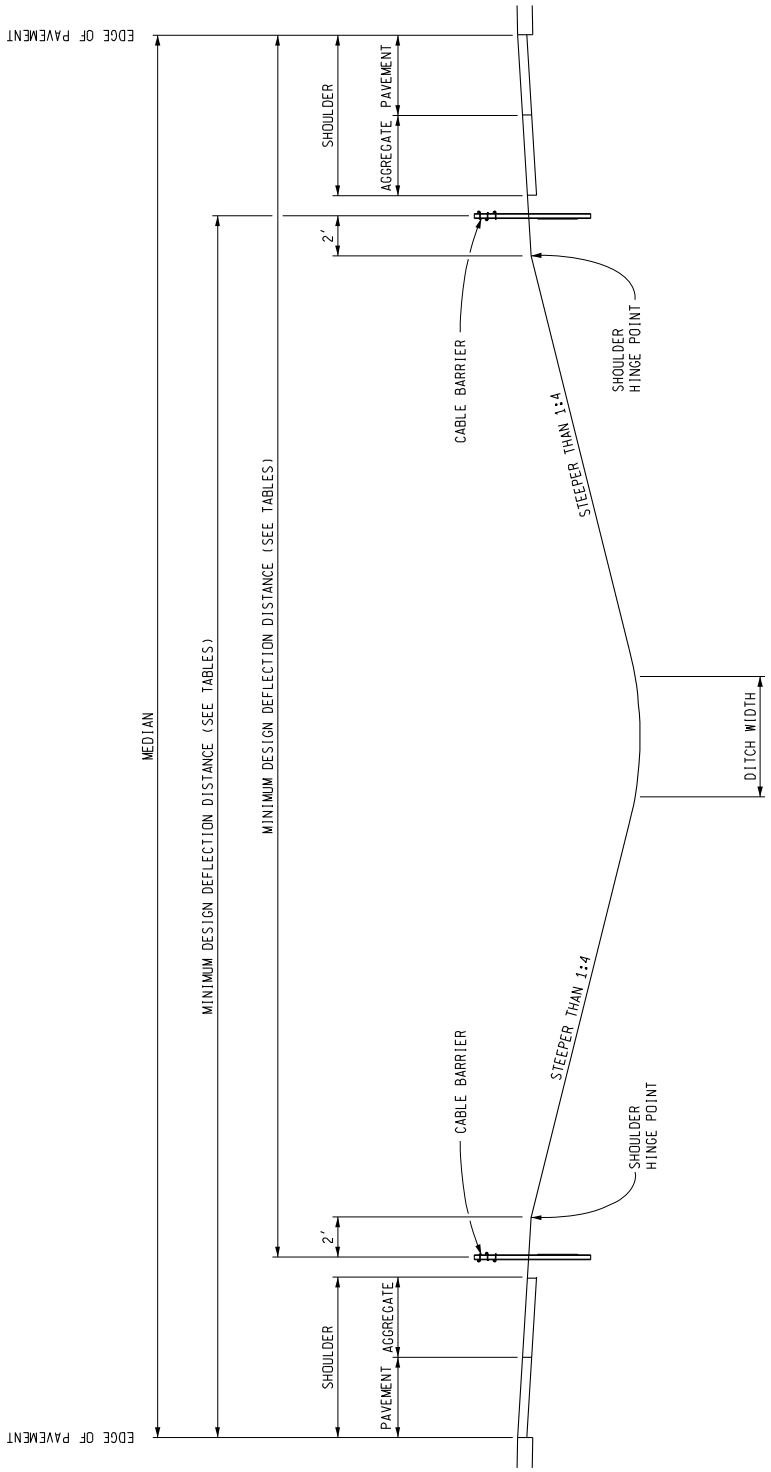


DUAL RUNS ON MEDIAN SLOPES STEEPER THAN 1:6 UP TO 1:4

FOR CABLE SYSTEMS RATED FOR INSTALLATION ON 1:4 SLOPES

7.01.55C (continued)

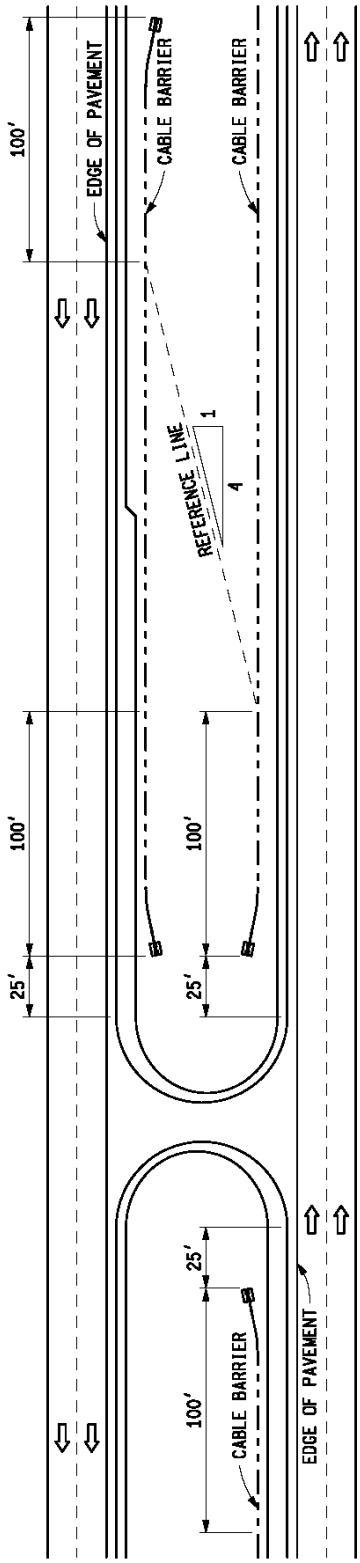
Median Barrier Types



MEDIAN SLOPES STEEPER THAN 1:4

7.01.55C (continued)

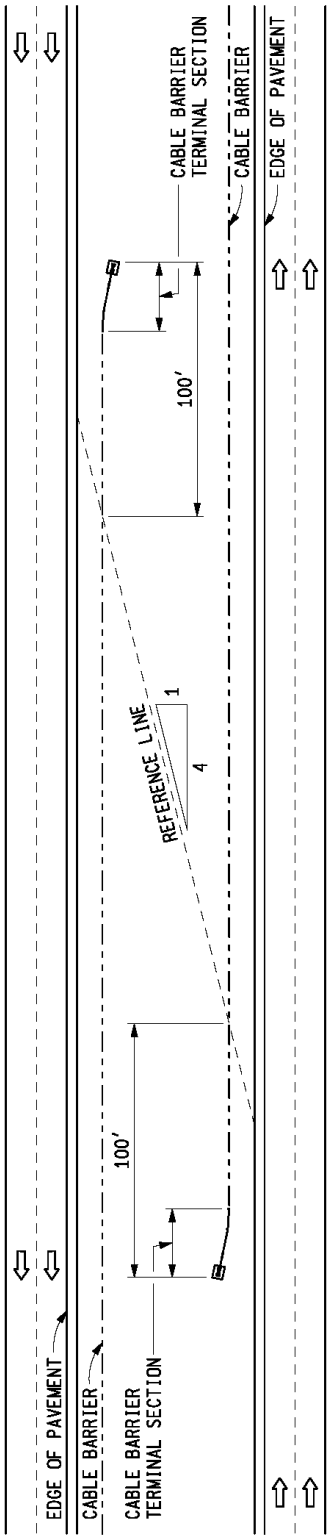
Median Barrier Types



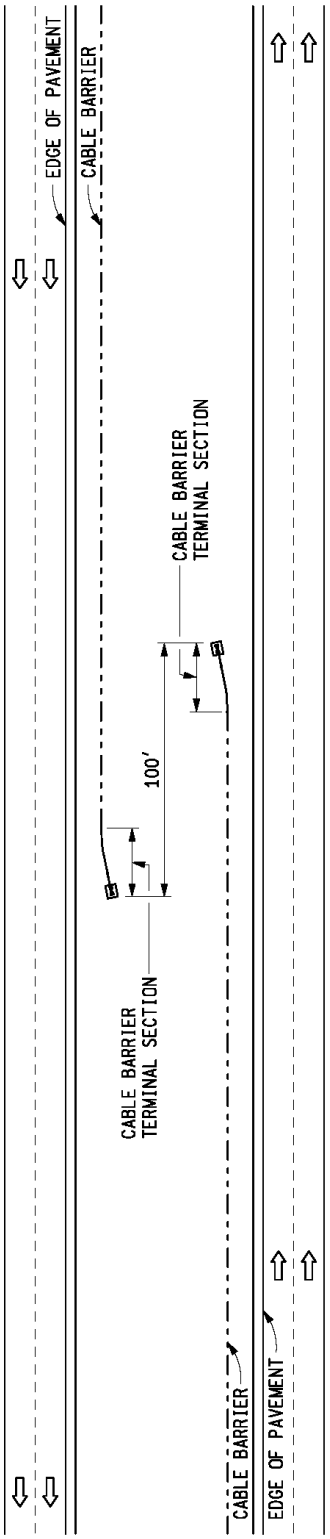
MAINTENANCE CROSSOVER LAYOUT

7.01.55C (continued)

Median Barrier Types



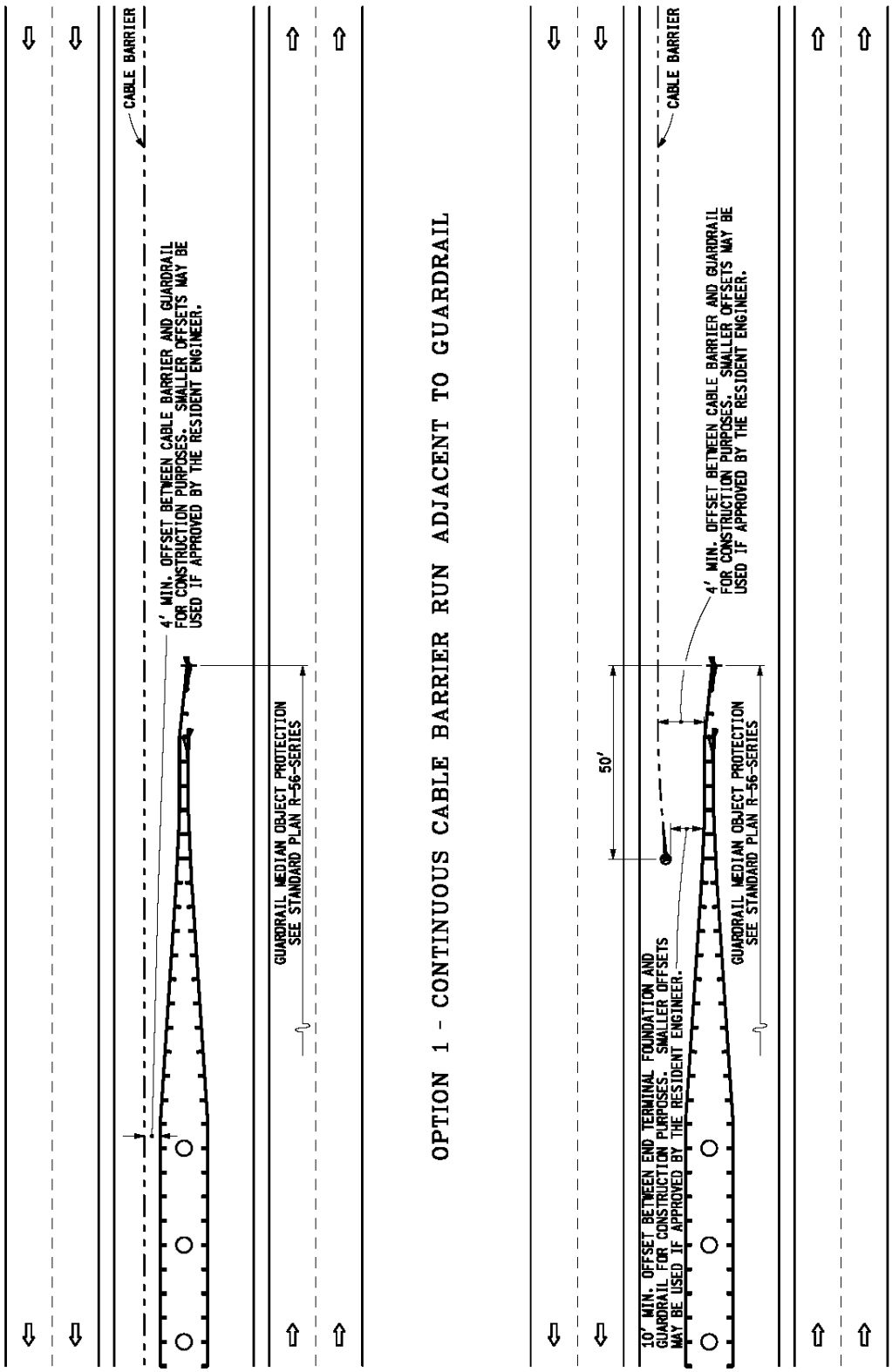
CABLE BARRIER SHIFT - APPROACH END



CABLE BARRIER SHIFT - DEPARTING END

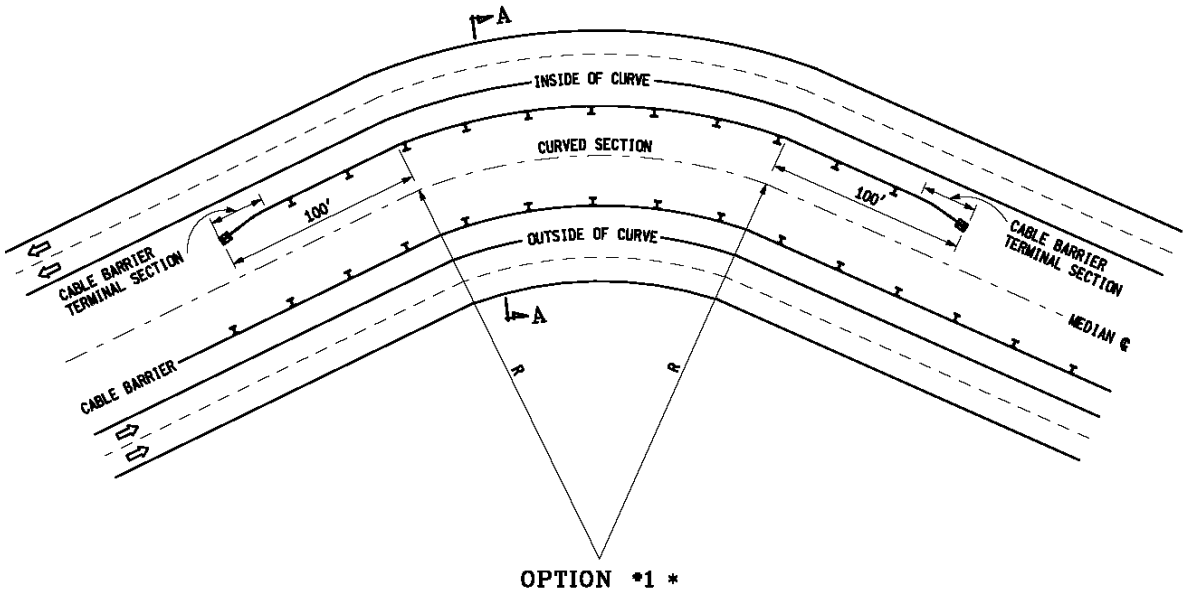
7.01.55C (continued)

Median Barrier Types

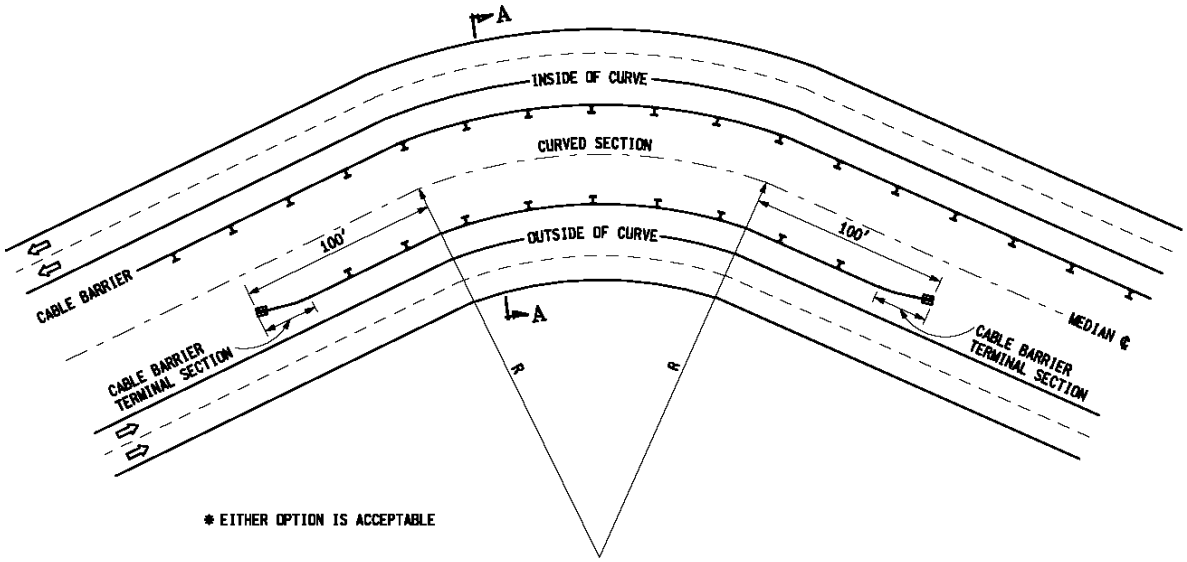


7.01.55C (continued)

Median Barrier Types

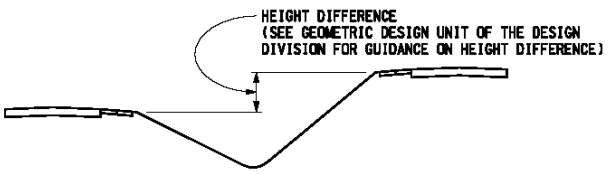


OPTION *1 *



* EITHER OPTION IS ACCEPTABLE

OPTION *2 *



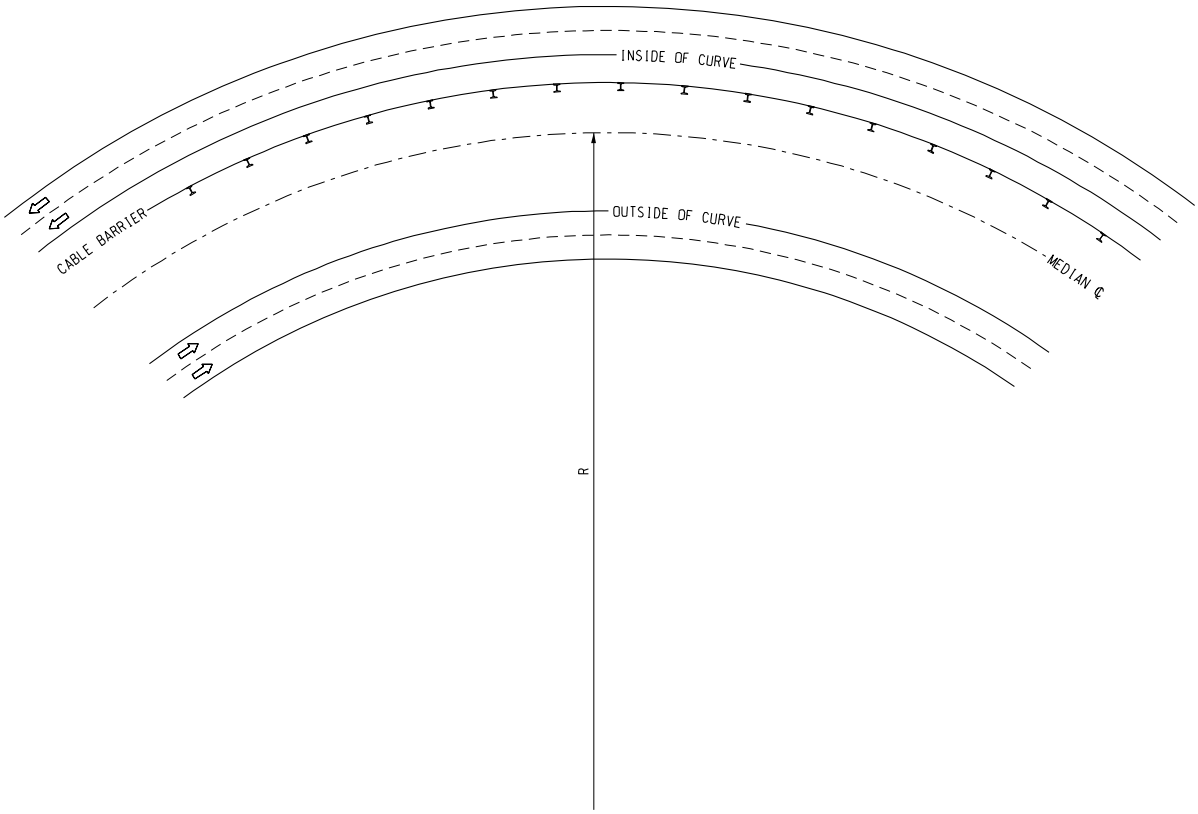
SECTION A-A

RECOMMENDED CABLE BARRIER PLACEMENT ON CURVED ROADWAYS

R < 5,730' WITH UNEQUAL EMBANKMENT HEIGHT OR MEDIAN SLOPES STEEPER THAN 1:4

7.01.55C (continued)

Median Barrier Types



RECOMMENDED CABLE BARRIER PLACEMENT ON CURVED ROADWAYS

$5{,}730' \leq R \leq 11{,}460'$

$R < 5{,}730'$ WITH EQUAL EMBANKMENT HEIGHT AND 1:4 OR FLATTER MEDIAN SLOPES

7.01.56 (revised 4-24-2023)

7.01.56 (continued)

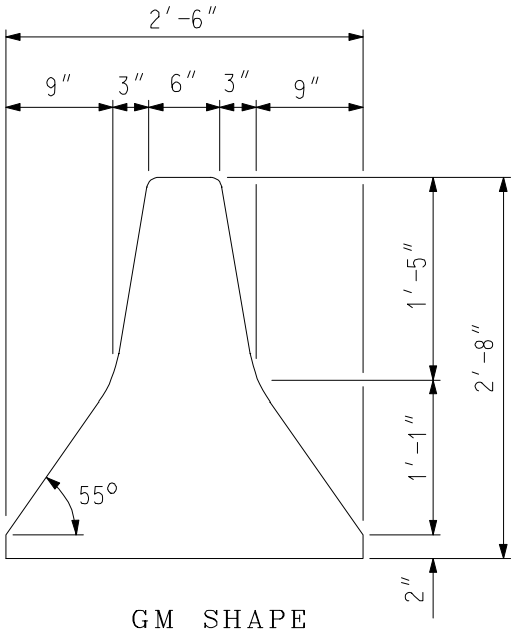
Concrete Median Barriers

A. GM Shape

The first concrete barrier shape used in Michigan was developed by General Motors. Sections of the GM barrier shape still remain in use, but is no longer being built on new construction projects. It was replaced by the New Jersey shape on Standard Plan II-49D in 1976.

The key design parameter for a safety shape barrier is the distance from the ground to the slope break point because this determines how much the vehicle suspension will be compressed. The higher slope break (1'-1") of the GM shape causes less sheet metal damage, but it has more potential for an impacting vehicle to ride up on the barrier. There would be nothing wrong with a vertical-faced barrier except that the slightest vehicle contact will result in sheet metal damage. A vertical wall, of course, is more difficult to construct if slip-form methods are used.

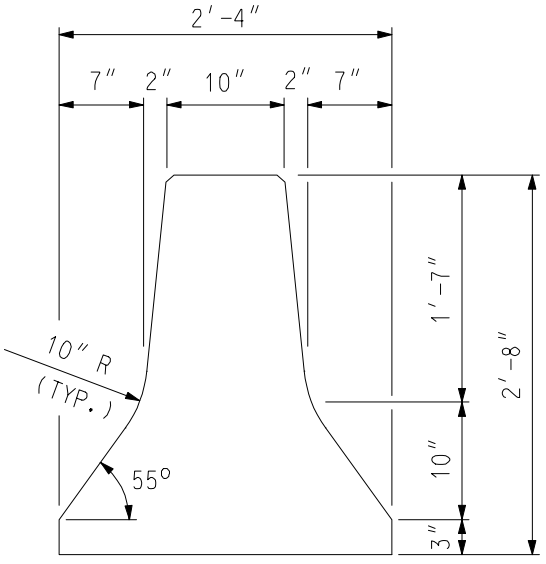
At it's June 2, 2000 meeting, the Engineering Operations Committee approved a Department policy that calls for replacement of existing GM barrier as warranted by the condition of the existing barrier and crash history.



GM SHAPE

B. New Jersey Shape

The New Jersey shape was the second barrier shape used in Michigan. It has a 3" high vertical face at the toe. This is an allowance for future resurfacing. The 10" radius at the change in vertical slope has no safety purpose; it is for aesthetic purposes only. The standard 10" top width was determined as necessary to provide the same overturning moment as the previously used G.M. barrier, and to reduce the probability of fracture under heavy impact. It should be emphasized that the New Jersey shaped barrier should not be built with a 6" top width and, in fact, has never been standard in Michigan.



NEW JERSEY SHAPE

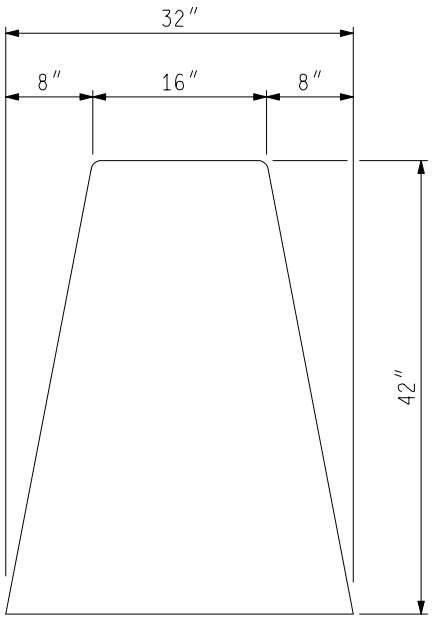
7.01.56 (continued)

Concrete Median Barriers

C. Single Slope

The single slope is Michigan's current standard shape. It has a 32" base and a 16" top which are connected by single 21:4 slopes on each side of the barrier. This single slope design provides the potential for several future overlays, since the single slope shape will not be impacted by future overlays. However, designers must ensure that the barrier is at least 36” tall after an overlay in order to meet the minimum barrier height requirement for MASH, TL-4 conditions.

The single slope is also common to a majority of the states in the country and is easier to slip form than the New Jersey shape.



SINGLE SLOPE

7.01.57 (revised 6-23-2025)

Ending Concrete Barrier

Concrete barrier normally can be ended by attaching a combination of a bridge guardrail anchorage (Standard Plan R-67-Series), conventional guardrail, and a guardrail approach terminal (see Standard Plans R-61 & R-62-Series). The same criteria for calculating the length of need should be used with the concrete barrier included in the length of need. The minimum length of anchorage and ending guardrail are specified on Standard Plan R-54-Series.

In the case of ending a concrete median barrier, the approach side can be ended with guardrail as long as the barrier is ended with all portions of the barrier system being located outside the clear zone area for the opposing traffic.

Where the minimum length and lateral clearance cannot be obtained, a more expensive alternative for ending the concrete barrier would be to use an impact attenuator. (See Section 7.02.)

Concrete barrier sloped end sections are not a preferred treatment when located within the clear zone of approaching traffic. Use sloped end sections only within the clear zone of approaching traffic when guardrail, impact attenuators, and other crashworthy treatments are not feasible, and when the posted speed is 35 mph or less. Consult the Roadside Safety Engineer in the Geometric Design Unit for guidance.

7.01.58 (revised 4-24-2023)

Two Types of Concrete Median Barrier Footings

Designers should note that the standard plan for concrete median barrier (R-49-Series) specifies a Type A and a Type B. Type A has an integrally cast footing whereas Type B is doweled to a separately cast footing or concrete shoulder. When Type A barrier is called for on the plans the contractor has the option of casting the base integrally with footing or constructing the barrier in the same manner as Type B without any extra payment. Type B is payment for the upper portion of the barrier and is doweled onto an existing separately cast footing or concrete shoulder. If the designer wants to designate that the barrier be cast on a separate footing, they should note this on the plans or in a special provision.

7.01.59 (revised 10-22-99)

Concrete Glare Screen

Concrete glare screen, as opposed to glare screen made of other materials, is now used exclusively in Michigan when a glare screen is needed in conjunction with a concrete median barrier. Glare screen is called for routinely whenever the concrete median barrier is on a curve and whenever the concrete median barrier is used on new urban type construction. See Section 7.03.

7.01.60 (revised 4-24-2023)

Retrofitting Concrete Median Barrier

It is usually difficult and costly constructing a concrete median barrier where no median barrier had existed previously and especially where the median is drained by open ditch. Factors which the designer must consider are:

1. Where will the median barrier be placed? If located at the center of the median, the clear recovery area remaining is equal for both roadways; if constructed adjacent to one shoulder, recovery area is unequal for the two directions.

7.01.60 (continued)

2. Is the median ditch shallow enough and the slopes gentle enough to permit safe traversal? Typically slopes leading to the face of concrete barriers should be 1:10 or flatter. If the open ditch must be filled in and enclosed drainage provided, then the median must be completely reconstructed.

3. If enclosed drainage is decided upon, are roadway grades sufficient to drain surface water?

When flat (0 - 0.1%) grades are encountered, it may be necessary to use metal slotted drain adjacent to concrete median barrier. When slotted drain is used, only about 50% of the length of flat grade actually needs the slotted drain (placed intermittently).

7.01.65 (revised 5-22-2017)

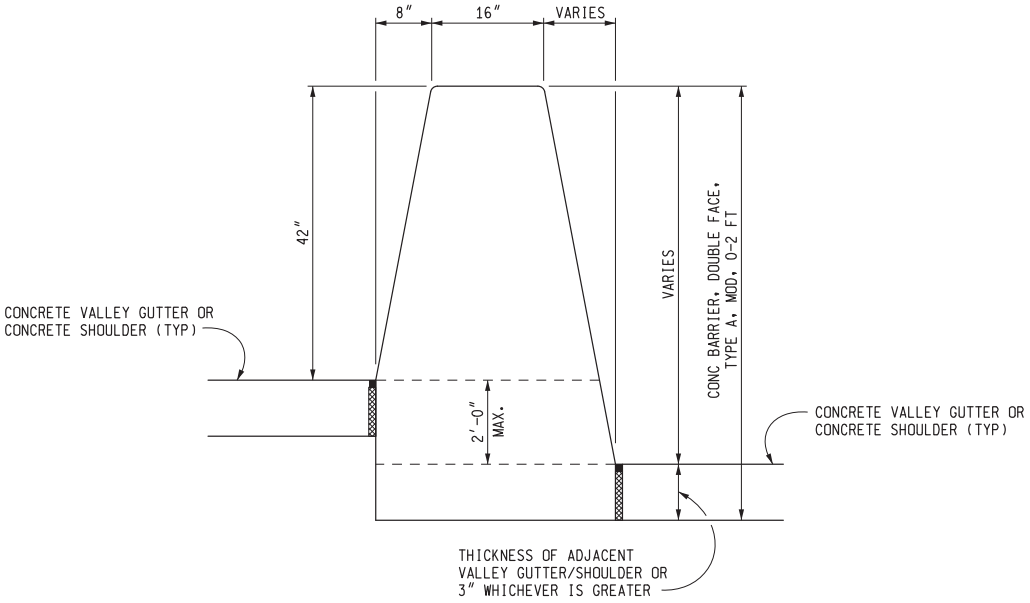
Concrete Median Barrier Between Roadways of Different Elevations

Superelevation on divided highways may cause the median shoulders to be at different elevations. When this occurs, one side will be higher than normal resulting in the median barrier being asymmetrical. The barrier must be specially detailed on the plans. The single slope shape should be used, and the high side should be created by extending the upper slope as high as necessary to match the other, normal, side. The plans should not refer to the single slope shape as such, except in the context that it is modified.

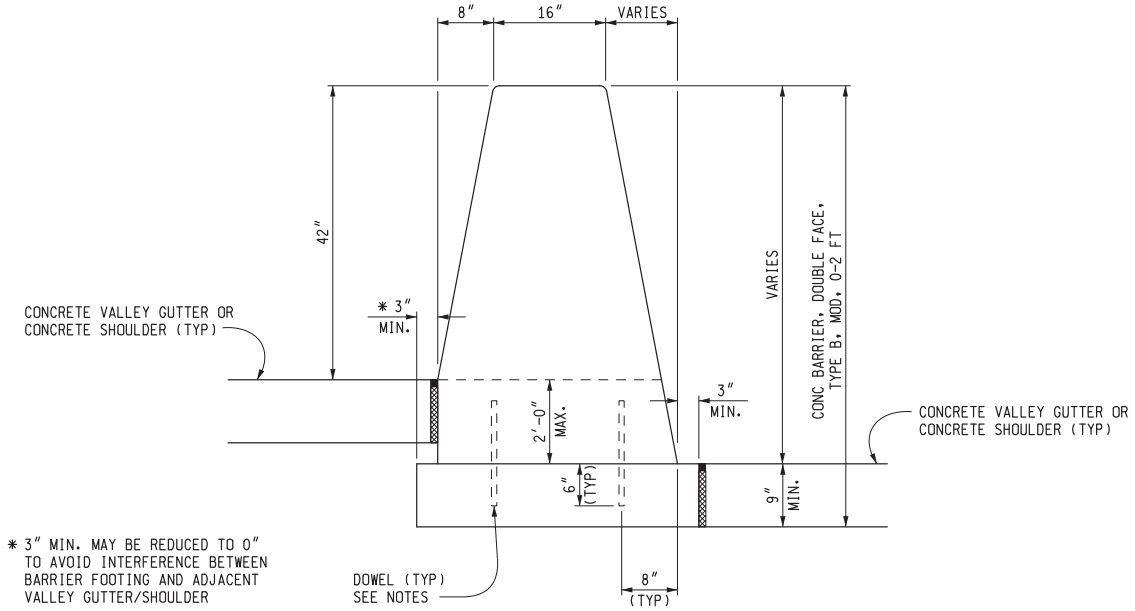
A 2'-0" difference in elevation is the maximum the barrier can accommodate without the use of steel reinforcement. Elevation differences exceeding 2'-0" will require structural steel reinforcement in the barrier, and slip-forming should not be permitted when constructing reinforced barrier sections. Contact the Geometric Design Unit, Design Division for assistance with designing barriers with a grade separation exceeding 2'-0".

7.01.65 (continued)

Concrete Median Barrier Between Roadways of Different Elevations



CONCRETE BARRIER, TYPE A
WITH
HEIGHT DIFFERENCE BETWEEN MEDIAN SHOULDERS
(2′-0″ MAXIMUM)



CONCRETE BARRIER, TYPE B
WITH
HEIGHT DIFFERENCE BETWEEN MEDIAN SHOULDERS
(2′-0″ MAXIMUM)

7.01.66 (revised 4-24-2023)

Concrete Barrier, Single Face

Single face concrete barrier was developed to shield roadside objects or features from one side only. One such situation is found on depressed expressways, where the right-side approaches to bridge piers need shielding from only one side. The Metro Region favors the use of a concrete barrier over the use of steel beam guardrail in these locations. The major justification for its use is minimal maintenance. The results are less exposure to risk for maintenance personnel and the reduced potential of a damaged system being exposed to the motoring public between an impact and the completed repair.

If the normal width shoulder can be maintained and a concrete barrier is needed, it should be placed in front of the underpass bridge piers. Otherwise, the concrete barrier should be transitioned to the vertical face of the pier column as specified on Standard Plan R-54-Series. Because single face concrete barrier is most commonly used on urban depressed expressways, the approach ending is usually buried in the adjacent cut slope. See Standard Plan R-54-Series. If the approach end cannot be buried in a backslope, it should be shielded with a minimum of a Guardrail Anchorage, Bridge and a guardrail approach terminal, or an impact attenuator.

The use of single face concrete barrier will usually be requested at the plan review meeting and will usually be restricted to the depressed urban freeway situation. Its use in rural areas is generally discouraged because of the cost factor, the "snow fence" effect, and drainage problems created by concentrating runoff at one or few locations on high fills. However, the single face concrete barriers might be considered between two consecutive bridges having concrete railings that are approximately 200' apart or less.

7.01.67 (revised 4-24-2023)

Temporary Barrier

Temporary barrier was introduced in Michigan around 1972, with temporary concrete barrier being the first type of temporary barrier available. Since that time, the use of temporary barrier in construction work zones has steadily increased. Temporary barrier serves a dual purpose: it shields hazards originating from construction practices and protects construction and maintenance personnel from the inherent hazard of closely adjacent moving traffic.

Presently, three crashworthy temporary barrier types are available for use; temporary concrete barrier, temporary steel barrier, and portable water-filled barrier. Each temporary barrier type has unique features and limitations. Therefore, it is important to determine which barrier types are acceptable for use on each project based on site-specific conditions.

A. Temporary Concrete Barrier (TCB)

TCB sections were initially precast. Then, a cast-in-place or slip-formed barrier similar to permanent barrier was allowed. Current designs meeting or exceeding NCHRP 350, TL-3 or MASH, TL-3 criteria are now required. TCB is the most commonly used temporary barrier type on Michigan roadways.

7.01.67 (continued)

B. Temporary Steel Barrier (TSB)

TSB sections are fabricated entirely of galvanized steel. Each TSB manufacturer has a unique design with a specific brand name assigned to each design. TSB used by the Department must meet or exceed NCHRP 350, TL-3 or MASH, TL-3 criteria and have FHWA acceptance.

TSB is typically much lighter than TCB. As a result, TSB is typically easier to transport, install, and disassemble compared to TCB. Various TSB designs are available with tested impact deflections and performance characteristics comparable to TCB. However, the purchase cost of TSB is typically more than TCB.

Some TSB manufacturers can provide TSB sections equipped with casters for ease of movement on paved surfaces. Casters on TSB sections are retractable, raised or lowered, either by a hand crank or compressed air mechanism. When the casters are raised, the bottom of the TSB section comes in contact with the underlying pavement and functions as a standard TSB section. When the casters are lowered, the casters allow the TSB section to be maneuvered in any direction. Casters and their respective mechanisms are located within TSB sections, and are typically installed at the manufacturing facility during fabrication of TSB sections.

Some TSB designs require the pinning of TSB sections to the underlying pavement. Generally, TSB pins can be easily removed and the resulting holes in the pavement are filled with epoxy.

7.01.67 (continued)

C. Portable Water Filled Barrier

Portable water filled barrier consists of plastic sections, alternating white and work zone safety orange for high visibility, that are filled with water after the sections have been assembled. Portable water-filled barrier used by the Department must meet or exceed NCHRP 350, TL-3 or MASH, TL-3 criteria and have FHWA acceptance.

When empty, portable water filled barrier sections are the lightest of all temporary barrier types. Consequently, they are relatively easy to transport, install, and disassemble. Due to their light weight, cranes or heavy equipment typically are not needed to install and disassemble empty barrier sections. The process of filling the barrier sections with water and emptying them is also simple and efficient.

Portable water filled barrier may be used year round, provided that manufacturer-approved and Department compliant anti-freeze agents are used in the appropriate doses to prevent the water from freezing inside the barrier sections.

The use of portable water filled barrier is very limited due to excessive impact deflection. Crash tests have shown that portable water-filled barrier designs typically deflect more than TCB or TSB when impacted. One specific portable water-filled barrier system deflected over 22 feet, laterally, when subjected to NCHRP 350, TL-3 crash testing.

Portable water filled barrier should only be used in cases where sufficient space is available for the barrier to deflect when impacted while providing adequate work zone protection.

7.01.67 (continued)

D. Temporary Barrier Quantities and Specifications

When computing quantities of temporary barrier, the designer should review the staging plans and determine the maximum length of each barrier type required at any one time on the project.

Contact the Geometric Design Unit (Design Division) for current specifications and special provisions regarding temporary barrier.

1. Temporary Concrete Barrier (TCB) and Temporary Steel Barrier (TSB)

   On most projects, standard TSB may be used as an alternative to standard TCB, and the Contractor may be given the choice of furnishing TCB or TSB. The option of furnishing standard TSB as an alternative to standard TCB can be provided by special provision without the use of a separate pay item. However, if TSB equipped with casters is required, a separate special provision and pay item is needed for furnishing TSB equipped with casters.

   Standard pay items should be used for operating, adjusting, and relocating standard TCB or TSB, since the same pay items apply to both standard TCB and standard TSB.

   Note that different pay items and special provisions are used for standard temporary barrier and limited deflection temporary barrier (furnishing, operating, adjusting, and relocating).

7.01.67D (continued)

2. Portable Water Filled Barrier

   The pay item "Portable Water Filled Barrier, Furn" is used for furnishing portable water filled barrier.

   The pay item "Portable Water Filled Barrier, Oper" is used for operating, maintaining, cleaning, relocating, filling/emptying the barrier sections, and removal of portable water filled barrier.

   Please note that additional pay items and quantities typically are not used for adjusting or relocating portable water filled barrier. Any costs associated with adjusting or relocating portable water filled barrier are included as part of the "Portable Water Filled Barrier, Oper" pay item, and are not paid for separately.

7.01.68 (revised 4-24-2023)

Ending Temporary Barrier

A. Temporary Concrete Barrier and Temporary Steel Barrier

The methods for ending temporary concrete barrier and temporary steel barrier are specified on Standard Plan R-126 Series.

B. Portable Water Filled Barrier

When the barrier ending is located within the clear zone, a crashworthy end treatment that is compatible with the portable water filled barrier must be installed. The crashworthy end treatment must meet or exceed the requirements of NCHRP 350, TL-3 or MASH, TL-3.

Some portable water filled barriers are designed such that the barrier itself is a crashworthy end treatment. In which case, when the barrier ending is located within the clear zone, a separate crashworthy end treatment is not required.

Payment for furnishing, operating, and relocating crashworthy end treatments for portable water filled barrier endings is included as part of the "Portable Water Filled Barrier, Furn" and "Portable Water Filled Barrier, Oper" pay items, and is not paid for separately.

7.01.69 (revised 4-23-2012)

Temporary Barrier at Bridge Deck and Railing Reconstruction

Temporary barrier is frequently used on bridge railing replacement projects. Its use, however, is not feasible if it results in lane widths of less than 10'-0", nor if the duration of need is short. In the latter event, alternatives are plastic drums, traffic signals at each end of the work site, or a detour. It may be noted that use of barrier on a bridge produces three points of constriction at about the same location: a narrower shoulder, introduction of the bridge railing, and the funneling down created by the barrier itself. If possible, it is better if these constrictions and driver decision points can be spread out along the approach roadway.

Bridge deck reconstruction usually requires more work area than bridge railing reconstruction, and will frequently result in bi-directional traffic control on a single lane. Temporary barrier is commonly used in this application and a detail showing placement is specified on Standard Plan R-126-Series. Maintaining traffic provisions should be included in the plans.

7.01.70 (revised 11-23-2015)

Temporary Barrier Adjacent to a Precipitous Drop-off

There are occasions, notably when reconstructing a bridge by part width, when maintaining traffic constraints will force the placement of temporary barrier immediately adjacent to a precipitous drop-off situation. This creates a potential for the line of barrier to be displaced under impact, when there may be inadequate room available for displacement. When this condition occurs, special barrier types and/or hardware are needed to ensure that the barrier will function properly.

Standard temporary barrier is usually adequate when the lateral offset between the toe of the barrier on the construction side and the drop-off is 26" or greater. However, when there is less than 26" laterally between the toe of the barrier on the construction side and the drop-off, limited deflection temporary barrier meeting the requirements of Standard Plan R-53-Series or an approved alternative is required.

If designers reference barrier offset from the toe of the barrier on the *traffic* side to the drop off, then limited deflection temporary concrete barrier should be specified for offsets less than 4'-6", as opposed to the "A" distance specified in Standard Plan R-53-Series. This is required since current MDOT specifications allow a wide variety of standard temporary barriers to be used, and the bottom width of standard temporary barrier can be as wide as 28". Therefore, when referencing barrier offset from the toe of the barrier on the *traffic* side to the drop-off, the 4'-6" minimum offset for standard temporary barrier would ensure that the "A" distance specified in Standard Plan R-53-Series is at least 26" with any standard temporary barrier permitted under current MDOT specifications.

7.01.70 (continued)

Note that any alternatives to Standard Plan R-53-Series must meet current crash testing criteria and must also be adequate for installation at each location taking site-specific features and constraints into consideration, including, but not limited to, proposed barrier offset from the drop-off, underlying surface type, and expansion joints in the underlying surface. In general, portable water filled barrier should not be placed adjacent to or near a precipitous drop-off, unless there is sufficient room between the barrier and the drop-off for the barrier to deflect during an impact.

When using limited deflection temporary barrier meeting Standard Plan R-53-Series, designers will need to select the appropriate detail for use at each location. Designers will need to determine the proposed offset between the barrier and the drop-off at each location, and the underlying surface type and condition at each location. In addition, when placing limited deflection temporary barrier over a bridge deck, designers may need to determine the number of expansion joints in the bridge deck, and the amount of thermal expansion/contraction expected at each joint.

7.01.70 (continued)

A. Detail 1, Standard Plan R-53-Series: Box Beam Stiffened Method

Of all the details in Standard Plan R-53-Series, Detail 1 requires the least amount of pinning to the underlying surface. With Detail 1, pinning to the underlying surface is only required to secure the ends of the limited deflection temporary barrier, as shown in Standard Plan R-53-Series. Therefore, Detail 1 is desirable in cases where pinning the barrier to the underlying surface needs to be minimized to reduce the possibility of damaging the underlying surface. For example, placing limited deflection temporary barrier over a new bridge deck or an existing bridge deck that will be left in place after construction.

When using Detail 1 on bridge decks, designers should extend the limited deflection temporary barrier beyond the limits of the bridge deck to ensure that all required pinning to the underlying surface occurs off the bridge deck.

Detail 1 may be placed over all bridge deck expansion joints, regardless of the number of joints in the deck or the amount of thermal expansion/contraction expected at each joint.

A minimum offset of 12" between the toe of the barrier on the construction side and the drop-off must be provided when using Detail 1. Other details must be considered if a minimum 12" offset cannot be provided.

7.01.70 (continued)

B. Detail 2, Standard Plan R-53-Series: Staked Method

Detail 2 should be considered when a limited deflection temporary barrier is required over an HMA roadway, and the barrier must be placed less than 12" from the toe of the barrier on the construction side to the drop-off. Note that a minimum barrier offset of 6", between the toe of the barrier on the construction side and the drop-off, must be provided in order to use Detail 2.

Since Detail 2 requires the use of 3'-4" long stakes that extend considerably into the ground, designers should examine the proposed installation site and verify that underground utilities or obstructions will not be impacted by the stakes. Designers may need to relocate the barrier and/or consider other options if underground utilities or obstructions are going to be impacted by Detail 2.

7.01.70 (continued)

C. Detail 3A, Standard Plan R-53 Series: Through Bolt Method on Concrete Bridge Deck

Detail 3A should be considered when a limited deflection temporary barrier is required over a concrete bridge deck, and the barrier must be placed less than 12" from the toe of the barrier on the construction side to the drop-off. With Detail 3A, the toe of the barrier on the construction side can be placed up to the edge of the drop-off, but must not be placed beyond the edge of the drop-off.

In general, Detail 3A is preferred over Detail 4A (Drilled and Grouted Method) on concrete bridge decks. However, designers must avoid using Detail 3A on bridge decks with corrugated metal decking, since the metal decking will present difficulties with anchor bolt installation.

Detail 3A must not be used on concrete bridge decks with an HMA overlay, since the anchor bolts in Detail 3A lack the additional reinforcement needed to withstand higher bending moments induced during an impact in the anchor bolts at the top of the concrete surface.

Since drilling through bridge decks may be undesirable or prohibited on some bridges, designers should consult with the Technical Section of Bridge Field Services before using Detail 3A.

7.01.70 (continued)

D. Detail 3B, Standard Plan R-53-Series: Through Bolt Method on Concrete Bridge Deck with an HMA Overlay

Detail 3B should be considered when a limited deflection temporary barrier is required over a concrete bridge deck with an HMA overlay, and the barrier must be placed less than 12" from the toe of the barrier on the construction side to the drop-off. With Detail 3B, the toe of the barrier on the construction side can be placed up to the edge of the drop-off, but must not be placed beyond the edge of the drop-off.

Detail 3B is required when an HMA overlay is present over a concrete bridge deck, since a steel tube is needed around each anchor bolt for additional reinforcement due to higher bending moments induced during an impact in the anchor bolt at the top of the concrete surface. This is the reason why Detail 3A must not be used on concrete bridge decks with an HMA overlay.

Designers must avoid using Detail 3B on bridge decks with corrugated metal decking, since the metal decking will present difficulties with anchor bolt installation.

Since drilling through bridge decks may be undesirable or prohibited on some bridges, designers should consult with the Technical Section of Bridge Field Services before using Detail 3B.

7.01.70 (continued)

E. Detail 4A, Standard Plan R-53-Series: Drilled and Grouted Method on Concrete Roadway or Concrete Bridge Deck

Detail 4A should be considered when a limited deflection temporary barrier is required over a concrete roadway or concrete bridge deck, and the barrier must be placed less than 12" from the toe of the barrier on the construction side to the drop-off. With Detail 4A, the toe of the barrier on the construction side can be placed up to the edge of the drop-off, but must not be placed beyond the edge of the drop-off.

Designers may consider using Detail 4A on concrete bridge decks with corrugated bridge decking. However, Detail 4A cannot be used on concrete bridge decks with an HMA overlay.

Since drilling through bridge decks may be undesirable or prohibited on some bridges, designers should consult with the Technical Section of Bridge Field Services before using Detail 4A on a bridge deck.

F. Detail 4B, Standard Plan R-53-Series: Drilled and Grouted Method on Concrete Roadways with an HMA Overlay

Detail 4B should be considered when a limited deflection temporary barrier is required over a concrete roadway with an HMA overlay, and the barrier must be placed less than 12" from the toe of the barrier on the construction side to the drop-off. With Detail 4A, the toe of the barrier on the construction side can be placed up to the edge of the drop-off, but must not be placed beyond the edge of the drop-off.

Detail 4B is intended for exclusive use on concrete roadways with an HMA overlay, and cannot be used on bridge decks.

7.01.70 (continued)

G. Placing Limited Deflection Temporary Barrier Over Bridge Deck Expansion Joints

Detail 1 may be placed over all bridge deck expansion joints, regardless of the number of joints in the deck or the amount of thermal expansion/contraction expected at each joint. However, Details 3A, 3B, and 4A have certain limitations when placed over bridge deck expansion joints.

Details 3A, 3B, and 4A may be used over bridge deck expansion joints with an expected thermal expansion/contraction up to 1.5", provided the expansion joint guidelines specified in Standard Plan R-53 Series are followed during installation. No special hardware is needed with Details 3A, 3B,and 4A when the expected thermal expansion/contraction does not exceed 1.5".

Special hardware must be used when placing Details 3A, 3B, and 4A over expansion joints with an expected thermal expansion/contraction greater than 1.5", up to 4". In this case, a Type J1/J2 assembly, as shown in Standard Plan R-53 Series, must be placed over the expansion joint to accommodate the expected thermal expansion/contraction. Designers should note that a separate pay item is used for Type J1/J2 assemblies. Therefore, designers will need to include the appropriate pay item for the Type J1/J2 assembly and estimate the quantity of Type J1/J2 assemblies required on each project.

Note that Details 3A, 3B, and 4A must never be used over bridge deck expansion joints with an expected thermal expansion/contraction greater than 4".

7.01.75 (revised 5-7-2001)

Concrete Filler Walls

Concrete filler walls between pier columns serve as a continuous barrier to prevent an impacting vehicle from snagging on the pier columns. They are used when the shoulder width does not allow the approach barrier system to be carried under the structure at the normal offset from the edge of pavement. When filler walls are used, the approach barrier system, if non-rigid, should be anchored to the filler wall. See Standard Plans R-55-Series and R-67-Series.

Concrete filler walls constructed between about 1976 and 1982 were 33" high. The height was increased in June 1983 to 42" to allow for future heavy resurfacing. Some difficulty is being experienced connecting the current thrie beam guardrail anchorage to these older 33" high filler walls if there has been (or will be) a thick-lift resurfacing. When this occurs, provide for a filler wall extension with a minimum height of 1'-8" reinforced, and adhesive anchored to the existing filler wall with steel bars. Use horizontal sleeves in the new concrete for the guardrail attachment bolts. The approach guardrail should be aligned to allow the holes that must be drilled into the existing filler wall to be as far from the top edge as possible, to lessen the possibility of spalling during the drilling operation.

Sometimes the toe header for the bridge slope paving is behind the pier columns. This condition should be noted at the plan review meeting. When it occurs, a separate footing must be provided for the filler wall.

7.01.75 (continued)

In the past, there have been occasional attempts to cast a concrete safety shape into the filler wall in the area of the pier. This usually results in a concrete "toe" being placed, having the 55 degree slope of the safety shape, but the wall being vertical, like the conventional filler wall. It seems to work out better to simply transition the approach barrier system into the vertical face of the filler wall, and not try to cast a semblance of a safety shape that will only break away from the remainder of the structure over time.

The top of the filler wall should be constructed parallel with the grade of the road, rather than level. This gives the top lines of the approach barrier and filler wall a continuous appearance. Even though the angle between the vertical columns and the top of the filler wall will be something other than 90 degrees, its appearance will be less noticeable.

A filler wall end block shall be constructed when the connecting guardrail anchorage has one or more of the posts that can not be installed full depth. See Standard Plan R-55-Series.

7.02 (revised 4-24-2023)

IMPACT ATTENUATORS

Questions regarding impact attenuators should be directed to the Geometric Design Unit of the Design Division.

7.03

GLARE SCREEN

7.03.01

References

A. Standard Plan R-76-Series, Concrete Glare Screen

7.03.02 (revised 10-22-99)

General

Glare screen was first used on median barriers within the limits of curves, where the headlight glare from vehicles rounding the curve would be momentarily aimed directly at on-coming vehicles in the opposite roadway. Various materials were tried, with expanded metal mesh finding favor in Michigan. Expanded metal mesh, while effective as a glare screen, is fragile and susceptible to damage by vehicle contact, fatigue, corrosion and wind. It thus requires almost constant maintenance. Its principal advantage is that it can be rather easily mounted on metal beam guardrail.

To overcome the shortcoming of expanded metal mesh, plastic paddles, or "Glarefoils", were developed around 1976. Varying in height from about 2'-0" to 4'-0" and made of polyethylene, they are fastened to metal brackets attached to concrete median barrier. Of hollow, oval cross-section, they are oriented at 45º to the line of barrier in such a manner that the line of sight is screened between the opposing directions of traffic, yet wind currents can pass through. Michigan's experience with plastic paddles has been mixed; they are more durable than expanded metal mesh, but they still require considerable maintenance. Plastic paddles may be considered if a temporary glare screen is required on temporary concrete median barrier, but we currently do not consider it for permanent installation.

7.03.02 (continued)

Concrete glare screen came into use in Michigan in 1973 as an "add on" to previously placed concrete median barrier. It soon became apparent that it was an economical, almost maintenance-free structure that, by comparison, ruled out further consideration of the other glare screen materials and designs. As techniques developed for slip-forming higher and almost vertical concrete walls, Standard Plan III-76D came out in 1978 requiring that, whenever glare screen was to be constructed in conjunction with a concrete median barrier, the wall must be cast monolithically, 51" high. Not only does this requirement achieve economy of construction, it lends strength and additional height to the concrete barrier as well. If concrete glare screen has a disadvantage, it is because it cannot be used in conjunction with steel beam guardrail.

7.03.03 (revised 4-24-2023)

Criterion for Use

It is current practice to place concrete glare screen on concrete median barrier whenever ***new*** concrete median barrier is constructed in urban areas. In rural areas the use of a glare screen will be as recommended on a project-by-project basis by the Geometric Design Unit, Design Division. (The terms "urban" and "rural" here refer to the characteristics of surrounding development, not the relationship of the project to city limit signs.)

7.04

PAVEMENT MARKINGS

7.04.01 (revised 1-19-2016)

General

Pavement markings, both permanent and temporary, are included in most trunkline projects. The inclusion of pavement markings on the remaining projects will be determined by the Region/TSC. The only type of project not required to include pavement markings (either by contract or by work order) are projects where the existing markings are not altered or obliterated.

When there are no construction projects scheduled, placement of pavement markings is accomplished through the annual Region-wide contracts.

7.04.02 (revised 10-22-2018)

Temporary Pavement Markings

See the Work Zone Safety and Mobility Manual, Section 6.01.12 - Temporary Pavement Markings.

7.04.03

Section deleted.

7.04.04 (revised 10-22-2018)

Removing Permanent Pavement Markings

See the Work Zone Safety and Mobility Manual, Section 6.01.12A - Pavement Marking Removal.

7.04.05

Statutory Participating Cities

Statutory participating cities are exempt from participating in the cost of permanent pavement markings.

7.04.06 (revised 7-26-2021)

Plan Sheets, Standards Referencing, and Witness, Log, $1,250.00

Most projects call for the placement and/or replacement of permanent pavement markings. To ensure the markings are laid out properly the Designer must include information in the plans or proposal to allow a Contractor to do so.

Markings are placed or replaced using one or a combination of the following methods:

- A log of previously witnessed markings
- Reference to standard plans (only if the standard can be placed in the field)
- Pavement marking plan sheets

When the roadway will not be geometrically or functionally altered by construction (no addition or removal of turn lanes, no change in passing and no passing zones, no addition or removal of signals, etc.) and the markings should be returned to their pre-construction configuration, marking layout can be addressed through the use of the pay item Witness, Log, $1,250.00. Use of Witness, Log, $1,250.00 requires the Contractor to witness and log any existing pavement markings prior to the markings or pavement being removed, and to lay the markings back out after construction. The Engineer should have the opportunity to review the pavement marking layout prior to placement and make any necessary changes, however if changes are anticipated plan sheets should be included in the project documents.

7.04.06 (continued)

While the applicable pavement marking standard plans should be listed in all contracts with markings, use of solely the standards for pavement marking establishment is only acceptable in a few situations. The standards do not address lane and shoulder widths, turn lane storage lengths, precise stop bar setbacks, and many other variables needed for marking layout, so virtually all projects should include either plan sheets or Witness, Log, $1,250.00. Some of the exceptions to this where referencing the standards would be sufficient are bridge-specific projects (deck and/or approach work) and pavement patching projects, where the Contractor is only being asked to reconnect lines that they can see both ends of.

Plan sheets should be included if neither of the above options will adequately address the pavement marking layout needs of a project. When only a portion of a project will require changes from the existing pavement marking configuration (addition of a turn lane, correcting a section of markings that do not meet standards, etc.) it is acceptable to include plan sheets for only the portion requiring changes and utilize Witness, Log, $1,250.00 for the remainder of the project.

7.04.07 (revised 9-22-2025)

Recessing Permanent Pavement Markings

To increase life expectancy pavement markings can be placed in a recess (groove) rather than on the pavement surface. Recessing provides protection from snowplow blades and also resistance to shearing forces from traffic passing over the markings.

All longitudinal permanent pavement markings placed with New Construction, Reconstruction, or Construction on Existing Road project types must be recessed, regardless of the pavement marking material used. Areas of exception are bridge decks, markings placed in a rumble strip, roadway sections that are candidates for road diets, and where markings are placed in pilot configurations (e.g. – where a road diet is installed but may be reversed). Recessing for special markings and on other project types is at the discretion of the Engineer.

While recessing does aid the durability of all marking types, careful consideration must be given when recessing many styles of special markings. The groove created for the material can trap water and debris, resulting in potential hazards where motorcycles, bicycles, and pedestrians cross over the markings. As a result recessing is generally not recommended for symbols and legends, and when considering recessing for stop bars and crosswalks the Engineer should evaluate marking durability concerns against user types and volumes.

Recessed marking pay items are specified as being either longitudinal, transverse, or guide line. Recessing for lane lines, edge lines, centerlines, and gore markings falls under the longitudinal recessing pay item. All special markings, including line-style markings such as stop bars, crosswalks, and cross hatching, utilize the transverse recessing pay item. Turning guide lines (also referred to as lane line extensions, “blips”, or “chicken tracks”) have a separate recessing pay item due to the work and machinery involved.

7.04.08 (added 2-26-2018)

Longitudinal Pavement Markings in Work Zones Outside of Project Limits

Projects with long term lane closures often have traffic control devices outside of the project limits that interfere with the annual restriping of longitudinal pavement markings. Designers should include quantities in these projects for the purpose of restriping the longitudinal pavement markings outside of the project limits that are not accessible to the annual Region-wide contracts. Designers should work closely with the Region Traffic & Safety Engineer to determine pavement marking materials and coordinate quantities to ensure there are no gaps or overlapping in annual restriping. Projects that are not required to include pavement markings per Section 7.04.01, are not required to include pavement markings for work outside of the project limits for annual restriping purposes.

Also see Section 1.02.18 Pavement Marking Plans.

7.05

TRAFFIC SIGNS AND ROADWAY DELINEATORS

7.05.01 (revised 12-22-2011)

Traffic Signs

The Department has jurisdiction over traffic operational signs (As opposed to local street name signs which are the property and responsibility of the local jurisdiction, and occupy the R.O.W. by permission). The responsibility for preparing any required freeway signing plans will be that of the Design Division – Traffic Sign Unit and/or its traffic signing consultant. The preparation of signing plans for non-freeway is the responsibility of the Region/TSC or a per-qualified signing consult. Design's responsibility will usually be limited to coordinating the signing plans with the project plans.

When a project involves completely new construction or reconstruction, the signing plans should be included as part of the project plans. If the project will be built under one contract, e.g., a two-lane, free access roadway, then the signing will be included with the road plans either as plan sheets or computerized log sheets. If a contiguous section of freeway is being built under several contracts, it is possible that the signing work will be done with a separate contract. Even if this happens, some foundation and sign base work may be included in the road and bridge contracts. The Design Unit should contact the Region/TSC Operations Engineer early in the project development stage to determine if signing will be a part of the project. Also a copy of the correspondence should be given to Design Division – Traffic Sign Unit. If the signing contract is being done with a separate contract, the Design Unit should also contact the Traffic Sign Unit to confirm that all items are included in their respective contracts.

7.05.01 (continued)

As mentioned above, signing plans will generally be prepared by the Design Division – Traffic Sign Unit or Region/TSC Traffic & Safety. There may be occasions, however, where time constraints will necessitate Design completing the final drafting of signing plans from preliminary layouts furnished by the Region/TSC. Design should contact the Reflective Systems Unit, if the Region/TSC has not submitted special provisions and support standards with plans. The role that the Traffic Sign Unit, plays is one of review and coordination between the Region/TSC and Design.

Salvaged signs remain the property of the Department and components will be re-used, whenever possible, by Maintenance and the sign shops.

For signing on detours see Section 12.05.

7.05.02 (revised 9-22-2025)

Delineators

See Standard Plan R-127-Series, "Delineator Installations" for information on both rigid-post and flexible-post delineators.

The contract items of “Delineator Reflector”, “Post, Rigid, Delineator”, and/or “Delineator, Reflective Sheeting”, and “Post, Flexible Delineator” shall be used on all New Construction, Reconstruction, and Construction on Existing Road project types for divided highways, freeways, and undivided high-speed roadways having curves with radii ≤ 1910’. Inclusion of these items should also be considered on divided highway and freeway CPM projects depending on the condition of existing devices and the pavement remaining service life.

The rigid delineator measurements and payments are for Delineator Reflector, of the color specified, measured as "each" (back-to-back reflectors on a single post are counted as two) and Post, Rigid, Delineator, also measured as “each”.

7.05.02 (continued)

Delineators

The flexible delineator measurements and payments are for Delineator, Reflective Sheeting of the color specified, measured as "each", and for Post, Flexible, Delineator, also measured as “each”.

Delineators with Red are to be used where red delineators are attached to the back of delineators on ramps to face possible wrong-way traffic movements.

7.06

FENCING

7.06.01

References

A. Standard Plan R-97-Series, High Tensile Eight Wire Fence

B. Standard Plan R-98-Series, Chain Link Fence (Using Tension Wire)

C. Standard Plan R-101-Series, Woven Wire Fence

D. Standard Plan R-102-Series, Installation of Woven Wire Fence (At Structures)

E. ***An Informational Guide on Fencing Controlled Access Highways***, AASHTO, October 1967. (This is the latest edition published.)

F. Construction Manual, MDOT, Section 6.21

7.06.02

Purpose of Fence

Reference "E", above, states, "Fencing along a highway is a means of preventing unwanted and likely hazardous intrusion of animals, people, vehicles, machines, etc., from outside the right-of-way line into the vicinity of moving traffic." In the early days of the development of our highway system it was considered the responsibility of the abutting property owner to keep livestock within bounds. If someone's horse got out on the road and was hit, it was the owner's fault and owner's loss. Today, with higher vehicle speeds and controlled access operation, the driver has the expectation that the road will be clear of roadside interference. It therefore has become increasingly the highway agency's responsibility to safeguard against unwarranted intrusion on the highway.

7.06.02 (continued)

Only controlled access highways are routinely and continuously fenced. Exceptions, on such highways, are where it can be definitely established that a fence is not necessary, such as in areas of precipitous slopes or natural barriers.

7.06.03 (revised 8-18-2014)

Types of Fence

The following types of fence are used for the applications indicated:

A. Woven Wire Fence

Woven wire fence, nominally about 4'-0" high, is the predominant fence used in rural areas. Steel posts are used, unless the fence is in swampy soil, in which case wood posts are used. The type of post, whether wood or steel, must be indicated in the pay item, which means that the designer must estimate where swampy soils will be encountered along the R.O.W. line. Normally, steel posts are less expensive than wood, so a contractor will want to use steel if possible. There have been cases where the contractor has asked to use wood posts throughout a project, and this has been allowed.

B. Chain Link Fence

Chain link fence is predominantly used in urban areas. Sometimes a project will require both woven wire and chain link fence, if the character of the adjacent development is both rural and urban. If this is the case, the change over point should be selected at a convenient location at or near the end of the urbanized section and not necessarily at the city limits.

7.06.03 (continued)

Types of Fence

C. High Tensile Eight Wire Fence

High Tensile Eight Wire Fence, as a right-of-way fence, is a substitute for woven wire fence. It is thought to be more economical to construct because it consists of individual strands of wire and has no vertical tie wires. It is considered to be more economical to maintain because a broken wire can be spliced with a patented device and re-tensioned, an obvious advantage when compared with the rehabilitation of a broken down or cut woven wire fence. Designers should consult with the Region/TSC and determine at the time of the plan review meeting whether high tensile eight wire fence should be used.

7.06.04

Location of Fence

Fence is ordinarily constructed 1'-0" inside the R.O.W. line. This is in accordance with an old common law custom that the owner of the fence should be able to theoretically construct and maintain it without setting foot on the neighbor's property.

On urban freeways, where fence is used between the freeway and the parallel service road, the location of the "R.O.W. line" between the two is often undefined. Usually, the fence will be placed at a determined distance from the inside service road curb, which may be as little as 3' to as much as 20' to 25'. The wider margin allows greater flexibility for landscaping and plantings, but the municipality must be willing to accept the greater maintenance responsibility. The fence should not be set back at a greater distance if the reason for doing so is to justify paving the area. See details of a typical fence installation between a service road and urban freeway in Section 12.01.05.

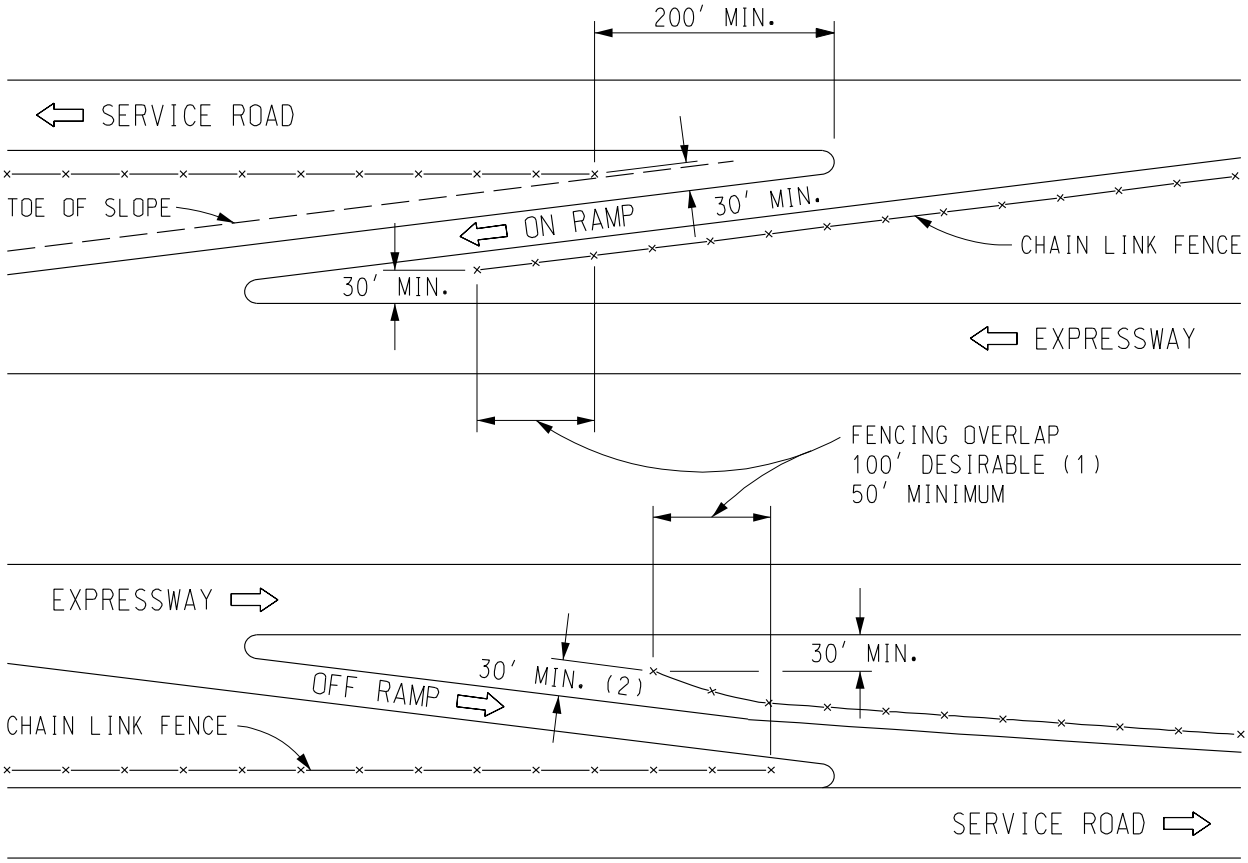
7.06.04 (continued)

In rural areas, the R.O.W. line will often coincide with a quarter or section line, which also may have formerly been a property boundary when the area was farmed. These old fence lines frequently became a depository for stone piles and/or were allowed to grow into a tree line. The question of whether to remove the trees and stone piles, or to place the fence inside the R.O.W. line to avoid the costly removal, has been faced repeatedly over the years. Department practice is, if at all possible, to remove the debris and vegetation sufficient to place the fence 1'-0" inside the R.O.W. line. However, it must be remembered that a fencing contractor is not equipped, nor does the contractor have the personnel, to do extensive clearing. While clearing of the line is included in the price paid for fencing, it is customary to allow the fence to veer around a large tree to avoid having to remove it.

When chain link fence is used on urban freeways, the gapping out for ramps and the fence overlap should be accomplished as shown on the next page.

7.06.04 (continued)

Location of Fence



(1) USE LESS THAN 100' ONLY WHEN REQUIRED TO SATISFY MINIMUM OFFSET FROM ADJACENT EXPRESSWAY LANES OR GORE AREAS.

(2) MINIMUM OFFSETS FROM EXPRESSWAY HAVE PRIORITY.

7.06.05

Use of Barbed Wire

In rural areas subject to stock grazing, woven wire fence has traditionally been topped with a single strand of barbed wire. This was done to discourage farm animals from leaning over the fence and breaking it down. However, there are areas where it is obvious that grazing will never occur, e.g., across state and federal forest lands. When this condition occurs, the barbed wire should be omitted, for economy.

Barbed wire is seldom used in conjunction with 4' and 6' chain link fence. (See Section 7.06.10) It may be used on top of 8' and 10' chain link fence adjacent to areas where special security measures are required, as around an industrial plant. In these cases the number of strands, and the direction they will be angled, will be as requested by the adjacent property owner, and may be part of the R.O.W. agreement.

7.06.06

Chain Link Fence

Both 4' and 6' chain link fence are used, with the higher fence favored adjacent to platted subdivisions. To avoid intermittent stretches of varying heights of fence, the designer should attempt to limit any one run of either 4' or 6' height to a minimum of 660' or 40 rods.

Initially, chain link fence was constructed on our projects using a pipe top rail. In 1973 the standard plan was changed to provide a tension wire that would replace the top rail on new construction. If the scope of a project includes alteration or updating of chain link fence that has a top rail, the fence should be modified to provide the tension wire, and the top rail should be removed.

7.06.06 (continued)

Chain link fence may cause a special problem at airports that are large enough to use radar, as the fence fabric has been known to cause ghost images on radar screens. Whenever new fence is contemplated adjacent to a major airport, the designer should coordinate the proposed project with the Federal Aviation Administration. It may be necessary to use a non-metallic fence through the area off the end of the runways.

There are also occasions when a woven fence is warranted because of the surrounding rural topography but the adjacent property owner may specifically request chain link fence. On one project where this occurred, in the Metro area, an agreement was worked out whereby the Department furnished the fencing materials and the property owner erected it at their own cost.

When the R.O.W. corridor has been purchased well in advance of construction, and subsequent residential areas have developed adjacent to the R.O.W., it is not unusual for the property owners to place their own chain link fence on the R.O.W. line, in their backyard. When the time comes to fence the freeway R.O.W., the question arises, "should a second chain link fence be erected 1'-0" from the existing fence so that the Department has complete ownership of the R.O.W. fence?" While this has been done, it creates an unsightly trash collector, it makes both fences difficult to maintain, and it is unnecessarily costly. The new fence should simply tie into the existing fence at its ends, assuming that the existing fence is in good condition. If it is not in good condition, then an agreement should be sought with the property owner to remove the existing fence and allow it to be replaced by the freeway R.O.W. fence.

7.06.07 (revised 10-22-99)

Gates in Chain Link Fence

Gates should be provided in chain link fence to provide access for maintenance equipment, e.g., mowers, cranes for servicing pumphouses, etc. Width of gates should be a minimum of 8'. The exact location and width of gates will be determined by Region/TSC personnel at the time of the plan review meeting.

Gates should preferably swing in toward the freeway, and not out onto the service road where an open gate could be struck by service road traffic. If the service road shoulder slope is continued upward past the fence it could cause problems opening the gate unless the earth is graded out somewhat to accommodate the arc of the gate swing.

7.06.08 (revised 2-27-2012)

Fencing Clear Vision Areas

Clear vision areas are usually fenced, but it is not a rule that they must be. There are situations where the property owner may wish to maintain the clear vision triangle as mowed lawn, in which case a fence across the corner would detract from the overall appearance and inhibit trimming and mowing. In these cases, the omission of the fence will be a consideration in the negotiation with the property owner, and safeguards to protect the integrity of the clear vision area will be included in the legal documents. These safeguards will include prohibition against parking equipment and vehicles in the area, and keeping trees trimmed high so that there is a clear line of sight. The designer should set up fencing of clear vision areas on the plans unless informed by the Development Services Division to omit it at specific locations.

7.06.09

Fencing Scenic Strips

Scenic strips located adjacent to limited access R.O.W. are usually fenced along the back and sides, but not along the regular R.O.W. line in front of the strip. Occasionally a scenic strip was acquired after the R.O.W. was fenced, in which case the area may be completely enclosed by fence. If for some reason this happens, a gate should be provided in the regular R.O.W. fence to provide vehicular access to the scenic strip. No driveway should be provided, however.

7.06.10 (revised 4-22-2019)

Fencing Borrow Area Lakes and Retention Basins

Borrow areas that have been excavated deep enough to form lakes should be fenced with 6' chain link fence, unless ownership is to be transferred to private interests who do not want the fence. Use 6' chain link fence with three strands of barbed wire on top. Show the fence located at least 10' to 15' from the water’s edge to enable a vehicle to drive between the lake or pond and the fence. A vehicular gate should be provided. Lakes transferred to the jurisdiction of the Michigan Department of Environment, Great Lakes and Energy (MDEGLE) should be fenced.

Retention basins that can be expected to have 2'-0" or more of standing water for more than a day or two should likewise be fenced.

7.06.11

Fence Between Twin Overpassing Structures

When twin independent structures (without a common backwall) carry a freeway over a crossroad, and there is no interchange, the median should be fenced on each side of the crossroad to prevent or inhibit vehicle or animal entry. The fence should preferably line up with the abutment walls.

7.06.12

Guardrail in Conjunction With Fence

There have been occasions in the past where there has been a reluctance to place guardrail in front of a fence. It should be remembered that guardrail does not serve the function of fence, nor does fence serve the function of guardrail, so if both are needed, both should be constructed. As a matter of practicality, however, the fence should be placed sufficiently behind the guardrail, if possible, to allow room for the expected guardrail deflection. See Section 7.01.20.

7.06.13 (revised 2-27-2012)

Temporary Fence

The Development Services Division does not pay for fencing as part of the ***limited access*** R.O.W. agreement with property owners. (On free access R.O.W., fencing is paid for as part of the property settlement by the Development Services Division.) This means that a problem could be created through areas of stock grazing in that it could leave pasture land unfenced for months during the construction of the project. A General Plan Note is placed on the Note Sheet that says, "Permanent right-of-way fence shall be constructed as the first operation in cases where the right-of-way cuts across stock grazing areas. Temporary fencing, when ordered by the Engineer, will be paid for at the contract unit price for “Fence, Temp”.

7.06.13 (continued)

Temporary fencing is used when it is not possible to construct the permanent fence until necessary grading is completed. This may be in muck storage areas, areas of grading permits, etc. Quantities of Temporary Fence are estimated on the basis of 3% of the total fencing for the project, with a minimum of 1320' or 80 rods. This quantity is shown in the Miscellaneous Estimate, on the Note Sheet. Removal of temporary fence is not paid for separately.

In the event that grading and surfacing are let as separate projects, the R.O.W. fence will, of course, be included in the grading contract, with the above provisions included.

7.06.14 (revised 12-22-2011)

Protective Fence

Protective Fence is woven wire or plastic fence that is placed around deep excavations such as those required for bridges, pumphouses, and other structures. It is used primarily to protect pedestrians and animals, as directed by the Engineer, but may even be used to protect trees. The road plans should, on urban freeway projects, set up an amount of Protective Fence equal to the length of the project in feet, labeling it as "estimated". On other urban projects and on rural projects, call for the item if requested at the plan review meeting.

If the pumphouse or structure is to be let separately, Protective Fence should be included in the plans for that structure. On package projects, coordination will be required between Road and Bridge Design to determine which plans will show the fence required to enclose "bathtub" construction.

7.06.15 (revised 12-27-2022)

Removing Fence

Payment for fencing includes the cost of clearing and cleaning the fence line, which includes any old fencing that may be there, except in areas where “Clearing, Fence” is a pay item. Removal of old fencing that is not coincidental with the construction of new fence should be paid for under the item "Fence, Rem".

When tying highway fencing to an existing intersecting private fence that has had to be interrupted by the construction, necessary corner bracing should be added to the private fence, as required. The plans should call attention to this requirement, which should not be paid for separately.

If fence removal is required, but the quantity is unknown, it is permissible to include the removal in compensation for another pay item.

7.06.16

Screening Fence

Construction of a screening or privacy fence is not a common undertaking of the Department, but it has been done. One that was constructed in East Lansing was wood, having 8' high panels, manufactured commercially. An existing chain link fence was removed and the screening fence placed generally along the former fence line. The screening fence overlapped the chain link fence at the ends by about 3', and the details called for a maximum allowable space underneath of 6", with a 2" space as average. Post were set in concrete 3'-6" deep. The pay item was "8' Screening Fence", measured in linear feet.

7.07

NOISE BARRIERS

7.07.01 (revised 8-26-2024)

References

A. 23 CFR 772, ***Procedures for Abatement of Highway Traffic Noise and Construction Noise***, FHWA, October 1997

B. ***An Inventory of Traffic Noise Levels Along Limited Access Freeways in Michigan***, Revision of Research Report R-1013A, (formerly) Materials and Technology Division, July 1981.

C. ***A Policy on Geometric Design of Highways and Streets***, AASHTO, 2018 7th Edition

D. ***MDOT Highway Noise Analysis and Abatement Handbook,*** July 2011

E. ***Noise Barrier Wall Design Guidelines***, MDOT, 2024

7.07.02 (revised 4-24-2023)

General

The concept of traffic noise attenuation became an integral part of highway planning and design in 1976 when FHWA first issued ***Procedures for Abatement of Highway Traffic Noise and Construction Noise*** (currently 23 CFR 772). This regulation established two types of noise mitigation projects, which are continued to the present.

7.07.02 (continued)

Type I projects are for new highway construction, reconstruction of an existing highway, or the addition of one or more lanes to an existing highway. Guidelines for noise levels for residential, commercial, and special sites are listed in 23 CFR 772. If highway noise levels exceed the specified levels, on a regular basis, then noise mitigation must be considered. The warrants for noise barriers or other noise attenuation devices must include an economic cost-benefit analysis.

MDOT indefinitely suspended the Type II Noise Abatement Program in December 2007. Type II guidelines and procedures referenced in this, and subsequent sections are retained for historical purposes.

Type II projects are proposed Federal or Federal-aid projects for noise abatement on an existing highway, with no other concurrent reconstruction or lane addition being considered. This is a voluntary program and states wanting to participate must meet certain requirements. In order to be eligible for federal participation the Department had to establish a "Noise Barrier Policy", prepare an inventory of sites where highway noise levels exceed FHWA noise guidelines, and establish a priority system for treatment of the identified sites.

Noise attenuation is confined almost entirely to freeways, although there are one or two locations in the state where an earth mound sound barrier has been constructed along a free access route. Generally, the distance between access points, i.e., necessitating an opening in a barrier, are so close on a free access road that a barrier would not be practical.

7.07.02 (continued)

Responsibilities for noise barrier investigation, evaluation, and design are generally divided as shown in the following chart:

Technical investigation and analysis	Instrumentation and Data Systems Unit, Construction Field Services Division
Environmental Impact Statement	Bureau of Planning, Transportation Planning Services Division
Choice of noise barrier type, general details of design	Roadside Development Design Unit, Design Division
Noise barrier structural analysis	Bridge Design Special Assignment Unit, Design Division
Noise barrier design details	Road Design Unit, Region/TSC

7.07.03

Technical Aspect of Sound Transmission

The sound pressure level (SPL) is equal to 20 times the logarithm of the ratio of the sound pressure measured to the reference sound pressure. The reference sound pressure is 20 x 10 Pascal. The unit of SPL is the decibel. The sound is also A weighted so that the measurement is similar to the frequency response of the human ear. The unit is abbreviated dbA.

Because decibels are in logarithms, doubling the sound pressure only raises the decibel level 3 dbA. Also, an apparent doubling of the sound level to the human ear occurs when the decibel level is increased by 10 dbA. The human ear can perceive a difference at 1 dbA when sound levels are presented on a comparative basis. However, the human ear cannot detect a change in highway noise level until the change amounts to about 3 dbA.

7.07.04

Current Requirements and Practices

23 CFR 772 (current issue is dated October 1997) requires highway noise to be analyzed in each environmental document. If the predicted design year noise level is greater than the stated FHWA noise level guidelines, then the affected residential properties or special sites must be analyzed for possible noise abatement in conjunction with the highway improvement.

The Department has established noise guidelines for Type II noise barrier projects. These guidelines have received FHWA approval.

The Department was also instrumental in obtaining vehicle noise legislation. In 1978, Section 707 of the Michigan Vehicle Code was changed to limit the level of noise that a car, truck, or motorcycle can produce on a roadway. The Department assists local enforcement agencies in administering that law, and makes periodic noise measurements to insure contractor compliance with construction noise specifications.

7.07.05 (revised 12-22-2011)

Process for Type I Projects

Type I projects are initiated by the environmental document prepared for each highway improvement project, whether it be an EIS or FONSI, with the Construction Field Services Division preparing the entire noise portion of the document. All homes are analyzed, even those that are widely scattered, though it is recognized that there is not enough money available to treat individual homes with a noise barrier. (Individual homes may be granted an exception to allow them to be treated, however, by adding insulation, solid core doors, storm windows, or air conditioning that would allow the residence to remain closed during hotter weather, thereby reducing interior noise levels.)

Existing subdivisions are examined, the number of homes counted in the first, second, third, etc. rows back from the highway, and the cost of shielding these homes is estimated. The Department's noise policy requires that at least a 6 dBA reduction be achieved in the noise level for attenuation measures to be considered worthwhile. They also set Leq = 67 dBA as the guideline for maximum sound level in a residential area. (Leq is the average intensity of sound in the 30th high hour, or at level of service "C", whichever is worse. Level of service "C" is considered the theoretical worst traffic condition for noise; beyond it the movement of traffic starts to break down, with a corresponding reduction in noise levels generated.)

A public meeting or hearing is then held. The Department, however, relies upon input from the local unit of government, rather than the public at large, in making the final determination relative to constructing a noise barrier. Even though all the data may point to the need for a noise barrier, if the public hearing reveals that the people as a whole do not want it, the Department will not build it.

7.07.06

Process for Type II Projects

The construction of Type II noise barrier projects is entirely dependent upon the funding annually set aside for this purpose. The same federal funds that are used for Interstate preservation and capacity improvements also provide funding for noise abatement. Obviously, there is much more potential barrier construction classified as Type II than Type I, as Type II encompasses the entire trunkline system, not just new projects. It is significant when considering Type II projects to know whether or not the highway preceded the construction of a subdivision, or vice versa, as it then becomes a question of whether or not the builders and buyers of homes did so with full knowledge of the highway-related environment. The Department uses the date on which a subdivision was platted, or the date the area was zoned residential, as this date is easily determined and undisputed.

An inventory has been made of the noise levels at all the residential sites along Michigan freeways. There are 1,135 such sites. These are ranked by predicted (as of 1981) noise levels, length of area and "who was there first", and a priority factor is computed. Priority #1 covers those situations where the highway came after the homes, Priority #2 covers those situations where the homes came after the highway.

Mitigation measures are then proposed, an informal public meeting is held, and, as in the Type I process, the Department takes its cue from the local governmental agency whether or not to proceed with the noise barrier. It can be seen that, with 1,135 sites, and treating two or three each year, most will never be treated.

7.07.07 (revised 8-26-2024)

Design Considerations for Noise Barriers

For information regarding noise barrier wall type selection, placement, plan preparation and other design considerations see the ***Noise Barrier Wall Design Guidelines***. The Roadside Development unit will work closely with the Road design unit in choosing details of the noise barrier.

7.07.08

Section deleted.

7.07.09

Section deleted.

7.08

MAILBOX POSTS

7.08.01 (revised 10-21-2013)

References

A. Standard Plan R-74-Series, Bumper & Parking Rails, and Misc. Wood Posts

B. ***Roadside Design Guide,*** AASHTO, 2011, Chapter 11

7.08.02 (revised 10-21-2013)

General

Typically, the post supported rural mailbox is private property that occupies the R.O.W. by permission. During construction activities, the Department assumes the responsibility for maintaining serviceability of existing mailboxes. After construction activities are completed, the Department or its contractor will place a department approved support at the permanent location, remove the mailbox from the old support and attach it firmly to the new post, and dispose of the old support. The property owner shall be given the option of disposing of the old support. Existing newspaper boxes are removed and stored for the property owner's future installation and are not paid for separately.

Even though the authority to regulate mailbox installations is not well defined, the property owner should be discouraged from reconstructing unusual mailbox installations. Crash tests seem to show that the mailboxes that remain attached to the post go down under impact and away from the vehicle. Attaching several boxes to one large horizontal support is discouraged by Chapter 11 of the ***Roadside Design Guide,*** AASHTO, 2011. Department standard plans now show

7.08.02 (continued)

a mailbox post having a smaller cross-sectional area than previously. Alternate mailbox support designs meeting the performance criteria of NCHRP Report 350 or MASH may be used as approved by the Engineer.

7.08.03 (revised 10-21-2013)

Design Considerations

As a part of the design, the number of existing mailboxes should be determined and used as a basis for estimating the number of mailbox posts to be placed on the project. Sometimes this can be determined from the plans if buildings are included in the topography shown, but this method is usually not as accurate as actually counting those in the field. The photolog is a reliable source of this information. Internet mapping websites can also be used.

Placement of mailboxes in a curb and gutter section may pose questions, particularly if a curb is being constructed where it did not exist before. If it is a vertical curb, the posts must be within arm's reach of the face of curb; the question then is, are existing boxes concentrated on one side only, or on both sides of the road? If the curb is a roll curb, then the boxes can either be directly behind the curb or at the far edge of shoulder. Either location has advantages and disadvantages. If immediately behind the curb, the post may interfere with the movement of vehicles on the shoulder, pedestrians, and bicyclists, as well as snow removal on the shoulder. If placed at the far edge of the shoulder, the shoulder should be strong enough and wide enough for the delivery vehicle to get completely off the road. Snow removal may not always be complete to the point that the shoulder area is clear, back to the boxes. Generally, however, it has been our practice to place the boxes, in a roll curbed section, at the back of the shoulder, particularly if the purpose of the roll curb and paved shoulder is to provide a bicycle path. Traffic volume and speed are considerations that will influence the location of mailboxes in a roll curb and gutter section.

7.09

CONCRETE STEPS

7.09.01

General

Concrete steps, with a pipe handrail, are not built as part of a highway project as frequently as they once were. Before designers were as conscious of safety and clear zones as they are now, it was not uncommon to construct concrete steps on a cut backslope to facilitate a property owner's access to a mailbox. This would not normally be done anymore, because the concrete structure would probably be located within the clear zone. Steps are, of course, constructed to facilitate frequent access up or down steep slopes. Before a decision is made to provide steps for this purpose, the designer should be satisfied that the structure is indeed outside the clear zone. In the rare case that concrete steps are included in a project, consult the Roadside Development Unit for step details and requirements.

7.10 (added 10-28-2024)

LANDSCAPING GUIDELINES IN MDOT RIGHT-OF-WAY

All **limited access right-of-way** landscaping must adhere to MDOT Road Design Manual 7.01.11C with the additional criteria that no tree planting is allowed on traversable (non-recoverable) fill slopes (between 1:4 and 1:3) and at least 10’ past the bottom of such slopes. Mature trees 4” and greater measured at 4’6” above ground, are considered obstacles and the guidelines from subsection 7.01.11 should be considered.

The clear zone is defined in the MDOT Road Design Manual 7.01.11.A.1. Furthermore, as indicated in 7.01.11, trees should be placed at least 50 feet off the edge of traffic lane on freeways. However, multiple stem shrubs or ornamental trees that are 4” or less in diameter, measured at 4’-6” above ground when mature, may be used since they are considered breakaway if they don’t interfere with sight distance. This includes most multi-stem, small ornamental trees.

Clear sight distance areas must be maintained in interchange merge areas, throughout horizontal curved alignment and at ramp terminals. Sheets 3 and 4 of GEO-300-Series shows all areas where plantings are restricted. All proposed landscaping plans must be reviewed for actual site conditions and clear zones increased for steeper slopes, etc., in accordance with MDOT Road Design Manual 7.01.11.

7.10 (continued)

LANDSCAPING GUIDELINES IN MDOT RIGHT-OF-WAY

All **free access right-of-way** landscaping must adhere to clear zone guidelines established in the MDOT Road Design Manual 7.01.11C. Where design speed is 40 mph or greater, a 10’ minimum offset is required. With design speeds greater than 25 mph and less than 40 mph, a 6’ minimum offset is allowed behind curb. Where design speeds are 25 mph or less through a central business district with curb and permanent on street parking is provided, landscaping can be installed a minimum of 1.5’ behind the back of curb. In no case shall landscaping be allowed to interfere with sight requirements. If the above offsets cannot be provided, shrubs and other plantings are recommended instead of trees.

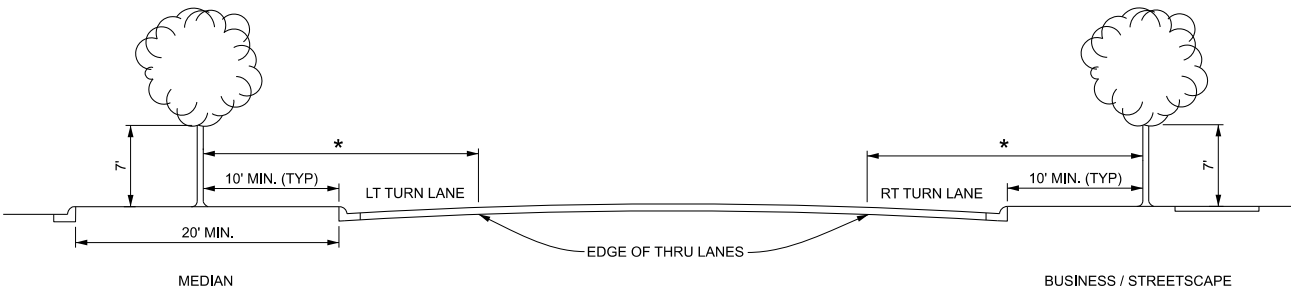
7.10 (continued)

All perennials and shrubs must be kept low with a 30” maximum height (measured from the road pavement elevation) and all street trees must have a minimum under clearance of 7’ to ensure clear vision requirements are met.

Finally, on two-way roads, the area on the inside of horizontal curves should be kept clear to provide adequate passing sight distance.

See attached illustrations as guides for landscaping placement.

GUIDE FOR LANDSCAPING PLACEMENT

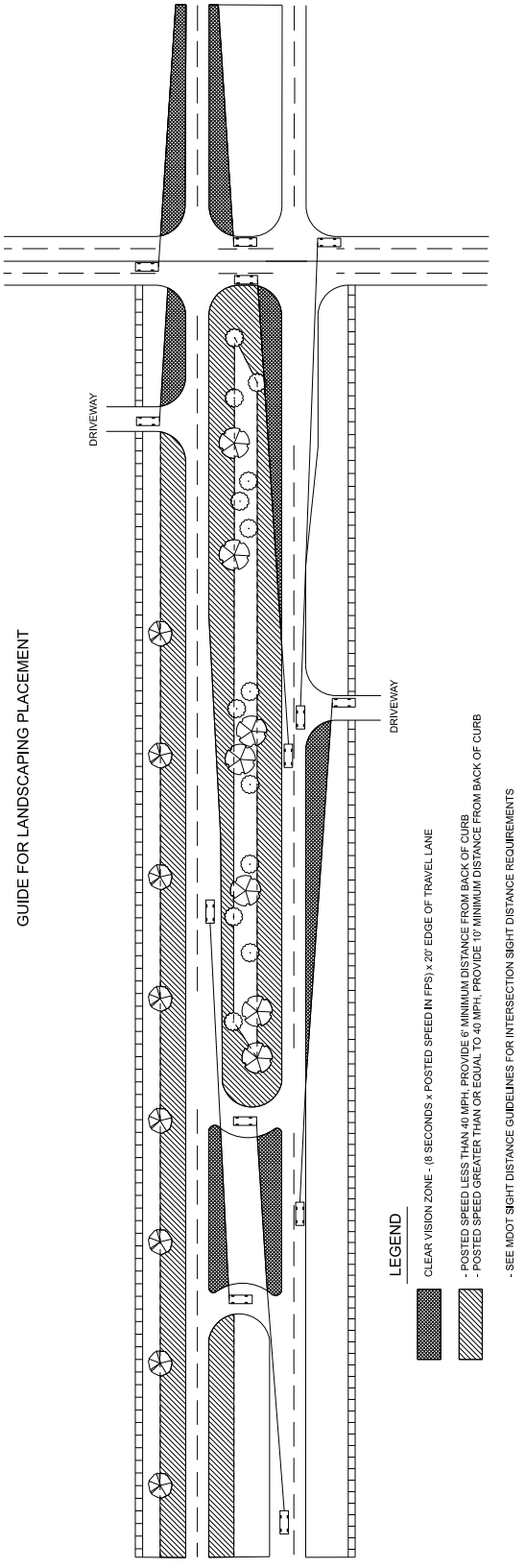


TREE PLANTING GUIDE FOR CURBED AREAS
40 MPH OR GREATER

* CLEAR ZONE DISTANCE MEASURED FROM EDGE OF THRU LANES DESIRABLE

7.10 (continued)

LANDSCAPING GUIDELINES IN MDOT RIGHT-OF-WAY



MICHIGAN DESIGN MANUAL
ROAD DESIGN

CHAPTER 8 • MAINTAINING TRAFFIC

8.01 REFERENCES

8.02 GENERAL

8.03 MAINTAINING TRAFFIC OPERATIONS

8.04 TRAFFIC CONTROL DEVICES

8.05 DELETED

8.06 DELETED

8.07 NON-MOTORIZED WORK ZONE SAFETY AND MOBILITY

CHAPTER 8 • MAINTAINING TRAFFIC

8.01 REFERENCES

(revised 10-22-2018)

A. Work Zone Safety and Mobility Manual

B. Michigan Manual on Uniform Traffic Control Devices

C. Traffic and Safety Standard Plans and Special Details

D. Standard Specifications for Construction

8.02 GENERAL

(revised 10-22-2018)

See the Work Zone Safety and Mobility Manual, Chapter 1 - Introduction: This chapter covers common basic work zone information.

8.03 MAINTAINING TRAFFIC OPERATIONS

(revised 10-22-2018)

See the Work Zone Safety and Mobility Manual, Chapter 2 - Transportation Management Plan (TMP): This Chapter discusses options to consider when designing a work zone and the required steps for developing maintaining traffic plans.

8.04 TRAFFIC CONTROL DEVICES

(revised 10-22-2018)

See the Work Zone Safety and Mobility Manual, Chapter 6 - Traffic Control Devices and Implementation: This chapter covers an overview of products and options available when developing maintaining traffic plans.

8.05 DELETED

Section deleted.

8.06 DELETED

Section deleted.

8.07 NON-MOTORIZED WORK ZONE SAFETY AND MOBILITY

(revised 10-22-2018)

See the Work Zone Safety and Mobility Manual, Chapter 5 - Non-Motorized Work Zone Safety and Mobility: This Chapter covers the proper steps and considerations to develop a compliant Work Zone for nonmotorized users.

MICHIGAN DESIGN MANUAL
ROAD DESIGN

CHAPTER 9 • UTILITIES

9.01 REFERENCES

9.02 MUNICIPAL AND PRIVATE UTILITY RELOCATION POLICIES AND PROCEDURES

9.02.01 Municipal Utility Relocation Policy

9.02.01A Definitions

9.02.01B General Information

9.02.01C Municipal Utility Costs and Betterments

9.02.01D Water Main Relocation Studies

9.02.01E Lead (Pb) and Galvanized Steel Water Service Line Replacement

9.02.02 Private Utility Relocation Policy

9.02.03 Including Non-Municipal Utility Work in Contracts

9.02.03A General

9.02.03B Procedures

9.03 DESIGN GUIDES

9.03.01 Utility Poles and Light Standards

9.03.01A General Considerations

9.03.01B Authorization

9.03.01C Clarifications of Terms Used in Guidelines

9.03.01D Lateral Offset Guideline

9.03.01E Light Standard Details

9.03.02 Municipal Utility Alterations and Notification of Utility Design Units

9.03.02A Procedure

9.03.03 Utilities on Plans

9.04 MISCELLANEOUS

9.04.01 Utility Trenches

9.04.02 Deleted

9.04.03 Permit Applications

9.04.04 Temporary Utility Hook-Ups

9.04.05 Water Main Appurtenances

9.04.06 Gas Main Relocation Policy

9.04.07 Sanitary Sewers

9.04.08 Sanitary Sewer Service Leads

9.04.09 Subsurface Utility Engineering (SUE)

9.04.10 Lighting Project - Energy Rebate Procedure

9.05 DELETED

CHAPTER 9 • UTILITIES

9.01 REFERENCES

(revised 7-25-2022)

A. MDOT Drainage Manual

B. MDOT Utility Coordination Manual

C. 49 CFR 645.105

D. Public Act 51 of 1951

E. Public Act 368 of 1925

9.02 MUNICIPAL AND PRIVATE UTILITY RELOCATION POLICIES AND PROCEDURES

9.02.01 Municipal Utility Relocation Policy

(revised 7-25-2022)

9.02.01A Definitions

Betterment: any upgrade to an impacted utility beyond what is required to return it to the level of service (both existing and potential) prior to the Department project. Such upgrades may include capacity, materials, or locations. These upgrades are made solely for the benefit of and at the election of the *Municipal Utility*. Note: Upgrades from the existing system necessary to make the system compliant with minimum standards are not considered betterments.

Department: The Michigan Department of Transportation (MDOT).

Direct Conflict: any *Municipal Utility* requiring an adjustment or alteration to facilitate completion of a Department project (trunkline need).

EGLE: the Michigan Department of Environment, Great Lakes, and Energy.

Indirect Conflict: a water main that does not create a direct conflict with a Department project but whose location or condition may compromise the design life of the project, as determined by a municipal utility relocation study performed by the Department and/or a consultant.

Municipal Convenience: Municipal utility work included on Department projects that occurs solely at the municipality's discretion. The existing municipal utility does not present a direct or indirect conflict. Typically occurs because of the cost efficiency gained by the municipality because of the work already conducted by the Department (maintenance of traffic, removal of pavement, etc.).

Municipal Utility: a *Utility* or service owned, operated, and maintained by a recognized governmental entity within its corporation or jurisdictional boundaries.

Municipal Utility Design Staff: Staff located in the *Department's* Road and Municipal Utility Design Unit that are responsible for assisting and fulfilling the responsibilities within this Chapter.

Permit: A legal document used to grant permission to private, governmental, and public entities for occupying, constructing, operating, using, or maintaining specified operations or facilities within the state highway ROW.

Right-of-Way (ROW): Real property or interests therein, acquired, dedicated, or reserved for the construction, operation, and maintenance of a highway under the Department's jurisdiction, in which federal-aid or federal highway funds are or may be involved in any stage of development. This includes lands acquired for scenic areas adjacent to highways, rest areas, roadside parks, scenic turnouts or overlooks, or access to lakes and rivers.

Utility: Privately, publicly, or cooperatively owned lines, facilities, and systems for producing, transmitting, or distributing communications, cable television, broadband, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, storm water not connected with highway drainage, and other similar commodities, including fire and police signal systems and street lighting systems, which directly or indirectly serve the public. The term utility also means the utility company inclusive of any wholly owned or controlled subsidiary.

9.02.01B General Information

1. Utility conflicts should be investigated early in plan development. Refer to Chapter 14 Sections 14.16 and 14.26.
2. Counties, townships, cities, and villages will participate in those costs attributable to the trunkline needs pursuant to Public Act 51 of 1951, as amended.
3. Public Act 51 of 1951 requires the Department to bear the cost of removal and replacement of streetlights impacted by a trunkline highway project. Municipalities generally provide street lighting as a public service through agreements with electric utilities. The Department typically coordinates streetlight reimbursement with the electric utility provider rather than the municipality.
4. Public Act 368 of 1925 grants the Department the authority to provide for the regulation or arrangement of municipal utility installations that interfere with the operation, maintenance, or improvement of state trunklines and regulate the installation of any new facilities on the trunkline Right-of-Way (ROW). Any modification to municipal utilities within the trunkline ROW requires a permit from the Department.
5. All reconstructed or relocated municipal utilities will, when completed, remain the property of the original owner for all future jurisdictional, maintenance, and operational obligations.
6. The relocation, extension, or alteration of private utilities due to trunkline needs that occupy public ROW by permit or sufferance shall continue to be the responsibility of the utility owners.
7. Work performed by a municipality at project expense shall be subject to prior approval and authorization by the Department.
8. Cost distributions for joint or cooperative storm sewers will continue to be made in accordance with the MDOT Drainage Manual Section 2.5.4. and are excluded from these guidelines.
9. Any agreements with municipalities must be initiated with the municipality through the Trunkline Agreement Engineer.

9.02.01C Municipal Utility Costs and Betterments

Municipal utilities are included in Department projects in any of the following capacities:

- Direct Conflict
- Indirect Conflict
- Municipal Convenience

The nature of the inclusion determines the Department's cost responsibility.

Note that any municipal utilities located outside of the municipality's corporate limits but within Department ROW that are relocated due to trunkline need will be at the municipality's expense (because the municipality is now acting as a private utility), unless it is conclusively determined that the affected utility only serves customers within the municipality boundary.

Additionally, in-kind replacement cost estimates are based on current commercially available materials that comply with the minimum standards.

Direct Conflict

A. In-Kind Replacement Cost

Direct Conflicts replaced in-kind will be a project expense. The limits of the replacement are limited to those necessary for the conflict to be mitigated.

B. Betterment Cost

Any betterments will be at the municipality's expense. The additional expense to be charged to the municipality is calculated as follows:

1. Estimate the expense to replace the utilities in-kind. This is the *in-kind expense*.
2. Calculate the increased cost of materials from the *in-kind expense* due to the betterment. This can be done by soliciting pipe supply vendors. This is the *materials increase*.
3. The *installation cost* for the betterment is calculated as 10% of the *materials increase*.
4. The Preliminary Engineering (PE) due to the betterment is calculated as 15% of the sum of the *materials increase* and *installation cost*.
5. The Construction Engineering (CE) due to the betterment is calculated as 15% of the sum of the *materials increase* and *installation cost*.
6. The total municipal participation for the betterment is the sum of the *materials increase*, *installation cost*, *PE*, and *CE*.

Indirect Conflict (Exclusive to Water Main)

The location and condition of water main can be a potential threat to the roadway due to the potential for future maintenance needs. When water main is located within the project limits, the Department will determine if a relocation is necessary to ensure the design life of the project is not compromised. This evaluation is referred to as a water main relocation study.

Every project involving federal funds must have a water main relocation study performed if there is any intention to include utility expenses on the project in addition to those necessary for direct conflicts. Refer to Section 9.02.01D.

A. In-Kind Replacement Cost

Since Indirect Conflicts are not necessary to be relocated for the project to proceed, but which would provide a benefit both to the Department and the municipality, non-federal funding for their inclusion into the project is split 50/50 between the Department and the municipality. This sharing amount holds true even if there is no federal participation.

1. Estimate the non-federal expense to replace the utilities in-kind (typically around 20% of the total replacement cost on projects containing federal funding). This is the *non-federal in-kind expense*.
2. The municipality's share of the *non-federal in-kind expense* is 50%. This is the *50% remainder*.
3. The *PE* is calculated as 15% of the *50% remainder*.
4. The *CE* is calculated as 15% of the *50% remainder*.
5. The total municipal participation for the in-kind replacement is the sum of the *50% remainder, PE*, and *CE*. This is used as an estimate for the municipality until actual costs are determined using official bid prices and the facility has been installed. Final costs are determined by the construction engineer.

B. Betterment Cost

Any betterments will be at the municipality's expense. The additional expense to be charged to the municipality is calculated as follows:

1. Estimate the non-federal expense to replace the utilities in-kind. This is the *non-federal in-kind expense*.
2. The municipality's share of the *non-federal in-kind expense* is 50%. This is the *50% remainder*.
3. Calculate the increased cost of materials from the *non-federal in-kind expense* due to the betterment. This can be done by soliciting pipe supply vendors. This is the *materials increase*.
4. The *PE* is calculated as 15% of the sum of the *50% remainder* and *materials increase*.
5. The *CE* is calculated as 15% of the sum of the *50% remainder* and *materials increase*.
6. The total municipal participation for the betterment for an Indirect Conflict is the sum of the *50% remainder*, *materials increase*, *PE*, and *CE*. This is used as an estimate for the municipality until actual costs are determined using official bid prices and the facility has been installed. Final costs are determined by the construction engineer.

Municipal Convenience

Occasionally, a municipality will choose to include work on Department projects as a matter of convenience and to potentially lower their costs by capitalizing on the work that the Department will be conducting (maintenance of traffic, removal of pavement, etc.).

The Project Manager should determine any unique contract requirements for the inclusion of the utility work into the project and allow time in the project schedule for outside agency approvals, agreements, and coordination in plan development and construction administration.

Municipality Funding Considerations

If during scoping and the stakeholder engagement process it is determined that municipal utility work will be included using non-project funds, the Project Manager, during project development, should request from the municipality the funding sources being used. It is important that the Contract Services Division (Manager of Construction Contracts) be consulted so that any other requirements are appropriately addressed, such as agency approval prior to the project award, securing of municipal loans, and similar items that may require special attention during the award process.

All non-project funds should be treated as if they were the local agency's funds. Special and unique requirements by other agencies, such as the U.S. Department of Housing and Urban Development and the U.S. Department of Agriculture, should be addressed by the Project Manager before the Plan Review Meeting (PPD Task 3590). The Department follows FHWA requirements in the administration of construction contracts; any deviation should be at the discretion of the Contract Services Division in consultation with the Michigan Division of the FHWA.

The Department is not a party to any agreement between the municipality and the funding provider.

If Construction Engineering (CE) is being performed by both the Department and the municipality, the payment to the Department from the municipality should be agreed upon and put into the cost participation agreement. This should be a lump sum price. The estimated CE will typically be 15% of the total dollar amount of the utility work (but is not *part* of that total dollar amount). Therefore, if the Department is providing all the CE for the utility work, the starting point for negotiation with the municipality should be 15%. However, if the municipality is providing all the CE for the utility work, a minimum of 5% is still required from the municipality to facilitate the Department's contract administration. A combination of Department and municipality CE will require a negotiation of the appropriate percentages between 5% and 15% based on the expected contribution of each party.

Regardless of which party performs the construction engineering and/or inspections, the Department is responsible for the oversight and only allows the municipality to perform inspections as a courtesy.

When requesting the municipality participation agreement, standard added work language should be used and a deposit may apply. Contact the Trunkline Agreement Engineer for specific deposit amounts. In the event of USDA Rural Development funds, no deposit will apply for Act 51 agencies. When a non-Act 51 agency is using those funds, the department will charge a 100% working capital deposit.

9.02.01D Water Main Relocation Studies

Prior to considering water main an indirect conflict and utilizing federal funds to relocate, it first must pass a two-part test. The first part is to determine if all the following conditions are met:

- The utility has the right of occupancy in its existing location.
- The utility is municipally owned.
- The utility occupies public Right-of-Way.
- The utility can be relocated to reduce future impacts.

The second part is to verify that the existing utilities are in one of the following locations:

- Under an existing pavement to be removed.
- Under an existing pavement's area of influence.
- Outside the existing pavement but under a proposed pavement widening.
- Under new roadways.
- Where the proposed grade significantly reduces earth cover or affects accessibility.

If the existing water main passes the two-part test, a water main relocation study must be performed that consists of input and recommendations from the Region/TSC Utility Coordinators and the Department's Municipal Utility Design Staff. The water main relocation study will determine if spending project funding on utility relocations is prudent and in the best interest of the project. Only relocations eligible for federal funding will receive a water main relocation study.

If the existing water main fails the two-part test, federal funds cannot assist in relocating the water main.

All municipal utility relocation study documentation must be saved in ProjectWise in the Correspondence/Utilities, Drainage, and Roadside subfolder.

Region/TSC Utility Coordinator Responsibility

After determining that water main relocation is a candidate for federal funding, the Region/TSC Utility Coordinator will initiate the relocation study.

This study starts by gathering information on the existing water main to determine if its characteristics (e.g., age, material, type of joint, maintenance history, location, etc.) could adversely impact the design life of the project if left in place. This information should include:

1. Existing Conditions:
    a. Location of water main in reference to existing pavement, bridge decks, piers, footings, etc.
    b. Size of water main.
    c. Age of water main.
    d. Depth of water main.
    e. Pipe material and class, if applicable.
    f. Type of joint, if applicable.
    g. Maintenance record.
    h. General comments (e.g. site specifics).
2. Proposed Conditions:
    a. Location of water main in reference to proposed pavement, bridge decks, piers, footings, etc.
    b. Depth of water main in reference to proposed pavement.
    c. Municipality-proposed alterations or plans.
    d. Type of Impact (e.g., proposed storm/sanitary sewer location, mucking operations, changes in grade, etc.).
3. Conclusions and Recommendations:
    a. Advantages/disadvantages of relocation.
    b. Cost of relocation.
    c. Region/TSC recommendation.

The Region/TSC shall make a preliminary recommendation based on their study and will notify the Municipal Utility Design Unit that this study is available on ProjectWise for their review.

Department's Municipal Utility Design Staff Responsibility

The Department's Municipal Utility Design Staff will make a recommendation based on the following:

- Information received in the water main relocation study.
- Proposed design life of pavement.
- Expected remaining life of existing utilities.
- Grading that results in less than adequate cover.
- Past experience and expertise.
- Potentially adverse materials or conditions, including:
    - Ductile iron pipe (Class 52, 53, 54, 56) older than 50 years.
    - Ductile iron pipe (Class 50 or 51) older than 30 years.
    - Cast iron pipe of Class 20 or 21 older than 30 years.
    - Cast iron pipe of Class 22 older than 50 years.
    - Pit cast iron pipe older than 70 years.
    - Asbestos cement pipe.
    - Non-reinforced concrete pipe older than 30 years.
    - Prestressed concrete pipe older than 50 years.
    - Plastic pipe with an SDR of less than 17.5 and older than 15 years.
    - Wood pipe.
    - Pipe with leaded joints.
    - Mechanical joints older than 50 years.
    - Thrust restraint by tie rods or friction clamps older than 50 years.
    - Metal pipe installed in acidic soil conditions.

Recommendations are reviewed between the Region/TSC and the Department's Municipal Utility Design Staff. If it is decided to relocate the facility, the Region/TSC will determine if there are any budget constraints for moving forward with the relocation and will proceed accordingly.

Failure to proceed with the necessary funding will result in only Direct Conflicts being included in the project.

9.02.01E Lead (Pb) and Galvanized Steel Water Service Line Replacement

Based on regulations from the Michigan Department of Environment, Great Lakes, and Energy (EGLE), partial replacements of water services containing lead (Pb) or galvanized steel that were once connected to lead (Pb) service lines are prohibited. Partial replacements are defined as any water service replacement that does not replace the entirety of the service line from the water main to the water meter before reintroducing water to that service. Impacted service lines must include replacement with proper materials outside the ROW, including from the curb stop into the building (or end user, where no building exists) being served.

Water service line replacement on Department projects can occur because of the following:

- When required by trunkline needs because of a Direct or Indirect Conflict.
- When performed by a municipality for its own benefit (Municipal Convenience).

Whether a Direct or Indirect Conflict, Department funding for water service replacement will only be allocated to the curb stop. All costs (including incidental costs such as surface restoration and ROW acquisitions) beyond the ROW are funded by the municipality; as noted in Section 9.02.01C, work outside of the ROW is considered a betterment. Temporary water service, when required, is included in the ductile iron water main pay item.

This work must be coordinated with the Water Authority during the scoping and design of the project. The Scoping Manual requires that MDOT Form 2483 be submitted to public and private utilities to gather information on their existing infrastructure. This form solicits information from municipalities on if any Pb or galvanized steel services are present within the vicinity of the project. If present, the Project Manager must contact the Department's Municipal Utility Design Staff when design is starting. The Department's Municipal Utility Design Staff will assist the Project Manager in ensuring compliance with both Department and EGLE requirements governing the replacement of such water services. If part-width construction (staging the project such that live traffic flow is maintained through the construction area on a reduced number of lanes, allowing for the balance of the road or bridge to be constructed) was selected to be the construction/maintenance of traffic methodology, it is possible that the water services will have to be directional drilled or jack and bored to avoid partial replacement. Part-width services can only be constructed provided that no water is introduced into the service until it is replaced in its entirety.

It is the ultimate responsibility of the Water Authority to facilitate the replacement of any Pb or galvanized steel services outside the ROW, regardless of which party is necessitating the replacement. If the Water Authority is not cooperative or willing to participate in the cost of these replacements (most notably from the curb stop to the water meter), the Designer/Utility Coordinator must contact the Project Manager and the Department's Municipal Utility Design Staff immediately to determine the proper course of action. Under no circumstances will a project be Advertised for Construction without Pb and galvanized steel service line replacements being addressed. This can be done in multiple ways:

1. A separate Water Authority project in coordination with the Department project. The Water Authority may elect to replace affected service lines with their own contract concurrent with the Department contract. A coordination clause between contracts will have to be included in the contract to ensure timely successful completion of the work.

2. The Water Authority work is included in the Department project. Project Managers must request that the Water Authority provide a written inventory of the water services and locations, including material types and sizes, expected to be encountered in the project. This information may have already been received as part of the scoping phase. This inventory is to be included in the water main materials special provision.

   The Water Authority is responsible for securing permission to work outside the existing ROW from the property owner and therefore Uniform Act requirements do not apply. This permission must be compliant with Subpart A of 23 CFR 645 titled “Utility Relocations, Adjustments, and Reimbursement,” specifically 23 CFR 645.111 titled “Right-of-Way.”

   The Water Authority must provide the Department with written certification stating all property interest necessary to construct the service line replacement has been acquired to do work outside the ROW. The Water Authority certification must be included in the Department ROW certification.

3. The Water Authority is granted an exemption from EGLE (Mich. Admin. Code R. 325.10302). It may be acceptable for the Water Authority to provide documentation of an exemption granted from EGLE to allow the portions of Pb and galvanized steel service lines between the curb stop and the water meter to remain in place during construction and a specified amount of time beyond project completion. In this case, the Department project would replace the impacted service lines from the water main to the ROW. If this is the alternative that the municipality pursues, it is imperative that this be identified as early in the design process as possible as it requires a submittal from the Water Authority to EGLE at least 90 days before project turn-in (Mich. Admin. Code R. 325.10303). This application, subsequent requests for information, and public hearings where required are to be coordinated and led by the municipality.

9.02.02 Private Utility Relocation Policy

(revised 7-25-2022)

Private utilities are those individually owned or owned by groups of individuals and stockholders. Private utilities normally provide communication services (e.g., telephone, cable TV, etc.), electric service, gas, and oil.

Private utilities may be located within trunkline ROW by permit issued by the Department pursuant to Public Act 368 of 1925. If conflicts between private utilities and a trunkline project exist, relocation or adjustment of the utility is at the utility company's expense. However, if a utility company has the right of occupancy in its existing location, they may meet the eligibility requirements for reimbursement.

9.02.03 Including Non-Municipal Utility Work in Contracts

(revised 7-25-2022)

All non-municipal utility work including in contracts must be referred to the Development Services Division's Utility Coordination and Permits Section.

9.02.03A General

Utility companies (excluding municipalities) occupying trunkline ROW by virtue of Public Act 368 of 1925 and the Department's Utility Accommodation Policy are subject to relocating their facilities at their own expense if a conflict exists. If during the preliminary design and utility coordination meetings it is determined that the Department can adjust its plans to allow either the utility company's facilities to remain in place or reduce their relocation cost, efforts should be made to do so if the overall project is not compromised. If the utility company's facilities are located in the ROW by permit, costs incurred by the Department to revise its plans in order to accommodate a utility company are billable to that utility company. Such adjustments will require coordination and concurrence with the Development Services Division's Utility Coordination and Permits Section.

Utility companies with facilities that have manholes within the roadway are responsible for adjusting these manholes if required by the project. Most utility companies will adjust their own manholes during the project, which requires a Special Provision detailing the work to be included in the proposal. However, provisions may be made at the utility company's request to include adjustment of their manholes in the work items of the project; this work would still be charged to the utility.

9.02.03B Procedures

The following procedure shall be used when work on behalf of a non-municipal utility is performed by a Department contractor during construction. Upon a mutual agreement between a utility and the Department, work items are incorporated in Department projects and charged to the utility.

Example work items that may be chargeable to a utility include adjustment of manholes, existing facility removals, supporting utility poles, and utility bridge attachments.

Region/TSC Utility Coordinator Responsibility

1. Meet with each utility to determine whether any work on behalf of the utility shall be included in the project. The following utility coordination issues shall be discussed:
    a. Proposed construction schedule.
    b. Type of work required.
    c. Plan completion date.

Project Manager Responsibility

2. Ensure the agreed upon utility work is included in the plans and contract documents.
3. Complete Utility Charge Estimate (Form 0223).

Note: When the total estimated cost of the utility work is less than $1,000, the Department shall not charge the utility, and simply incorporate the work into the project. If a pay item(s) is not federally participating, it shall be funded 100% by the Department.

Note: Contact Bridge Field Services for asbestos removal and disposal estimates.

4. Send Form 0223 and any plan sheets that indicate the utility work to the Region/TSC Utility Coordinator if the total estimated cost of the utility work is greater than $1,000 and less than $100,000.

   Note: For costs greater than $100,000, an individual agreement shall be required. The Project Manager shall contact the Development Services Division's Utility Coordination and Permits Section to initiate this request.

5. Receive copy of Form 0223 and Utility Approval Letter or notification of utility denial from Region/TSC Utility Coordinator.

6. Develop a special provision that covers all work for the utility, except for asbestos removal and disposal as noted. The pay item shall be established as a lump sum with an established maximum based on the line titled "Maximum Contract Bid Amount (125% of Subtotal)" on Form 0223.

   Note: The maximum contract bid amount is not the "Total Maximum Charge to the Utility."

   Note: Lump sum pay item(s) for utility work are the preferred method. However, per unit pay item(s) can be considered for items of work that are not suitable as lump sum.

   Note: When the utility work involves asbestos removal and disposal, a special provision is required. Asbestos-related work will be paid as a dollar amount and not as a lump sum. The Special Provision for Utility Coordination and Utility Work is not needed for this work.

7. Establish a separate non-federally participating category in AP Preconstruction for each utility.

8. Ensure JobNet reflects the utility funding.

9.03 DESIGN GUIDES

9.03.01 Utility Poles and Light Standards

(revised 1-23-2023)

These guidelines apply to the location of utility poles and light standards on free access roadway construction projects and all trunkline, utility, and roadway lighting construction. Where reconstruction of a roadway is included in the project, every effort should be pursued to ensure that adjacent poles meet the recommended location criteria. However, if the project does not impact the location of existing poles, a specific pole relocation is dependent on a concentration of fixed-object crashes or the clear potential for crashes.

When placed within trunkline ROW, light standards and utility poles should be located to provide a safe recovery area for motorists.

9.03.01A General Considerations

Individual cases may arise that require special treatment such as: traffic signal installations; locations demonstrating fixed-object crash patterns; and locations with unique design problems, sight distance restrictions, higher multi-modal activity, or unique environmental conditions.

Certain trunkline geometrics warrant special consideration for placement of light standards and utility poles. Target positions to traffic flow should be avoided if possible. Such locations are: opposite T-intersections; outside of curves; beyond lane drops; and locations not conducive to safe traffic operation. Where guardrails or barriers are in place specifically for shielding other roadside obstacles, light standards and utility poles should be placed behind the guardrail or barrier and outside of the deflection zone of the guardrail/barrier. The number of light standards and utility poles should be kept to a practical minimum. Consideration should be given to utilizing joint-use construction where possible.

9.03.01B Authorization

The Development Services Division processes permit applications to place light standards or utility poles. These applications will be made on forms furnished by the Department and shall be accompanied by a sketch showing the proposed locations in relation to the pavement edge or curb face and ROW and should also include the posted speed limits and the widths and locations of any sidewalks.

9.03.01C Clarifications of Terms Used in Guidelines

The placement of light standards and utility poles includes all related appurtenances.

All lateral distances are measured from traffic side of the utility pole or light standard to lane edge or curb face.

9.03.01D Lateral Offset Guideline

Light standards and utility poles should always be placed as far from the roadway as feasible.

1. Where posted speeds are less than 35 mph:
    a. In areas with curb types F or C (as specified on Standard Plan R-30-Series) or their equivalent, light standards and utility poles should be a minimum of six feet from the back of curb.
    b. In areas with curb types B or D or their equivalent, light standards and utility poles should be a minimum of 15 feet from the edge of pavement
    c. In Central Business District areas with curb types F or C or equivalent and continuous sidewalk between the curb and buildings, light standards and utility poles may be placed two feet from the back of curb.
    d. Where pedestrian and bicycle traffic will take place on sidewalks or side paths designers should consider these users when deciding on proper placement of utility poles.
2. Where the speed limit is 35 mph or greater on tangent roadways with flat side slopes, light standards and utility poles should be placed according to the following table, regardless of the presence or absence of barrier curb.

SPEED LIMIT mph	LATERAL OFFSET (from travelled way) feet
35	18
45	20
50	25
55	30

These lateral offsets should be increased for steeper slopes and for horizontal curves.

Light standards on roadways with a speed limit of 35 mph or greater that cannot be placed equal to or greater than the prescribed distances shall be equipped with a "Frangible Device." The device shall meet NCHRP 350 criteria and be certified by FHWA (as proven by a letter of acceptance from FHWA).

9.03.01E Light Standard Details

All light standards must be detailed on the design plans. Department details for light standards (non-frangible base and frangible base) and light standards assemblies are available by contacting the Municipal Utility Design Staff. Shop drawings and design calculations for all light standards are to be submitted to the Municipal Utility Design Staff and the Operations Field Services Division’s Structural Fabrication Unit for review and subsequent approval by the Project Manager. This applies to all light standards and details other than those developed and provided by the Department.

Any light standard foundation(s), light standard(s), or portions thereof considered for salvage and reuse must first be inspected by the Structural Fabrication Unit during the planning or design stage of the project. Contact the Structural Fabrication Engineer to arrange for

inspection.

9.03.02 Municipal Utility Alterations and Notification of Utility Design Units

(revised 7-25-2022)

9.03.02A Procedure

This procedure is to be followed whenever municipal utility alterations occur on a project and *after* the Utility Coordination Meeting (Refer to Chapter 14 Section 14.26)

Municipal Utility Design Staff/Consultant Responsibility

1. If utility relocation is part of the Department contract:
    a. Prepare plans to include the utility alteration in the Department contract (Begin PPD Task 3670).
    b. Send plans and specifications to the affected municipality for comments.
    c. Once municipality approves utility plans, submit plans, specifications, and estimates to the Project Manager for incorporation into the plans to be reviewed during the Final Project Coordination meeting.
    d. Address Final Project Coordination Meeting comments and resubmit to the Project Manager and municipality.
    e. Complete all certification acceptance documents.
    f. If requested, assist the municipality in filling out the required permits for the project. However, all permits required by EGLE must be submitted by the facility owner.
    g. Submit copies of municipal plans, special provisions, specifications, and draft permits (if applicable) to the municipality.

9.03.03 Utilities on Plans

(revised 7-25-2022)

MISS DIG provides a central source of information regarding the location of underground utilities throughout the state. Most underground utilities participate in the "Miss Dig" system. Ensure the following note is placed on the plans:

Contact MISS DIG System, Inc. for the protection of underground utilities and in conformance with MCL 460.721 et seq, by phone at 811 or 800-482-7171 or via the web at either elocate.missdig.org for single address or rte.missdig.org, a minimum of 3 working days prior to excavating, excluding weekends and holidays.

Additionally, label underground utility lines that are no longer in use, or are to be abandoned, as “UTILITY LINE OUT-OF-SERVICE” on the plans. Include the following note for underground utilities in the note sheet:

Plan information indicates an existing underground utility is or may be out-of-service within the limits of this contract. The contractor is cautioned to treat such a line as if it were still in service and notify MISS DIG when working in the area of the out-of-service facility.

Refer to Section 1805.02 of the Utility Coordination Manual.

9.04 MISCELLANEOUS

9.04.01 Utility Trenches

(revised 7-25-2022)

Utility trenches for buried utilities are detailed on Standard Plan R-83-Series. For permanent trench pavement cross-section replacement, the replaced engineered cross-section (including the pavement, base, and subbase layers) should be structurally equivalent to the existing pavement section on either side as defined by Department pavement design guidelines. The replaced cross-section should match in materials and thicknesses to the existing pavement on either side of it. However, constructability or material availability may prohibit the exact replacement. In these instances, the replaced cross-section can be of different materials and/or thicknesses but should be as similar as possible and maintain structural equivalency to the existing pavement section on either side. Contact the Department Region Soils Engineer for current pavement design guidance and assistance.

9.04.02 Deleted

Section deleted.

9.04.03 Permit Applications

(revised 7-25-2022)

Municipalities and private corporate utilities may require permits or other approvals for utility alterations or the installation of new utility facilities. Coordination with the Municipal Utility Design Staff, the Development Services Division's Utility Coordination and Permits Section, and the Region/TSC Utility Coordinator is needed to determine the current requirements for permits and approvals. Refer to Chapter 14.

9.04.04 Temporary Utility Hook-Ups

(revised 7-25-2022)

Occasionally a project requires utility services for contractor operations (e.g., electrical power feed on a rest area or pumphouse project). A budgeted amount should be included in the proposal to compensate the Contractor for arranging and paying advanced fees for connection and service.

Information on cost breakdown and utility contact is needed to prepare a special provision to show the budgeted amount. When electrical service is required, the Municipal Utility Design Staff will contact the utility company for all necessary information. When other utility services are required, contact with the utility company is made through the Region/TSC Utility Coordinator.

9.04.05 Water Main Appurtenances

Adjustments and relocations of fire hydrants, valve boxes, water manholes, water shutoffs, and service connectors require coordination with the Municipal Utility Design Staff.

9.04.06 Gas Main Relocation Policy

(revised 7-25-2022)

The following policy governs the relocation of gas mains in Department projects.

1. All gas mains (distribution or transmission) may remain under proposed widening areas unless the main has a history of frequent repairs or is cast iron. The maintenance records furnished by the gas companies will be reviewed by the Region/TSC Utility Coordinator, and if the report indicates there have been no repairs in the five preceding years, the gas main may remain.
2. Excluding cast iron, no main shall be required to be relocated:
    a. When the construction project is less than ½ mile in length.
    b. Where relocation would require extensive private easements.

Only extenuating circumstances will warrant modification from the above policy. Contact the Development Services Division's Utility Coordination and Permits Section Manager.

All documentation pertaining to the disposition of gas mains must be saved in ProjectWise in the Correspondence/Utilities, Drainage, and Roadside subfolder.

9.04.07 Sanitary Sewers

(revised 7-25-2022)

Existing combined sanitary and storm sewers should not be used for drainage purposes on a new roadway or improvement project.

9.04.08 Sanitary Sewer Service Leads

(revised 7-25-2022)

On projects that include sanitary sewer relocation, continuity of existing service leads must be addressed. This may entail reconstructing the lead, bulkheading and abandoning the lead, or just bulkheading the lead. Approval for abandonment of an existing sanitary service must be approved by the municipality.

9.04.09 Subsurface Utility Engineering (SUE)

(revised 7-25-2022)

SUE is a branch of engineering practices that manages risks associated with utility mapping, utility coordination, utility relocation design and coordination, utility condition assessment, communication of utility data, utility relocation cost estimates, implementation of utility accommodation policies, and utility design. [American Society of Civil Engineers (ASCE) Standard 38-02]

This section is not intended to be an all-encompassing document or to replace sound engineering judgment.

Funding for SUE-contracted services is typically derived from the project's Preliminary Engineering (PE) phase. An evaluation on the merits of applying SUE should be done during the project's scoping or design phase so that appropriate funding may be allocated. The earlier SUE services are identified, the better they can be coordinated during the project's PE phase.

If the need for SUE-contracted services is determined prior to the development of the design scope of work, SUE services should be included as part of that scope. This is particularly beneficial on consultant design projects where the prime consultant is then responsible for both the design and SUE services. This will enhance coordination of these functions during the project's design phase.

All SUE providers shall be selected from the Department's SUE prequalification list.

The following guidelines provide items to consider when determining whether to use SUE for a project. It is not all inclusive.

- Impact of conflicts with unknown subsurface utilities during construction.
- Likelihood that inaccurately-located subsurface utilities would delay the project's completion schedule and increase contractor costs.
- Critical nature of project progress schedule and/or completion date.
- Safety risks involved with the subsurface utilities present on the project.
- Type and quantity of subsurface utilities present.

SUE may be applied to varying degrees on a project depending on the situation. These degrees are denoted as Utility Quality Levels. There are four Utility Quality Levels that represent the professional opinion of the quality and reliability of utility information based on different methods of data collection and interpretation. (ASCE Standard 38-02)

A project may include one or multiple utility quality levels depending on the risk factor(s) associated with each subsurface utility. Subsurface utility data evaluation is an important part of the utility coordination and SUE process.

Utility Quality Level D - Information derived from existing records or oral recollections. (ASCE Standard 38-02)

Utility Quality Level C - Information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to Quality Level D information. (ASCE Standard 38-02)

Utility Quality Levels D and C are typically used on almost all Department construction projects. Both involve contacting utility owners and obtaining available utility records. They may also include a site visit to survey visible surface features to verify utility records.

Utility Quality Levels D and C are typically suitable when a project has only a few subsurface utilities, their location is well known, and there is limited risk in only using available utility records.

Utility Quality Level B - Information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities. Utility Quality Level B data shall be reproducible by surface geophysics at any point of their depiction. This information is surveyed to applicable tolerances defined by the project and is incorporated into plan documents. (ASCE Standard 38-02)

Utility Quality Level B, also referred to as “designating,” involves the horizontal mapping of subsurface utilities to a projects survey control. Obtaining Utility Quality Level B information is desired when the PM is risk-averse. Utility Quality Level B should be considered for subsurface utilities that have discrepancies or may impact the project if not in the exact position shown. Once Utility Quality Level B information is obtained, it is compared with the project plans to identify conflicts. Obtaining Utility Quality Level B information shall be considered when:

- Discrepancies exist between the utility records and what is represented in the field.
- The project involves lots of utilities and/or the utility owners are unsure of their location.
- An adverse effect on the project could be caused by utilities inaccurately represented on the records.
- Inaccurate horizontal locations received from utility records may cause the project to miss a critical completion date.
- It is suspected that there are more utilities in the project limits than shown and/or received from utility record.
- It is suspected that there are buried structures (tanks and/or foundations) not shown on drawings.

Utility Quality Level A - Precise horizontal and vertical location of utilities obtained by the actual exposure (or verification of previously exposed and surveyed utilities) and subsequent measurement of subsurface utilities, usually at a specific point. Minimally-intrusive excavation equipment is typically used to minimize the potential for utility damage. Precise horizontal and vertical location, as well as other utility attributes, is shown on plan documents. Accuracy is typically set to 15-mm (approximately 5/8-inch) vertical and to applicable horizontal survey and mapping accuracy as defined or expected by the project owner. (ASCE Standard 38-02)

Utility Quality Level A, also referred to as “locating,” involves using non-destructive excavation techniques (e.g., air-based vacuum excavation) to expose the subsurface utility and obtain its precise horizontal and vertical position. Obtaining Utility Quality Level A information shall be considered when:

- A subsurface utility could have a major impact on the project and knowing its exact position is critical.
- Precise vertical location of subsurface utilities is critical to a design feature of the project. This may occur when modifying a design to leave a utility in its current location.
- Proposed grade changes may require subsurface utility relocations or cause a utility to have insufficient cover.
- There is a possibility that subsurface utility vertical elevations could be inaccurate.
- A delay, based on vertical location received from utility records, may cause the project to miss a critical completion date.

9.04.10 Lighting Project - Energy Rebate Procedure

(added 2-16-2016)

Most major energy companies (e.g. Consumers Energy, DTE, Lansing Board of Water and Light, Cloverland Electric) have annual energy reduction incentive rebates. Energy company participation in rebate incentives and contact information can generally be found on their respective websites. Contact Municipal Utility Design Staff if this information is not found or is unclear.

The amount of the rebate is based on the energy reduction percentage by converting existing lighting fixtures to more efficient ones. New lighting installation projects do not qualify for rebates. The reduction of energy on existing lighting must be determined from utility electric meter KWH readings.

The Department or consultant designer initiates the rebate request by verbal contact with the energy company early in the preliminary plan development phase, then subsequently by formal application. Incentives are available on a “first come/first served” basis until annual funding has been exhausted. Consultant lighting designers must notify the statewide electrical engineer when a rebate incentive has been initiated on behalf of the Department.

When conversion of lighting fixtures is performed by Department forces, the request to the energy company for an incentive rebate is made by the design engineer (either the Department statewide electrical engineer or the region designer) during the design and prior to the start of work.

The information submitted to the utility company required for the incentive request consists of the lighting plans, utility electric meter numbers, shop drawing submittals of the proposed lighting, and the type of existing lighting presently installed.

The utility company then reviews the information and approves the request as submitted to reserve the incentive funds to be awarded once the project is complete. As part of the approval process, the utility company calculates the rebate amount for the qualifying project work from the documentation provided.

Upon completion of the lighting installation, the Department statewide electrical engineer requests a final inspection by the utility company of the new lighting installed. Typically, within four to six weeks from the final inspection, the Department receives the rebate incentive check from the utility company. Forward all rebate checks to the statewide electrical engineer for processing.

9.05 DELETED

Section deleted.

MICHIGAN DESIGN MANUAL
ROAD DESIGN

CHAPTER 10 • ENVIRONMENTAL

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CHAPTER 10 • ENVIRONMENTAL

10.01 REFERENCES

A. Clean Air Act

B. Environmental Quality Improvement Act

C. Executive Order 11514 (Protection and Enhancement of Environmental Quality)

D. Federal Clean Water Act

E. Transportation Efficiency Act for the 21st Century (TEA-21)

F. Michigan Natural Resources and Environmental Protection Act (P.A. 451 as amended, 1994)

G. National Environmental Policy Act

10.02 ENVIRONMENTAL POLICY

The National Environmental Policy Act (NEPA) requires an examination and consideration of the potential impacts of a transportation project upon sensitive resources. These resources include, but are not limited to, floodplains, wetlands, endangered species, historic and archeological sites, parklands, air quality, water quality, wildlife habitat, etc. It is the policy of the Federal Highway Administration that this examination be completed as part of the NEPA process, that evidence of compliance with the process be contained in appropriate documentation, and that public involvement must be an essential part of the process.

10.02.01 General

Every project that utilizes federal funding must be analyzed for environmental impacts and environmental clearance obtained before the funding is released. The depth of analysis of a project is determined by the severity of its impact upon the environment, not the size of the project. It is possible to have a small project which has such severe impacts that extensive analysis is required. Conversely, it is possible to have a very large project which has very little impact and which requires relatively little analysis. In general, large and complex projects often require more analysis than small, simple projects, but it should be kept in mind that this is a coincidental connection, not a procedural one.

The term “environment” may be confusing in this usage. While “environment” encompasses those areas customarily thought of as the environment; i.e., water and air quality, wetlands, endangered species, etc., it also includes the “social environment”. Such things as impacts upon historical structures, parks and recreational areas, adverse economic and social consequences, etc. are also a part of the analysis.

The purposes of the analysis are, basically, to determine, what the adverse effects of the project are, whether the positive benefits of the project outweigh the negative effects, to attempt to avoid the negative effects, and to attempt to mitigate those negative effects which can’t be avoided. This approach recognizes that the project itself will become a part of the environment. It must therefore be integrated into the existing environment rather than imposed upon it.

10.02.02 Documents / Definitions

(revised 7-27-2026)

There are three levels of analysis: categorical exclusion, environmental assessment, and environmental impact statement.

10.02.02A Categorical Exclusion

Most projects are cleared through the Categorical Exclusion (CE) process. This process consists of a cursory examination of the proposed scope of work by specialists in the Environmental Services Section. If there are no apparent “significant” long term negative environmental impacts, “substantial” controversy on environmental grounds, or significant impacts upon public parks, recreation areas, or refuges, the project receives an environmental clearance to proceed. Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator), with any necessary attachments, serves as the documentation of compliance with the NEPA process. Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator) will often include mitigation measures such as limitations on areas where work can occur, or compensation such as replacement trees in order to avoid or minimize environmental impacts. These mitigation measures must be incorporated into the design of the project.

10.02.02B Environmental Assessment

When it is uncertain whether or not a project may have a “significant” impact upon the environment, an Environmental Assessment (EA) is prepared. The purpose of the EA is to conduct a more in-depth analysis of the project and to determine either that there is a “Finding of No Significant Impact” (FONSI) or that there is significant impact. If it is determined that there is significant impact, an Environmental Impact Statement will be required.

10.02.02C Environmental Impact Statement

When it is obvious that a significant impact upon the environment will result from a project, or when an Environmental Assessment determines that a significant impact will result, an Environmental Impact Statement (EIS) must be prepared. The main purpose of the EIS is to ensure that all considerations and deliberations required by NEPA are carried out and that the decision making process is documented.

10.02.03 Permits / Laws / Ordinances

(revised 4-28-2025)

There are a number of federal, state, and local laws which govern many of the activities or tasks which make up a project. In some cases, permits are required before certain actions can be taken. In others, certain actions must be taken to avoid incurring liability, fines or worse.

10.02.03A Wetlands

1. Statutes

    a. Federal

        1) Federal Water Pollution Control Act

            a) Section 404: This section regulates the discharge of materials into wetlands. Such discharges, or “fills” require a permit. Although the permit program is the responsibility of the U.S. Army Corps of Engineers (ACOE), in Michigan the actual administration of the permit program has been formally delegated to the Michigan Department of Environment, Great Lakes, and Energy (EGLE). Oversight and audit of EGLE’s permitting process and performance is conducted by the U.S. EPA. In some cases which involve navigable waters, the ACOE may also issue a permit either separately of jointly with the EGLE.

    b. State

        1) Michigan Natural Resources and Environmental Protection Act (Act 451, P.A. of 1994) This act formally collects and codifies most previously existing state environmental laws into a single statute. The formerly independent laws have become Parts of this Act.

            a) Part 303 – Wetlands Protection. The purpose of this Part is to protect the wetlands of the state.

2. Discussion

    When it is necessary to take a wetland in the course of a project, the need must be established and permit issued by the EGLE. It will be necessary to mitigate or replace the taken wetland. This Part interacts to a certain extent with Section 404 of the Federal Water Pollution Control Act in that it establishes the basis for the delegation of the 404 program to the EGLE and allows the use of the State permitting process to administer that program.

3. Contacts

    Regulation of Discharge into Wetlands (Section 404) and Wetlands Protection (Part 303): The staff of the Environmental Services Section serve as a liaison with these agencies. When provided with sufficient and correct information, they will assemble and file the permit application with the appropriate agency(s), respond to their questions, and monitor the status of the application.

10.02.03B Water Quality

1. Statutes

    a. Federal

        1) Federal Water Pollution Control Act

            a) Section 402: National Pollutant Discharge Elimination System (NPDES) permits. This section regulates the discharge of materials into the surface waters of the U.S., including soil particles.

        2) Rivers and Harbors Act of 1899

            a) Section 10: This statute regulates the “creation of an obstruction” in “any port, roadstead, jetty, haven, harbor, canal, navigable river, or other water of the United States.” This act is administered by the U.S. Coast Guard.

    b. State

        1) Michigan Natural Resources and Environmental Protection Act (Act 451, P.A. of 1994, as amended) This act formally collects and codifies most previously existing state environmental laws into a single statute.

            a) Part 31 – Floodplain protection

                Incorporates language which allows the EGLE to administer the NPDES Permit program, including the Municipal Separate Storm Sewer System (MS4) permit and Notice of Coverage.

            b) Part 91 – Soil Erosion and Sedimentation Control

            c) Part 301 – Inland Lakes and Streams

                Fill or construction below the ordinary high water mark (OHWM) of any inland lake or stream requires a permit issued by the EGLE.

2. Discussion

    Projects that have an earth disturbance of an acre or more and discharge to a water of the state are required to meet the provisions of the MS4 permit. See the Stormwater Treatment Manual for additional information.

    Any actions which require an earth disturbance of more than five acres of land and have a discharge to waters of the state, require an NPDES Notice of Coverage to be filed with the EGLE. Plans of the proposed actions and plans to control or prevent loss of sediments and other polluting materials during the actions are required. Certain project personnel who will be on-site during construction are required to receive soil erosion and sedimentation control training (Phases I, II and III), and become certified storm water discharge operators under NPDES.

    Construction activities in or near a floodplain, lake, river or stream will require a permit from EGLE and/or the Army Corps of Engineers.

3. Contacts

    a. MS4, Stormwater Program Manager, Environmental Services Section.

    b. NPDES Notice of Coverage (Section 402): The staff of the Grading/Drainage and Consultant Contracting Unit of the Construction Field Services Division.

    c. Soil Erosion and Sedimentation Control (Part 91): The staff of the Grading/Drainage and Consultant Unit of the Construction Field Services Division.

    d. Floodplain Protection (Part 31) and Inland Lakes and Streams (Part 301): The staff of the Environmental Services Section.

    e. Rivers and Harbors (Section 10): The staff of the Environmental Services Section.

10.02.03C Endangered Species

1. Statutes

    a. Federal Endangered Species Act

    b. Part 365 of the Michigan Natural Resources and Environmental Protection Act (Public Act 451 of 1994)

2. Discussion

    Threatened and endangered plants and animals are afforded all protection granted to them under the state and federal Endangered Species Acts. An Endangered Species Permit is required from the EGLE for all state and federal species that may be directly or indirectly impacted during construction. This may require field surveys during the proper season and coordination with numerous state and federal agencies during the project clearance process. Additionally, a formal consultation process and permit may be required by the U.S. Fish and Wildlife Service (USFWS) for all federal endangered species that may be impacted. These agencies may require MDOT to completely avoid the habitat area, change the scope of work to reduce impacts, and provide suitable mitigation prior to the granting of each permit.

3. Contacts

    a. Endangered Plant Species - The staff of the Environmental Services Section

    b. Endangered Animal Species - The staff of the Environmental Services Section

10.02.03D Potential Contaminated Sites

1. Statutes

    a. Federal Resource Conservation and Recovery Act

    b. Federal Comprehensive Environmental Response, Compensation and Liability Act (a.k.a. “Superfund”)

    c. Part 201 (environmental response); Part 211 (underground storage tanks); Part 213 (leaking underground storage tanks) of the Michigan Natural Resources and Environmental Protection Act (Public Act 451 of 1994)

2. Federal and state laws passed in the 1980s and early 1990s imposed liability for environmental contamination of real property merely for the act of buying the property without proper investigation. The Environmental Assessment Unit (EAU) was established in the Development Services Division to carry out the necessary investigations to avoid liability and to fulfill secondary informational needs (public and worker safety, project constructability, construction contract provisions, exacerbation of contamination and tort liability) regarding contamination.

   Sometime after this Unit was established, it was recognized that projects which did not require the acquisition of property for Right-of-Way (ROW) were unexpectedly encountering contamination. This often resulted in major project delays and cost overruns. A process parallel to that of the EAU's was developed and assigned to the District Resource Specialists. This process was outlined in Design Division's Information Memorandum IM#408-R dated May 18, 1993. Its purposes were the same as the secondary purposes of the EAU process.

   The amendments to the environmental statutes largely removed the liability from the acquisition of property for ROW purposes. There still remains a danger of acquiring liability from properties purchased for non-ROW purposes, and there are specialized and somewhat complex procedures that must be followed to avoid it. The Development Services Division still remains a customer for that portion of the process. The amendments removed the need for the bifurcated, overly complex process.

   Interim procedures have been developed for identifying potential contaminated sites, conducting the necessary testing, and estimating the cost of remediation. See Section 14.13 for these procedures.

   Noteworthy, responsibilities for the Designer include coordinating activities with the EAU and Construction Field Services Division in order to acquire the pay item and quantity information for inclusion in the design package. In some instances, the individual sites should be shown on the plan sheets.

3. Contacts

   a. The Environmental Assessment Unit of the Development Services Division will conduct a survey of the project area for projects which require the acquisition of ROW. A Contaminated/Leaking underground storage tank search will occur. They will make specific recommendations regarding the disposition of any sites found.

   b. Underground storage tanks - removal; The Grading/Drainage and Consultant Contracting Unit of Construction Field Services Division has firms under contract which specialize in the removal of underground storage tanks, leaking or otherwise.

   c. The Region Resource Specialist may also be contacted for assistance.

10.02.03E Mining

Mining permits are issued by the local unit of government. The Design Division will contact the local unit of government directly.

10.02.03F Air Quality

1. Statutes
    a. Clean Air Act, as amended (CAA)
    b. 23 CFR 770
2. Discussion

    All actions which have the potential to increase vehicle capacity, are taken in order to alleviate congestion, or to create new roadways must meet the requirements of the CAA and 23 CFR 770, and must be included in the State Implementation Plan. Computer modeling projections based upon traffic volumes for comparison of present and future impact must be made.

3. Contacts
    a. Air Quality, Environmental Services Section

10.02.03G Noise

1. Statutes
    a. 23 U.S.C. 109
    b. 23 CFR 772
2. Discussion

    All actions which have the potential to increase vehicle capacity, are taken in order to alleviate congestion, or create new roadways must have the existing noise level monitored and analyzed, followed by computer modeling for projection of future impacts.

3. Contacts
    a. Noise staff of the Environmental Services Section

10.02.03H Farmland Preservation

1. Statutes
    a. Federal
        1) The Federal Farmland Protection Policy Act of 1984
    b. State
        1) The Farmland and Open Space Preservation Program, Public Act 233, commonly known as PA 116
2. Discussion

    The federal requirement involves all federal agency proposed projects that may convert farmland / forest land, as defined in the Federal Farmland Protection Policy Act, to non-agricultural uses. MDOT or its consultant will complete a farmland conversion impact rating in conjunction with the Natural Resources Conservation Service of the U.S. Department of Agriculture. This analysis is a land evaluation / site assessment which must accompany the environmental clearance document when new Right-of-Way (subject to review) is needed.

Under the Farmland and Open Space Preservation Act, the state program allows farmers to lease their property development rights (PDR) to the state in exchange for a tax credit for a minimum of ten years. It also allows, farmers to sell their development rights to the state. When new Right-of-Way is required from parcels enrolled in either part of the state program there are certain acquisition procedures to follow and financial penalties due. These lands are also unavailable for borrow. Projects are reviewed for this factor during the environmental review process and again when Right-of-Way plans are available.

3. Contacts

    a. Farmlands / PDR staff of the Environmental Services Section

10.02.03I Coastal Concerns

1. Statues

    a. Federal

        1) The Coastal Zone Management Act of 1972

        2) The Coastal Barrier Resources Act of 1982

    b. State

        1) Part 353 of Act 451 (NREPA) Sand Dune Protection and Management

2. Discussion

    The Coastal Zone statute requires a consistency determination that federally funded projects are consistent with the Coastal Zone Management Program which has been approved for the State of Michigan. This program is administered by the EGLE. Also, activities within a designated critical dune area may require a permit from the EGLE.

    The purpose of the Coastal Barrier Resources Act is to reduce federal expenditures which encourage development in these hazardous areas and preserve the natural resources of these areas. There are very few areas in Michigan which are designated under this Act. Coordination with other federal and state agencies would be required to determine if the proposed work would be prohibited.

3. Contacts

    a. Coastal Zone staff of the Environmental Services Section

10.02.03J Section 4(f) and 6(f) Protection of Public Park and Recreation Lands, Wildlife and Wildfowl Refuges and Historic Sites

1. Statutes
    a. Federal
        1) U.S. Dept. of Transportation Act of 1966, 23CFR Part 771
2. Discussion

    The use of land from a public park, recreation area, or wildlife and waterfowl refuge or historic site of national, state, or local significance is prohibited unless there are no prudent or feasible alternatives to the use of the land and all measures are taken to minimize harm. Note: This is often a very difficult issue to resolve and in some cases may not be resolvable. As soon as an actual or potential project **involvement with such a facility is known or suspected, the contact person for this issue should be notified.**

3. Contacts
    a. 4(f) / 6(f) staff of the Environmental Services Section

10.02.03K Section 106, Historical Preservation

1. Statutes
    a. Federal
        1) National Historic Preservation Act of 1966, 36 CFR Part 800 (Section 106)
2. Discussion

    Section 106 of the National Historic Preservation Act requires a Federal agency with jurisdiction over a federally assisted, or federally licensed undertaking to take into account the effects of the agency's undertaking on properties included in or eligible for the National Register of Historic Places. The Federal Agency must also afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. The Agency with jurisdiction over an undertaking has legal responsibility for complying with Section 106. This includes identifying historic properties, assessing effects upon them, and considering alternates to avoid or reduce those effects.

    Projects are reviewed for historic resource impacts during the environmental review process. This includes both above-ground structures and archaeological resources.

3. Contacts
    a. Historic Preservation staff of the Environmental Services Section

10.03 PROJECT ENVIRONMENTAL CLASSIFICATION

Every MDOT project is reviewed and it is assigned an environmental classification. The classifications are: Class I Action (Environmental Impact Statement), Class II Action (Categorical Exclusion) and Class III Action (Environmental Assessment). The majority of projects receive a Categorical Exclusion classification.

10.03.01 General

Projects are classified according to the significance of the impact(s) that they will have on the environment. The level of analysis of a project increases as the potential significance of its impacts increases. Those projects in which there are no potential impacts are classified as Class II Action (Categorical Exclusions). Those projects in which there is uncertainty as to whether significant impacts will occur receive a Class III Action (Environmental Assessment) classification. Projects in which it is known or strongly suspected that significant impacts will occur receive the Class I Action (Environmental Impact Statement) classification.

10.03.02 Environmental Impact Statement

10.03.02A Draft Environmental Impact Statement (DEIS)

A DEIS containing a description of project, a discussion of alternatives to the construction of the project (including “no build”), an analysis of the impacts that the project and the alternatives would have on the human and natural environment is developed. The DEIS is then circulated to the appropriate federal and state regulatory agencies and made available for public review. A public hearing on the DEIS is held and public comments recorded.

At this stage of analysis, no decisions are made. It is a fact and opinion finding stage.

10.03.02B Final Environmental Impact Statement (FEIS)

The FEIS includes discussion of the “recommended alternate” and presents justification for its selection. It also responds to comments gathered from the DEIS and the Public Hearing, and incorporates any corrections to the DEIS. Mitigation and / or enhancement measures intended to reduce or correct any adverse impacts of the recommended alternative are described. Any major unresolved issues will also be incorporated.

The FEIS is then given a final distribution to the public and agencies. A Record of Decision (ROD) is issued by FHWA. After issuance of the ROD, which constitutes environmental clearance and design approval, the project can proceed to the final design, Right-of-Way acquisition and construction stages.

10.03.03 Environmental Assessment

10.03.03A Significance of Impacts

When the significance of the impacts of a project are not clearly established, an EA is prepared. It generally describes the project, discusses the purpose of and need for the project, the alternatives to the project, the impacts of the project and their mitigation, comments and coordination with appropriate agencies, and any Section 4(f) Evaluations that may be necessary.

10.03.03B Finding of No Significant Impact (FONSI)

The EA process has one of two results. If no impacts are determined to be significant a document known as a FONSI is issued. It states the findings and the basis for the findings and references the EA. If, however, significant impacts are determined to be probable, the Environmental Impact Statement process is initiated for the project.

10.03.04 Categorical Exclusion

All MDOT projects receive at least a cursory analysis for environmental impacts. If no significant impacts are known or anticipated, the project receives a Categorical Exclusion classification. If, subsequent to this designation, significant impacts are found to be possible or probable, the project is reclassified as either and EA or an EIS.

10.04 DESIGN CONSIDERATIONS

As developers of the plans and proposals for various road improvements, the Designer should strive to provide for the needs of highway users while maintaining the integrity of the environment. Unique combinations of requirements that are often conflicting result in unique solutions to the design problems.

10.04.01 General

Designers should recognize the implications of how the proposed road improvement is going to impact the human and natural environment. When the design details are being developed, care should taken to either minimize or totally eliminate negative impacts to critical environmental conditions.

This can sometimes be accomplished by the Designer choosing values from a recommended range of design guidelines which satisfy the needs of the proposed improvement while at the same time lessening or eliminating any negative influence to the environment. Any chosen design should be cost effective in comparing the highway user benefits with the needs of non-users and the environment.

The effects of the various environmental impacts can and should be mitigated by thoughtful design processes. This principle is intended to produce highways that are safe and efficient for users, acceptable to non-users, and in harmony with the environment.

10.04.02 Human Environment

10.04.02A Social Impacts

The effects of a project upon the social fabric of an area must be considered. “Social” is a very broad and vague term which can be applied to everything from the temporary disruption of an annual celebration or festival by construction activities to the permanent division of a historically cohesive ethnic neighborhood by a new road. It may encompass such things as the increase in noise due to an increase in volume of traffic or a change in the composition of traffic; e.g., a new routing which takes heavily loaded tractor-trailers on a steep climb near a formally quiet rural area. Effects, both temporary and permanent, must be considered and weighed. When unavoidable adverse effects result, mitigative measures must be developed and applied as part of the project.

10.04.02B Economic Impacts

Projects can have impacts on a local economy which range from a temporary and minor inconvenience to customers and business owners or operators to the permanent devastation of the economy. Measures must be considered and applied to mitigate the former while the latter must be avoided to the extent possible (the project may not be built).

10.04.02C Environmental Justice

Presidential Executive Order 12898 requires that each federal agency ensure that its actions do not adversely affect minority and low income communities disproportionately with regard to human health or environmental effects. The U.S. DOT has issued Order 6640.23 to comply with these requirements.

10.04.02D Impact to Community Facilities and Services

1. Emergency Services

   The effect that closing a road or bridge may have upon the access of the community to such things as fire, ambulance, police, hospital services, etc. must be carefully considered. What may have been a 5 or 10 minute trip for response time may be transformed into hours, or even become impossible altogether. It may become necessary to establish a temporary alternate route or routes to ensure delivery of these services during the project.

2. School Bus Services

   In the same manner that the impacts to emergency services must be considered, so must the effects on school bus routes. Similar mitigative measures; e.g., temporary alternate routes, bridges, etc., must be considered.

3. Special Events, etc.

   It is now commonplace for communities to have recurring celebrations or other activities on an annual or more frequent basis. Often, this activity has major economic or cultural significance to the community. Examples are sporting events, parades, celebrations of historic events, harvest events, etc. Since most of these events are short lived and usually occur at very specific intervals or on specific dates known well in advance of projects, the easiest form of mitigation is usually project scheduling to avoid conflicts with them.

10.04.02E Historical / Archeological

Historic buildings and archaeological sites are protected by federal law and in some cases state law. A project which will result in adverse impacts to such properties must first be reviewed and cleared to proceed by the State Historic Preservation Officer (SHPO). If the effects are unavoidable, measures to mitigate the damage must be developed and applied. Unavoidable adverse effects require preparation of an Environmental Assessment or an Environmental Impact Statement. Adverse effects can include both direct and indirect project impacts.

10.04.03 Natural Environment

(revised 5-27-2025)

10.04.03A Wetland Impacts

Compensatory mitigation will be required for any wetland impacted by the proposed project which are over one-tenth of an acre in extent. Under state and federal law, every effort must be made to avoid and/or minimize wetland impacts before the resource agencies will grant a construction permit. Therefore, the design engineer must be able to demonstrate and document that there is no feasible and prudent alternative to the proposed project that will avoid the wetland impacts. The design engineer will also be required to provide an acceptable wetland mitigation plan. These steps are outlined as follows:

1. **Avoidance** - During the design phase of the project every effort must be made to avoid wetlands to the extent possible. This effort may include, but is not limited to, minimizing road widths, narrowing shoulders, adding guardrail and steepening side slopes to the extent current safety standards will allow.
2. **Minimization** - When impacts are not otherwise avoidable, steps must be taken to minimize impacts on the wetlands. Specific soil erosion and sedimentation control plans must be developed during the design stage to ensure impacts to area watercourses and wetlands are minimized. Areas disturbed during construction must be stabilized and seeded as soon as possible. Existing drainage patterns to wetlands adjoining the Right-of-Way must be maintained by providing culverts or other means of hydraulic connection.
3. **Compensatory or Replacement Mitigation** - When there is no prudent or feasible alternative to destroying regulated wetlands, state and federal regulations require compensatory mitigation. This may take the form of wetland restoration and/or creation. Project on-site opportunities for mitigation measures must be evaluated for suitability before off-site mitigation is considered. The wetland mitigation must also usually be in the same watershed and as close to the project as possible. In some cases, such as general permit projects, the mitigation may be consolidated with those of other small projects and/or credited to existing “moment-of-opportunity” wetlands. General permit projects do not need to be mitigated within the same watershed.
4. For larger or more complex projects which involve the preparation of an Environmental Impact Statement or Environmental Assessment, mitigation is generally identified during the clearance process and included in the document for approval by the resource agencies. The Design Project Manager is responsible for coordinating this with the Wetland Mitigation Specialist in the Environmental Services Section.

For categorical exclusions projects, the Design Engineer should notify the Environmental Services Section as soon as they are aware of potential wetland impacts on the project. The Permits Coordinator will then arrange for a preliminary review of the project, if necessary, with the resource agencies, and/or an in-house review with the appropriate environmental staff, including the Wetland Mitigation Specialist. When the need for wetland mitigation is suspected, it is important to notify the Permits Coordinator as soon as possible to allow enough time to locate and design an acceptable wetland mitigation site. **Note: The wetland mitigation plan must be approved by the regulatory agency before it will issue a construction permit for the project.**

10.04.03B Floodplains

The evaluation and documentation of 100 year floodplain and floodway encroachments must be provided in conjunction with the environmental classification of the project. The level of analysis required depends upon the potential impacts and risks which are associated with the proposed work. Encroachment into a floodplain, floodway, or stream is regulated and requires state and/or federal permits. To obtain a permit for floodplain or floodway encroachments, the applicant must demonstrate that the work will not cause a “harmful interference”. For more information about floodplains and floodways, based on hydraulic analysis, contact the MDOT Hydraulic Unit.

Encroachments in floodplains and floodways are often also regulated by local governments (zoning ordinances). In such instances, the Designer should contact the Hydraulic Unit - Environmental Services Section for coordination in contacting the local agency to determine their requirements. Types of projects which might involve encroachment include widening, passing lanes, realignments, slope flattening, culvert replacements, culvert extensions, bridge widening, bridge replacements, and scour countermeasures. Contact the Hydraulic Unit Supervisor with questions. (See Chapter 4 – Drainage and the MDOT Drainage Manual)

10.04.03C Inland Lakes and Streams

An inland lake or stream is defined as a body of water that has definite banks, a bed, and visible evidence of a continued flow or continued occurrence of water. Any work in an inland lake or stream below the ordinary high water mark requires state and/or federal permits and must be documented during the environmental classification process. In some instances, work within 500 feet of an inland lake and stream is also regulated. Many inland lakes and streams have special regulatory concerns that must be addressed before a permit will be issued. Designated trout streams, Natural Rivers, and Wild and Scenic Rivers may involve special design or construction requirements, such as construction restrictions for fish spawning or aesthetic improvements. In some locations, approval of the US Army Corps of Engineers or the US Coast Guard may be required. The US Army Corps of Engineers regulates watercourses near the Great Lakes and on navigable waters. Work in navigable waters of the US may also require approval from the US Coast Guard. Project types that often require an Inland Lakes and Streams permit include culvert replacements, culvert extensions, bridge replacements, pier repairs, riprap placement, stream relocation and other drainage work. Contact the Environmental Services Section with questions. Also, the Designer should contact the Hydraulic Unit Supervisor to discuss any hydraulic analysis requirements. (See Chapter 4 – Drainage and the MDOT Drainage Manual)

10.04.03D Threatened / Endangered Species

Plant or animal species which are threatened with extinction are protected by state and federal law. If any use of habitat area for a threatened or endangered plant or animal is proposed, a permit must be obtained from the appropriate regulatory agency. A typical component of the application is a mitigation plan, subject to approval by the agency, to eliminate or offset the damage to the habitat and/or the species. All project areas are surveyed to some extent for the presence of endangered or threatened plant and/or animal species or habitat that would support them.

10.04.03E Natural, Wild and Scenic Rivers

Rivers may be designated as “natural” or “wild and scenic” by either state or federal agencies. This designation greatly restricts the number and type of construction and structures allowed in the designated area.

10.04.03F Air Quality Impacts

1. **Impact** - Increase in both regional and immediate project area air pollution due to increased traffic.

   Mitigation - The CAA and 23 CFR 770 require transportation control measures (TCM) to be implemented before such a project can be approved.

2. **Impact** - Increase in carbon monoxide concentrations on adjacent residential properties due to widening of the roadway which brings the traffic flow closer to residents.

   Mitigation - Widen away from the residential areas or buy the affected properties.

10.04.03G Noise Impacts

1. **Impact** - Increase in noise due to an increase in the volume of traffic, the speed of the traffic, and/or in the number of trucks.

   Mitigation - Create buffer zones, construct barriers (noise walls or berms), planting vegetation, and installing noise insulation in buildings.

10.04.03H Hazardous Waste Sites

When potential project areas are suspected to be contaminated, the Project Manager must contact the Environmental Assessment Unit (EAU) of the Development Services Division, the Region/TSC Resource Specialist (RRS) and the Project Coordination Unit (PCU) of the Environmental Services Section. The entire project area will be examined for the presence of contaminated sites which might affect the project. If such sites are found, they will be analyzed in detail and a strategy for dealing with them in the course of the project will be developed. These sites are usually extremely expensive to clean up, and sometimes physically dangerous. Careful evaluation by specialists is required.

It is sometimes necessary to perform a physical investigation of a site which involves the collection and analysis of soil, water, groundwater, and/or other material samples. The purpose of the investigation is to determine the nature and extent of any existing contamination, determine a strategy for dealing with it, and to make an estimate of the cost of such an effort. (See Section 14.13)

10.04.03I County Drains

When it becomes evident a county drain will be affected by a project, the Project Manager should contact ***both*** the Region/TSC Drainage Coordinator and MDOT Drainage Coordinator (Hydraulic Unit - Environmental Services Section) as soon as possible. The Project Manager is also responsible for a copy of the plans (required by law under the Drain Code) at milestone reviews (Plan Review and Final Project Coordination (FPC)) to the County Drain Commissioner, Water Resources Commissioner or Drainage Board per Section 2.5.5 of the MDOT Drainage Manual.

Any project that may change the amount of storm water flow to a county drain will require a hydrologic and hydraulic design analysis. See Section 2.5.5 of the MDOT Drainage Manual for “Intracounty and Intercounty Drainage Systems for State Trunkline Stormwater”.

10.04.04 Mitigation of Impacts During Construction

(revised 4-28-2025)

10.04.04A Maintenance of Multi-Modal Traffic

Disruption of traffic in the construction area must be minimized to the extent possible. Although prevention of all construction related inconveniences is not possible, multi-modal safety will be ensured by signing of all construction areas. Access will be maintained to properties adjacent to the construction area to the maximum extent possible. Traffic will be maintained using part-width construction techniques; e.g., maintaining traffic on one half of the roadway while the other half is being reconstructed, or by use of a detour route. Consideration should also be given to maintaining pedestrian and/or non-motorized travel as needed.

10.04.04B Drainage and NPDES Runoff Controls

Drainage - All drainage within the project area must be controlled in terms of velocity and volume. No increase in discharge rate or volume of water (above the pre-existing level) leaving the site is allowed. Water velocities must be maintained at non-erosive levels to reduce the potential for off-site erosion and sedimentation. Controlling runoff velocity and volume can be accomplished using standard soil erosion and sedimentation controls. (See Section 2.05)

The Federal Water Pollution Control Act requires that on-site personnel, certified as Storm Water Operators under the National Pollutant Discharge Elimination System (NPDES) program, inspect the construction site soil erosion and sedimentation measures on a weekly basis and after storm events. Any measures which are inadequate or have failed require immediate corrective action. A written report of each inspection must be made and kept on file for every inspection. The reports must be made available to the EGLE or U.S. EPA staff upon request. (See Section 10.04.04C)

10.04.04C Soil Erosion and Sedimentation Control

The erosion and sedimentation control quantities and locations are set up on the plans for the contractor to install and maintain. Failure by the contractor to install and maintain adequate soil erosion/sedimentation controls may result in project shutdown and/or possible fines from EGLE for MDOT and the contractor. Refer to Section 2.05 for detailed information on this topic.

10.04.04D Wetland Mitigation

If wetland mitigation is being constructed with the project, a detailed design plan will be included in the project plans. A EGLE and possibly a U.S. Army Corps of Engineers permit application should be included in the project proposal. Notify the Environmental Services Section prior to the pre-construction meeting. A person will be available during construction to answer questions regarding the design of the wetland and also to inspect the initial staking and give final approval of the site. Existing wetland or vegetation to be preserved on the site must be protected with either silt fence or protective fencing when necessary.

The Roadside Development Unit in the Design Division should be contacted prior to any project tree and/or shrub plantings in order that they may provide detailed planting instructions to the contractor. The Region Resource Specialist must inspect any plant material before it is installed.

10.04.04E Deleted

Section deleted.

10.04.04F Air Quality / Pollution

1. **Impact** - Dust migration from construction traffic and wind blowing across open construction areas.

   Mitigation - Spray the access roads and the open areas with water to eliminate dry dust conditions.

2. **Impact** - Emissions from concrete and HMA batch plants.

   Mitigation - The contractor must obtain an air quality permit from EGLE prior to start up.

10.04.04G Noise Levels and Vibration

1. **Impact** - Construction noise may interfere with the social environment such as church functions, schools, etc.

   Mitigation - Construction may be limited to certain times of the day or week.

2. **Impact** - Construction vibrations may cause danger to adjacent structures.

   Mitigation - Preliminary review of adjacent structures including taking pictures for future reference. If damage has occurred during construction reparations must be made.

10.04.04H Tree Removal and Replacement

Although some tree removal may be necessary in some projects, the existing natural and ornamental vegetative cover will be maintained whenever possible. Where existing ground cover must be removed, replacement vegetation must be established in a timely manner by use of seed or mulch.

Roadside trees adjacent to residences will be preserved whenever possible. If trees must be removed from the front of a residence, the property owner must be given appropriate notice and offered replacement trees as a mitigation for the loss of the functional or aesthetic value of the trees.

The species and number of replacement trees will be determined by the Region Resource Specialist or by the Roadside Development Unit in coordination with adjacent property owners. In those cases when an owner requests replacement trees, the trees will be installed, with the owner’s concurrence, as close to the Right-of-Way line as possible. The property owner then assumes ownership and responsibility for maintaining the trees.

10.05 MISCELLANEOUS

10.05.01 Changes Affecting Environmental Clearance and Required Permits

(revised 4-28-2025)

As the design of a particular roadway improvement is developed, it is sometimes necessary, for a variety of reasons, to change the original scope / location of the project. These changes in scope will often affect the conditions under which the environmental clearance and required permit applications for the project were originally approved. Care should be taken whenever the original project scope or location is modified to ensure the environmental clearance is still valid and to make sure that new permit applications or modifications to existing permits are acquired if necessary.

Some items that require review/discussion with the Environmental Services Section including Hydraulic Unit staff to determine if environmental clearance and permits are affected are listed below.

Changes in Drainage

- Culvert extensions, size changes, or new replacements.
- Widening bridges, piers, and abutments.
- Relocating drains or streams.
- Ditch cleanouts.
- Construction access pads or roads in watercourses, lakes, or wetlands.

Other Factors

- Guardrail upgrading, including elimination and slope flattening.
- Additional ROW or Grading Permits than originally scoped including commercial or residential displacements.
- Any grading operations added to the project outside existing shoulders including commercial or residential developments.
- Addition of tree removal to the scope.
- Addition of a detour route or a change in the detour route (i.e., change location, upgrading existing roads, etc.).
- Temporary roads or ramp closures.
- Changes to project limits of change to project scope, such as a resurfacing project that becomes a reconstruction project.

If these, or any other items which are suspected to impact the existing environmental clearance and permit situation arise, the Designer should contact the Environmental Services Section.

10.05.02 Historic Bridges

MDOT has a statewide historic bridge inventory. Designation as a historic bridge offers agencies opportunities to plan preservation efforts for bridges under their jurisdiction and opens the door for additional funding assistance. To qualify a bridge must be at least 50 years old and display a unique or distinguishing feature. Examples include one-of-a-kind bridges, bridges associated with historic events, or bridges with an unusual design.

Designers should be aware that if a historic bridge is located within the project limits of a proposed road improvement project, the environmental clearance process may be impacted as historic bridges are protected by both Section 4(f) of the Department of Transportation Act, and the National Historic Preservation Act. It may be necessary to have an Environmental Assessment completed to determine the extent of any impacts the project may have on the structure. Also, if any work is proposed for the bridge itself as part of the overall project, the Designer may be required to accommodate the design features of the bridge into the design of the roadway. Contact the Environmental Services Section with questions.

10.05.03 Native Wildflower Plantings

(added 10-28-2024)

10.05.03A Federal Requirement

In accordance with 23 USC 319 (USCODE-2021-title23-xchap3-sec319.pdf (govinfo.gov)), any action taken as part of a highway construction project or as a separate action to enhance the aesthetics of a highway through the placement of plant materials consistent with a landscape design plan that receives federal aid shall have at least $^{1}/_{4}$ of 1 percent of the total cost of such landscaping pay items expended exclusively for native wildflower seeds or seedlings, or both (forbs). Native grass seeds, rushes, and sedges do not fulfill the requirement of planting forbs. Section 815.04 of the Standard Specifications for Construction includes information on approved materials, construction methods, watering, cultivation, period of establishment requirements, and pay items associated to landscaping items of work.

10.05.03B Planting Process

FHWA allows for flexibility on where the wildflower plantings occur provided the minimum spent amount in 23 USC 319 is being met. While MDOT recommends wildflower plantings be included on projects whenever feasible to encourage pollinator habitat within the Right-of-Way, it is recognized that not all federal projects are suitable for wildflower plantings due to various site constraints. However, native wildflower seed mixes should be used whenever site conditions are favorable, such as in new detention basins, wetlands, or dry upland sites outside of the clear zone that will not be mowed regularly. Project Managers should consult the Roadside Development Unit or Region Resource specialists to include wildflowers on a project and should utilize one of the MDOT special provisions that contain wildflower species. The Roadside Development Unit will be responsible for ensuring compliance with this spending amount on an annual basis.

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11.01 GENERAL INFORMATION

11.01.01 References

(revised 11-26-2018)

A. Michigan Manual of Uniform Traffic Control Devices, Current Edition

B. Standard Specifications for Construction, Current Edition

C. 23 CFR 635

D. FHWA Technical Advisory HAIM-20 March 20, 2010

E. US Government Printing Office Style Manual

11.01.02 Overview

(revised 7-27-2026)

Specifications are documents that detail directions, provisions, and requirements for the work to be performed. Specifications provide a description of the work, construction methods, materials, and the method used to measure and pay for work items. If the special provision references the plans for details, add a comment in the special provision providing a link to the plan set and the sheet number where the detail is on the plans, or place a PDF of the detail in the Special Provision-Unique folder in ProjectWise to aid in the review and approval process.

Under federal law, permanently incorporated materials must meet specific domestic preference requirements: iron and steel products, as well as manufactured products (those not consisting predominantly of iron or steel), must comply with 23 CFR 635.410. Construction materials must comply with 2 CFR 184. See section 11.01.07 Buy America Requirements.

A designer's first choice should be to utilize the Standard Specifications and pay items already established.

If a standard specification and pay item does not exist to cover the necessary item of work, the designer should look for a special provision of the types listed herein that fit the situation or require only slight modification.

If none of these sources covers the specific work, one could possibly be a starting point in developing a new special provision. As a last resort, the designer may need to write a new special provision to cover the necessary item of work.

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The Quality Assurance Section maintains the Errata version of the Standard Specifications for Construction, Supplemental Specifications, and Frequently Used, Recommended, Template, Previously Approved, and Real Estate Special Provisions on the Previously Approved Special Provision list. The Innovative Contracting Section maintains the Innovative Contracting Special Provisions on the Previously Approved Special Provision list. The ITS Programming Area maintains the ITS Special Provisions on the Previously Approved Special Provision list. These documents can be found at the MDOT web site links:

- Standard Specifications for Construction
- Supplemental Specifications
- Frequently Used Special Provisions
- Previously Approved Special Provisions - A drop down box allows you to select the following groupings:
    - Recommended.
    - Recommended Requiring the Use of De-Minimis.
    - Templates Requiring Approval.
    - Templates Requiring Approval but Require Use of De-Minimis.
    - Previously Approved.
    - Previously Approved Requiring Use of De-Minimis.
    - Real Estate Demolition.
    - Real Estate Demolition Requiring Use of De-Minimis.
    - Innovative Contracting.
    - Innovating Contracting Requiring Use of De-Minimis.
    - ITS.
    - ITS Requiring the Use of De-Minimis.

11.01.03 Definitions

The following definitions are provided:

A. Standard Specifications for Construction - The book of specifications approved for general application and repetitive use.

B. Supplemental Specifications - Detailed specifications that add to or supersede the Standard Specifications for Construction.

C. Special Provisions - Revisions and additions to the Standard and Supplemental Specifications which are applicable to an individual project and are shown on the web in the groupings listed herein.

D. Pay Item - Term used to describe an item of work in the contract.

E. Method of Measurement - The method used to measure material used or work done on a project. Measurement can be by the unit or lump sum, or included in the measurement for other items.

F. Buy America Preferences - This term refers collectively to the federal domestic sourcing laws governing this project: FHWA Buy America (23 U.S.C. 313) and the Build America, Buy America Act (BABA).

11.01.04 Order of Precedence

See subsection 104.06 of the Standard Specifications for Construction for the order of precedence if plan/proposal information differs or conflicts.

11.01.05 Roles and Responsibilities

(revised 7-27-2026)

The following definitions are provided to clarify the roles and responsibilities in relation to Special Provisions:

A. Project Manager - MDOT employee responsible for the design phase of the project, including the development and review of special provisions for compliance with the special provision guidelines Buy America Preferences, and MDOT Form 5638 prior to submitting to Quality Assurance Section for review. Documentation showing the items in the special provision meet the Buy America Preferences must be placed in the Special Provision – Unique folder in ProjectWise. The completed Form 5638 should be placed in the Special Provision – Unique folder in ProjectWise. The instructions to fill out the form are included as the second page of the form. This form is required for Construction to be able to pay the contractors when the material is incorporated into the project.

B. Special Provision Author - Designer (MDOT or consultant) as determined by the Project Manager who drafts a special provision for a project. The Project Manager is the “author” of record for special provisions drafted by consultants.

C. Special Provision Reviewer - A person(s) assigned by the Quality Assurance Section to review and provide feedback on special provisions. Assignments are based on their technical knowledge.

D. Quality Assurance Section - Oversees the special provision review and approval process. Often performs the second review with an emphasis on conflicts with the Standard Specifications for Construction; use of appropriate pay items and general organization of the information; if the special provision is ADA compliant; whether Form 5638 is included with the special provision submittal; and whether the special provision has Buy America Preference documentation. Also oversees determination of which special provisions will be placed on the various maintained lists.

11.01.06 Location of Additional Information

(revised 7-27-2026)

Additional information regarding supplemental specifications and special provisions is available on the Design Division Plan Development web site including:

- Frequently Asked Questions
- ProjectWise Unique SP Search
- Special Provision Technical Reviewers Listing
- Special Provision Training
- Special Provision Formatting Instructions
- Special Provisions using “Modified” or “Special”
- Tracking Changes Using ProjectWise and Microsoft Word for Special Provisions

11.01.07 Buy America Requirements

(revised 7-27-2026)

Federal law requires compliance with Buy America requirements for any project that uses federal dollars in any phase of the project. There are three key elements to Buy America compliance.

A. All steel or iron products and manufacturing processes must meet 23 CFR 635.410 requirements. This includes all processes such as cutting, bending, coating, etc. Items falling into this category included but are not limited to, guardrail, reinforcing steel, mast arms, steel beams, etc. MDOT is applying a risk-based approach to steel and iron products during the design phase. Therefore, designers are not required to submit documentation verifying that a product can meet Buy America Preferences prior to advertisement, provided the product is a standard pay item in the Standard Specifications for Construction or a standard structural shape.

B. Manufactured products (those not consisting predominantly of iron or steel), must comply with 23 CFR 635.410.

C. Construction materials permanently incorporated into a project must have all manufacturing processes and final assembly done within the United States. Construction materials are defined as follows.

    1. Non-ferrous metals.

    2. Plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables).

    3. Glass (including optic glass).

    4. Lumber.

5. Drywall.
6. Fiber Optic Cable (including drop cable).
7. Optical Fiber.
8. Engineered Wood.

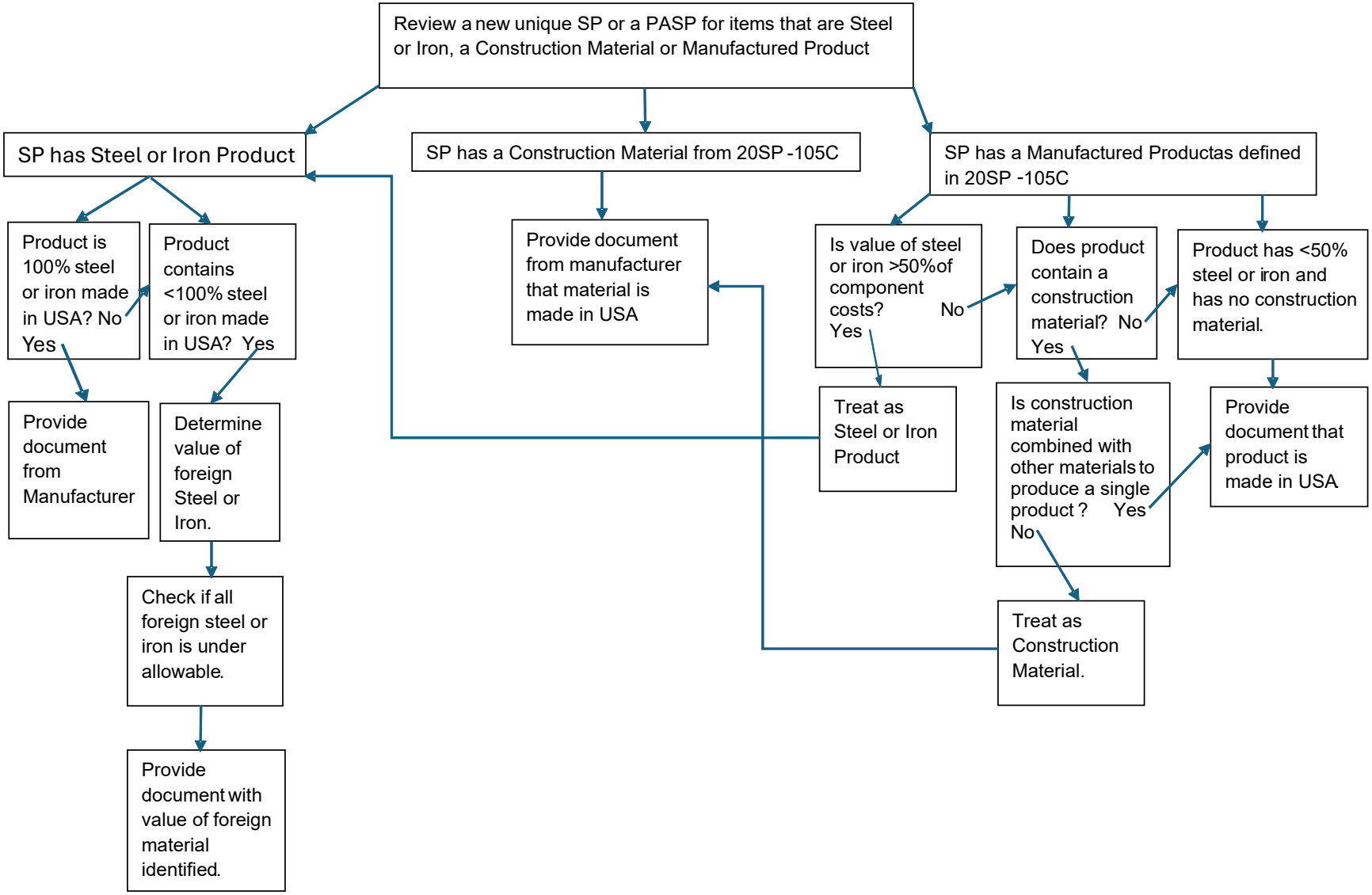
Therefore, items defined as manufactured products or construction materials that are in a special provision, need a document stating that the manufactured products and/or construction materials can meet these requirements must be placed in the Special Provision - Unique folder in ProjectWise when submitting the special provision for review in MDOT-SpecialProvision mailbox.

The Signals and ITS areas have identified some products that are non-compliant. They are sharing this information with designers, and the non-compliant materials/products must be included in the de-minimis for federal aid projects.

If specific manufactured products or construction materials are listed in a special provision by manufacturer name, a document stating that the manufactured products and/or construction materials can meet these requirements must be placed in the Special Provision – Unique folder in ProjectWise when submitting the special provision for review in MDOT–SpecialProvision mailbox.

If a project has no federal funds in any phase of the project, and will not use any federal dollars in construction, the owner (MDOT or local agency) must not add the FUSPs 105C or 105D in the proposal.

If a special provision or items in a special provision cannot meet the Buy America Preferences the cost of non-compliant products and material must be considered as part of the allowable non-compliant materials (de-minimis) covered in the 23 CFR 435.410.


Review a new unique SP or a PASP for items that are Steel or Iron, a Construction Material or Manufactured Product
SP has Steel or Iron Product
SP has a Construction Material from 20SP -105C
SP has a Manufactured Productas defined in 20SP -105C
Product is 100% steel or iron made in USA? No Yes
Product contains <100% steel or iron made in USA? Yes
Provide document from Manufacturer
Determine value of foreign Steel or Iron.
Check if all foreign steel or iron is under allowable.
Provide document with value of foreign material identified.
Provide document from manufacturer that material is made in USA
Is value of steel or iron >50%of component costs? No Yes
Does product contain a construction material? No Yes
Product has <50% steel or iron and has no construction material.
Treat as Steel or Iron Product
Is construction material combined with other materials to produce a single product ? Yes No
Provide document that product is made in USA
Treat as Construction Material.

11.01.08 De-Minimis Under Buy America

(added 7-27-2026)

Federal law allows a certain amount of non-compliant materials for steel and iron products, construction materials and manufactured products. The amounts vary depending on how the project has been evaluated under the National Environmental Policy Act (NEPA).

A. If there is only one contract under the NEPA decision.

    1. For steel or iron products or manufactured products with more than 50 percent of the cost is from steel or iron components, the de-minimis allowances are 0.1 percent of the total contract amount or $2,500.

    2. For construction materials and/or manufactured products (those not consisting predominantly of iron or steel), , and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product the de-minimis allowances are the lessor of $1,000,000 or 5 percent of the total applicable contract costs.

B. If there are more than one contract under the NEPA decision.

    1. For steel or iron products or manufactured products with more than 50 percent of the cost is from steel or iron components, the de-minimis allowances are 0.1 percent of the total contract amount or $2,500. This allowance would be the total amount for each contract under the NEPA decision.

    2. For the construction materials and the manufactured products, the de-minimis allowance will need to be prorated and separate amounts applied for each contract under the NEPA decision.

       The contract scopes will need to be reviewed for each contract to make an evaluation on how much the total de-minimis allowance will need to be used on each contract.

       The evaluation will need to factor in the length of each contract, the work type of each contract, the number of items that may need non-compliant materials or products, and the Engineers judgement.

       Once completed the evaluation will set the maximum amount for the de-minimis allowance for the construction materials and manufactured products for each contract.

       These values will need to be entered into the Special Provision for De-Minimis Calculation for Domestic Materials, Multiple Contracts Under National Environmental Policy Act Decision. Each contract will need a separate special provision unless all the allowances are equal in value.

C. To calculate the de-minimis value take the material costs of non-compliant items and divide it by the total applicable cost of all iron, steel, construction materials and manufactured products used in the contract. This value must be under the allowance values listed above. This calculation can be documented in a memorandum or excel spread sheet and placed in the project files.

D. If the article, material or supply cannot meet the Buy America Preferences including the use of de-minimis then a waiver would be required to move the project to advertisement. The waiver should be requested as early as possible during the development phase of the project as it may take a long time for it to be approved. A waiver may not be requested during the construction phase of the project.

11.02 SPECIAL PROVISIONS

11.02.01 Types of Special Provisions

(revised 7-27-2026)

Special provisions provide revisions and additions to the Standard and Supplemental Specifications which are applicable to individual projects. Use a special provision when work is required that is not covered by the Standard or Supplemental Specifications and a new pay item is needed and/or the construction method, the materials, and/or the basis of payment is revised.

The following sections describe the various Special Provision categories.

11.02.01A Frequently Used Special Provisions (FUSP)

Special provision used on a regular basis with stable requirements applicable to numerous projects. All FUSP's are reviewed and approved by MDOT and the FHWA. Approved FUSP's with multiple pay items can be used without deleting unused pay items similar to the way we use the Standard Specifications for Construction manual. FUSP's that can not meet Buy America Preferences will require a statement in the Use Statement that the FUSP work will need to be included in the allowable non-compliant material cap (de-minimis).

11.02.01B Unique Special Provisions

Special provision written specifically to cover work not covered in the Standard or Supplemental Specifications for a specific project.

11.02.01C Template Special Provisions

An approved special provision with stable requirements but with project specific information left out to be added later by the Project Manager.

These special provisions have been standardized to cover an item of work but must be modified to fit a specific project. Some of these may be used without further review and some require review using the regular special provision review and approval process. To create a template special provision, an electronic copy must be sent to the Quality Assurance Section. Designers should follow the instructions listed at the top of the template document and proceed accordingly.

11.02.01D Recommended Special Provisions

An approved special provision containing requirements thought to provide the best results for a specific type of work or construction practice.

The majority of these have been developed by reviewing duplicate special provisions approved for use over several years and selecting the best practices and incorporating them into a single special provision which is posted to the website as a portable document format (pdf) file. In order to provide continuity in the specifications for similar work and to make more efficient use of the review and approval process, designers are asked to use the recommended special provisions whenever possible. Recommended special provisions are intended to be used without revision and no further review and approval is required.

11.02.01E Previously Approved Special Provisions

Unique project specific special provision that has been reviewed and approved for use in one project yet may be used on other projects without change or as a starting point for a new special provision.

Use these documents whenever possible to reduce the variation in descriptions of work, construction and measurement and payment for similar items of work.

11.02.01F ITS Approved Special Provisions

These are special provisions developed and approved for use on Intelligent Transportation System projects. These special provisions are written and reviewed by the ITS Program Area and only reviewed for format as part of the regular review process. These special provisions are added to or removed from the list by the ITS Program Area.

11.02.01G Real Estate Demolition Special Provisions

Occasionally it is necessary to place the demolition of certain buildings or features on parcels into trunkline projects. These special provisions have been developed to make it easier for the real estate section to develop the correct special provisions and add them to the trunkline projects.

11.02.01H Innovative Contracting Special Provisions

Due to the use of innovative contracting methods which are different from our standard process certain special provisions are developed to allow designers to create the necessary special provisions or use already approved special provisions in their projects depending on the type of innovative contracting method being used. These special provisions are added to or removed from the list by the Innovative Contracting Section.

11.02.02 Special Provision Development

(revised 6-26-2023)

Designers are asked to always check for a template, recommended and/or previously approved special provision to use first. If you are not able to find one suitable on the web site, send an email to; MDOT-SpecialProvision@michigan.gov to request a search for a suitable special provision.

Many approved provisions are posted to the web in Microsoft Word (rtf) format and may be reused or revised (and in some instances **must** be revised) to include project specific details. Already approved special provisions must be reviewed carefully to make sure all requirements are applicable to the project.

If no changes are required, simply insert the approved special provision in the proposal package. Do not change the source code, approval code, or identification code.

If any change is required then the special provision must be resubmitted for review and approval. Use the track changes feature of Microsoft Word to make any revisions being sure to leave the source code, approval code and the identification code for the previously approved version, to allow the reviewer to check the original version.

It is **unacceptable** to make any changes to a document without resubmitting for review and approval.

11.02.02A Exempt Special Provisions

Due to the nature of certain special provisions, review and approval by Lansing central office staff engineers is not always a value added process. These documents are instead reviewed and approved at the Region/TSC level or as identified in the listing below. The approved format and organization of content, as described herein, **must** still be followed and the appropriate source code and approval code and approval date is required. At this time only, the following types of special provisions are exempt from the Lansing central office review and approval process:

- Maintaining Traffic, except as modified in Section 11.06.01
- Maintaining Waterways
- Intelligent Transportation System are reviewed by the ITS Program Area but should be submitted like any other special provision
- Municipal Water or Sewer System (when developed with input from the Municipal Utilities Unit of the Design Division), submit like all other Special Provisions and the Municipal Utilities Unit will ensure they have been approved
- Railroad Insurance, will be approved by the Office of Rail
- Rest Area Buildings, Pump House Buildings, and Operator House Buildings on Bascule bridges and Lift bridges will be reviewed by an as needed consultant. Submit all special provisions through ProjectWise for the project and they will be assigned to the Project Manager of the as needed consultant.

11.02.03 Page Layout

(revised 7-27-2026)

11.02.03A Document Format

The following guidelines must be followed when developing a special provision to give a uniform appearance to proposals. Special provisions submitted for review and approval that do not follow the approved document format will be returned to the submitter for reformatting before the approval process begins.

1. Margins – Use 1 inch margins.
2. Fonts - All headers use Arial 12 point, special provision text uses Arial 11 point including tables and figures.
3. Tabs and Indents - Use 0.25 inch intervals. Automated numbering or labeling of subsections must **not** be used.
4. Bold Face - The use of bold face font is limited to the special provision title, section labels and names, table and figure titles and pay items in the measurement and payment section only.
5. For formatting guidelines see the Special Provision Formatting Instructions.

11.02.03B Title Block, Headers, and Footers

1. Document (Word) Headers/Footers - On the first page the document header must contain the Identification Code (see below). Right justify the Identification Code.

   On any remaining pages the document header contains the secondary header.

   All headers and footers should begin 0.5 inches from the edge of the page.

2. Identification Code - The Identification Code naming convention shown below must be applied to all special provisions, with the exception of Special Provisions for Maintaining Traffic.

   When using a special provision that has been approved and assigned an Identification Code, the file must **not** be revised unless the special provision is resubmitted for re-approval.

   The Identification Code must be defined by the Project Manager prior to submittal for approval, to the extent possible. However, the last four digits within the parentheses are assigned by the Specification Engineer upon approval. A sample Identification code is as follows:

   20RD501(A055)

   Digits 1 and 2 designate the year of the Standard Specifications for Construction book that the special provision has been written against.

   Letters 3 and 4 designate the code for the type or origin for the special provision. Type codes are presented on the next page.

   Digits 5, 6 and 7 designate the section of the Standard Specifications for Construction book in which the work in the special provision is covered. If it can be attributed to more than one section use the one that is most closely related to the work in the special provision.

Within the parentheses is a four digit alpha-numeric code assigned by the Specification Engineer to identify the special provision as a unique document for tracking purposes.

The first digit is an Arabic letter followed by the number 005 for the first special provision by that area and increasing by 5 for each successive special provision approved for that area. These will be assigned as the Quality Assurance Section approves the special provision.

3. Title Block - The Department name and the special provision title are included in the Title Block at the top of the first page of document, but not actually in the document header as defined by Microsoft Word. Center this information on the page.

   Make the special provision title short enough to fit on one line if possible and provide a clear idea of the content and the subsection of the standard specifications being altered. If possible, make the title match the pay item affected or established by the special provision in the title. Do not use any abbreviations in the title.

   For formatting guidelines see the Special Provision Formatting Instructions

4. Approval Header - Locate below the Title Block only on the first page. Includes the source code, page number, and approval code.

5. Page Numbers - The page number must appear at the center of the page in the approval header on the first page. The total number of pages in the special provision includes any graphics, appendices or forms which are part of the document. The word “Page” should not be included when setting up page numbers.

6. Approval Code - The approval code indicates that the special provision has been reviewed and approved for use. It consists of the abbreviation APPR, the technical reviewer’s initials, and the date of approval.

   Type Codes for 3rd and 4th letters of Identification Code

   - BR - used on special provisions from Bridge Design
   - CB - used on special provisions from Crash Barrier/Geometrics
   - CF - used on special provisions from Construction Field Services
   - CO - used on special provisions from Construction Operations
   - DS - used on special provisions from Design units not included in other SP ID Codes
   - EN - used on special provisions from Environmental
   - FN - used on special provisions from Contract Services Division
   - GT - used on special provisions from Geotechnical
   - IC - used on special provisions from Innovative Contracting
   - IT - used on special provisions from ITS
   - MU - used on special provisions from Municipal Utilities
   - OF - used on special provisions from Operation Field Services
   - OR - used on special provisions from Office of Rail
   - PL - used on special provisions from Planning

- PM - used on special provisions from Pavement Markings
- RC - used on approved recommended special provisions added to the PASP list
- RD - use on special provisions from Road Design in the Regions or TSCs
- RE - used on special provisions from Real Estate
- RL – use on special provisions from Roadside Development
- SG - used on special provisions from Traffic Signals
- SI - used on special provisions from Traffic Signing
- SM - used on special provisions from Structures Management
- SP - used on FUSPs with FHWA approval
- ST – used on special provisions from Structures Technical
- TM - used on approved template special provisions

7. Secondary Header - The Secondary Header appears on every page except the first page. It includes the Identification Code, source code, page numbers and the approval date. See Section 11.02.03 B 11 for example.

8. Approval Date - Added by the Quality Assurance Section. Do not show the date the special provision was written. Only the date approved is shown in the secondary header, not the reviewers' initials.

9. Source Code - This two-part code identifies the author's location and their initials. The Project Manager is the "author" of record for special provisions drafted by consultants. There are three types of Location Codes: Business Area, Region, and Transportation Service Center (TSC). (ex: UTL:SJU). Location codes are shown on the next page.

10. Contract Numbers - Contract numbers (control section, project/job numbers, trunkline etc.) should not be shown on special provisions. The same is true for document file names and consultant firm names. In order to facilitate the re-use of the special provision in subsequent proposals, these items must not be included.

LOCATION CODES for SOURCE CODE

- Business Area
  - BRG Bridge Design
  - CFS Construction Field Services
  - COS Construction Operations Services
  - CSD Contract Services Division
  - DES Design Units
  - ENV Environmental
  - GCB Geometrics/Crash Barriers
  - GEO Geotechnical Section
  - HYD Hydraulics
  - ICS Innovative Contracting Section
  - ITS Intelligent Transportation Systems
  - OFS Operations Field Services
  - PMK Pavement Markings

    - PPD Project Planning
    - RAL Office of Rail
    - RED Real Estate
    - RSD Roadside Development
    - SGN Traffic Signs
    - SIG Traffic Signals
    - STM Structures Management
    - STR Structures Technical
    - UTL Municipal Utilities
- Region
    - BAY Bay
    - GR Grand
    - MET Metro
    - NOR North
    - SWR Southwest
    - SUP Superior
    - UNIV University
- TSC
    - ALP Alpena
    - BCY Bay City
    - BRI Brighton
    - CAD Cadillac
    - COL Coloma
    - CRF Crystal Falls
    - DAV Davison
    - DET Detroit
    - ESC Escanaba
    - GND Grand Rapids
    - GLD Gaylord
    - ISH Ishpeming
    - JAK Jackson
    - KZO Kalamazoo
    - LAN Lansing
    - MAR Marshall
    - MAC Macomb
    - MTP Mt. Pleasant
    - MUS Muskegon
    - NEW Newberry
    - OAK Oakland
    - TAY Taylor
    - TRV Traverse City

11. Examples - The following are examples of what the first page of a special provision should look like and what the second page should like when the proper information has been placed in the correct location as they are submitted for review.

First page example:

20RD404()
Identification Code

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
UNDERDRAIN AND UNDERDRAIN OUTLET VIDEO

(Location:Author)	1 of #	APPR:XXX:YYY:00-00-00
Source Code	*Page*	*Approval Code*

Second page example:

20RD404()
Identification Code

(Location:Author)	2 of #	00-00-00
Source Code	*Page*	*Approval Date*

11.02.04 Tables and Figures

(revised 7-27-2026)

Minimize the use of tables and especially figures (graphics) in a special provision. Include figures only if they are absolutely necessary to present information not conveyed in the text. All figures must be in Microsoft Word compatible format, preferably jpeg. Examples are shown below.

Reference all tables or figures in the text. Follow the table format in the standard specifications. All tables must have a table number and a title which clearly describes the content, placed above the table. All graphics must have a figure number placed below the graphic. Figures may be enclosed by a single line border. With both tables and figures alternate text must be added for the visually impaired.

Center tables and figures horizontally on the page and separate them from the text by several lines. (See the examples below) In the case of large tables or multiple tables it is advisable to place the table(s) at the end of the document. Figures are generally placed at the end of the document.

Number and Title all Tables (Example: Table 1: Sample Table)

Use a Header Row that Will Continue on Subsequent Page(s) for Multiple Page Tables	Use Initial Caps in Column Headers	Indicate Units for Table Values, °F
Use Initial Caps in Row Labels		
Use only single line borders		
Use lower case letters for all footnotes. (a) Use parentheses around each footnote letter in the body of the table. (b)(c)		Do not separate with comma. (d)(e)
Do not use tables if the information can be presented in text format.		

a. Include all footnotes in the last row of the table not outside the table. Do not use parentheses around footnote letters here. Use hard left indent to wrap text to indent point.
b. Refer to standard specifications for examples of table footnote format.

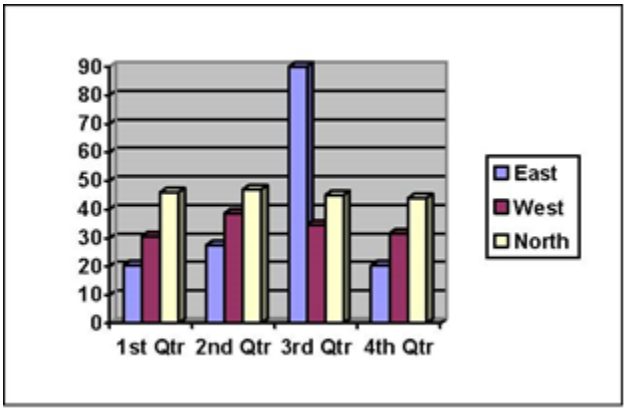


Figure 1: Traffic Count by Direction

11.02.05 Special Provision Naming Convention

(revised 7-27-2026)

The following file naming convention must be used for all unique special provisions submitted for review. Special provisions not using the file naming convention will be returned to the Project Manager for correction and resubmittal.

The only exception to this naming convention will be for template and recommended special provisions since they use a separate a naming convention that is similar but includes additional information.

Each file name must begin with the exact title of the special provision in Title Case (Initial capitalization and lower case for prepositions, articles, and conjunctions) followed by a dash, and then the Identification Code (less the four digits after the hyphen).

The Specification Engineer will enter the remaining four digits within the parentheses, but the Project Manager should enter the first seven digits.

For example: if the special provision is titled “Water Main, Ductile Iron, [Insert Size] Inch, Trench Detail [Insert Type], Special” and is being turned in by the municipal utilities design unit, the special provision file name would be “Water Main, Ductile Iron, [Insert Size] Inch, Trench Detail [Insert Type], Special-12DS823().docx”.

Note that abbreviations are not to be used in special provision titles, even the standard abbreviations that we use in the pay items cannot be used when developing the special provision title.

If a special provision is returned unapproved for use after being submitted for review, the filename must be revised to include “rev1” or as appropriate “rev2”, etc. The following is an example of a special provision filename for a document that was resubmitted. The revised file name would be “Water Main, Ductile Iron, [Insert Size] Inch, Trench Detail [Insert Type], Special-12DS823()rev1.docx”.

11.03 SPECIAL PROVISION WRITING STYLE

11.03.01 General

A successful specification is clear and brief. Information that is not essential to the directions and commitments that will be a part of the contract only increases the potential for differing interpretation of the specification in the field. The author's intent should not be left open to interpretation.

Use short sentences with simple, direct language. Continuous restatements that the "Contractor shall ....." and "the work shall consist of..." do not provide needed information. Avoid repetition. If the original statement of the requirements seems vague or unclear, restating the requirement will likely worsen the problem. Instead, rethink the requirement and reword the sentence or subsection.

The primary goal is clear communication of what is required of the Contractor and how the completed results will be measured and accepted by the Department. Do not include a requirement if it cannot be verified. All terminology should be defined, particularly terms that are part of the required work responsibility of the Contractor or those that have a bearing on the quality of the work or its measurement.

11.03.02 Active Voice

Use active voice by putting the verb first in sentences, when possible. Active voice is preferred to directly state directions and procedures and matches the active voice used in the Standard Specifications for Construction.

Often a much shorter sentence results from using active voice. The word “shall” is passive and is replaced with the active word “must”. The following examples illustrate how the usual (passive voice) language of past specifications can be changed by using active voice grammar and minor editing.

- **Passive:** The gravel shall be placed and shaped by power equipment to the specified lines, grades, cross-sections, and depths, without segregation. (21 words)

  Active: Place and shape gravel to the specified dimensions without segregation, using power equipment. (13 words)

- **Passive:** A mechanical broom or sweeper shall be provided which is adjustable to uniform contact with the surface and designed to thoroughly clean without cutting into the surface being swept. (29 words)

  Active: Provide a mechanical broom or sweeper that can be adjusted to uniform surface contact and does not cut into the surface. (21 words)

- **Passive:** Concrete shall be thoroughly consolidated against the faces of all forms and joints, including concrete in a previously constructed lane of pavement, by means of vibrators inserted in the concrete. (30 words)

  Active: Consolidate fresh concrete against all form faces, joints, and previously constructed pavement using insertion type vibrators. (16 words)

11.03.03 Abbreviations, Units, Acronyms and Capitalization

The US Government Printing Office Style Manual is generally followed for rules of capitalization and compounding.

- Abbreviations - Do not use abbreviations except in the pay items. Then only use those abbreviations that are shown in the Pay Item Code Book.
- Units - Spell out primary units such as inch or foot in the body of the text. In the text, the use of acronyms for long compound units, such as “pounds per square inch” (psi), is permitted. Abbreviations, acronyms or symbols are acceptable in tables and figures.
- Acronyms - The Standard Specifications for Construction book provides a list of acronyms in section 101.02 that may be used throughout a special provision with the exception of the title and the pay item description. Other acronyms may be used if necessary, but the author must write out the full wording first then then show the acronym following it in parentheses. Thereafter just the acronym may be used.
- Capitalization - Minimize the use of capital letters. Capitalize Engineer, Contractor and Department whenever they appear in the document. Capitalize Standard Specifications for Construction only if you cite a section number. Use standard specifications when not citing a section number.

11.03.04 Common Phrases

Several common phrases have been adopted for use in MDOT SPs as a result of the move to the active voice writing style.

- **Passive:** The Contractor shall [details of work] at no additional cost to the Department.
- **Active:** [Details of work]. All costs associated with this work will be borne by the Contractor.
- **Passive:** Materials shall be in accordance with...
- **Active:** Provide materials in accordance with …
- **Passive:** Payment for [Item Name] shall be considered to include...
- **Active:** [Item Name] includes

11.03.05 Citing Specifications and Standards

(revised 11-26-2018)

MDOT Standard Specifications for Construction - Do not capitalize “section” and “subsection”, when used in references to the Standard Specifications for Construction book. When the reference to the Standard Specifications for Construction book is not specific to a section, subsection, table, etc., the reference should simply be to “the standard specifications” (all lower case). Example: “Use materials in accordance with the standard specifications”.

MDOT Standard Plans and Special Details - To ensure that the most current version is applied, do not include the letter designation of standard plans. For example, refer to Standard Plan R-128 Series. The term “series” includes any subsequent interim special details for the named standard. All other special details not in the standard plan series are included in and considered part of the project plans.

MDOT Frequently Used Special Provisions – To minimize the reapproval of special provisions when referring to a FUSP call out the identification and the title without including the revision number. For example, 12SP105A - Source of Steel and Iron (Buy America).

AASHTO, ASTM and Michigan Test Methods - If it is not covered by section 101.02, the full title of the specification should be listed.

Michigan Public Acts - Cite by the <YEAR>PA<Act No.> followed by section/part number and name if necessary. Example: 1994 PA 451, Part 91, Soil Erosion and Sedimentation Control.

Code of Federal Regulations - Cite using the title, part and section number. Example: 23 CFR 623.1 refers to title 23, part 623, section 1.

Italics - Use italics for names of publications other than MDOT's standard specifications. For example, Standard Specifications for Construction is not shown in italics but *AWS Bridge Welding Code* is italicized.

11.04 ORGANIZING THE SPECIAL PROVISION

11.04.01 Four-Part Document Outline

(revised 5-26-2015)

Use the standard four-part outline to establish a uniform approach to providing needed information, describing the work to be performed and identifying the responsibilities of the Contractor and the Department. Provide an organized logical progression of instructions. Each section should progress from general administrative information to specific technical instructions.

Divide the subsections for clarity using the outlining convention shown below. Only use bullets as shown below or when listing a group of items, as included in a plan submittal or similar listing.

a. Description.
b. Materials.
c. Construction.
1. Arabic number followed by a period
A. Uppercase letter followed by a period
(1) Arabic number in parentheses - no period
(a) Lowercase letter in parentheses - no period
(i) Lowercase Roman numeral in parentheses - no period
1) Arabic number with single parentheses - no period
a) Lowercase letter with single parentheses - no period
- Bullet - solid dot only

d. Measurement and Payment.

Use subheadings only when their use adds to the clarity of the text. When listing only one or two items or clauses in text that does not include complex subheadings, it is appropriate to use bullets or indents in place of subheadings. Remember that contractual requirements are interpreted based on subsection numbering and indentation.

Although the materials and construction sections might not always apply, do not omit them. The special provision should show all four parts and state "None specified." when appropriate. For example, a special provision for Clearing, Modified would have information for the description, construction, and measurement and payment part. If there are no materials requirements, state:

b. Materials. None specified.

Special provision content will dictate when this standard four-part outline needs to be modified. For example, test methods and basis of acceptance may be subheadings in Materials and equipment may be a subheading of Construction.

11.04.02 The Description Section

(revised 3-23-2020)

Make a concise statement of the work to be done and a general statement concerning compliance with plans and standard specifications. Establish the relationship of this special provision to the contract, items of work or other construction phases. For complex specifications, include definitions or terminology in this section as appropriate.

Completely describe the scope of work covered. For example, do not wait until the measurement and payment section to state that furnishing, placing and compacting backfill is included in the work of removing a culvert. However, do not elaborate on materials and construction methods in this section.

Do not cite the current standard specification year. This is covered by the proposal cover and the title sheet of the plans, both of which state the specification year under which the project is to be constructed. It is also in the Identification Code.

Likewise, manuals, test methods or standard specifications published by AASHTO, ASTM, etc. which are included by reference in the standard specifications or in the special provision, should also not include the publication edition year. Subsection 101.01 of the Standard Specifications for Construction also indicates that these references refer to the most current edition of the referenced publication (including interim publications) as of the advertised date. For example, a proper citation would be; "... in accordance with the ASTM D1784 ..." or "... in accordance with ASTM D1754/D1754M ..." The reference should be listed exactly as shown on the ASTM portal without the year.

Standard or specifications that have been discontinued by the organization who created them cannot be cited in MDOT special provisions.

11.04.03 The Material Section

(revised 11-26-2018)

List all materials that are used in the work specified. If listing specific products or manufacturers in this section, a minimum of two products or manufacturers must be listed and must include the phrase "or approved equal". If three or more products or manufacturers are listed, the phrase "or approved equal" is not required. If there are no materials, then state "None specified". Define materials with a reference to the standard specifications when possible. State all changes, additions or deletions to material requirements covered by the standard specifications.

If the materials required are covered by the standard specifications, either state that all materials must be in accordance with the standard specifications or list the pertinent material name and section of the book. When standard materials are used in non-standard applications, list any changes from the standard basis of acceptance.

When specifying non-standard materials, state the underlying material specification (AASHTO, ASTM, MTM, etc.) and basis of acceptance for all materials not covered by the Standard Specifications for Construction. AASHTO specifications should be used instead of ASTM standards whenever possible.

State the sampling, testing requirements, and basis of acceptance for all materials not covered by the standard specifications. State if the materials must be tested, certified, or otherwise accepted, and the documentation required as well as the responsible party.

Standard or specifications that have been discontinued by the organization who created them cannot be cited in MDOT special provisions.

See Section 11.08 for further information if the material is proprietary.

11.04.04 The Construction Section

This section will usually be the most detailed and may need subsections such as: General Requirements, Documentation Required, and Equipment.

Avoid writing method specifications. Concentrate instead on the required end product. Detail the sequence of events to be followed in completing the item of work or fulfilling the special provision requirements. If no actual construction work is added as in the case of a materials SP, include a general statement to this effect.

Avoid ambiguous phrases such as "to the fullest extent possible." If the requirement cannot be measured or is not measured against a standard, the use of adjectives and other word modifiers will not change the meaning. For instance, what is the difference between "thorough consolidation" and "consolidation" of concrete? The judgment made would be whether or not the concrete has been consolidated.

If the cost for repairing, removing, replacing or otherwise making whole an item, will be borne by the Contractor, state it in this section.

This section should include such things as a discussion of tolerances if a component needs to be fabricated. A discussion of unique issues such as cure time and limitations. If the contractor is responsible for design work, it should be described in this section. Discuss such things as: needs to be accounted for, required design codes, design criteria, who to submit the design to, if working drawings are required, whether Engineer approval is required for plans or drawings, and if the design needs to be sealed by a Professional Engineer.

11.04.05 The Measurement and Payment Section

(revised 2-22-2022)

This section is used to establish any new pay items that will be used to pay for the work required, and state how the work required will be paid for.

Explain how each pay item will be measured if it is not apparent from the description of work and the pay unit. For example, “…along the centerline shown on the plans, from the top of the wall to the top of the footing…”.

List pay items using the exact AASHTO Preconstruction wording and using the established abbreviations (see Pay Item Code Book). Follow the standard specification format of noun, adjective, modifier for all new pay items. See example at the bottom of this page. See Section 11.05 for further discussion on pay items names and the use of *Modified* and *Special* with existing pay items.

If no new pay items were created and existing pay items will be used, it is not necessary to include a listing of pay items and pay units. Include a general statement such as "This work will be measured and paid for as specified in subsection ###.04 of the Standard Specifications for Construction."

Exceptions to this rule include instances when Department or a third party will furnish equipment, labor or materials to be used or installed by the contractor or if a unique piece of equipment or specific skilled labor (example: licensed electrician, certified pesticide applicator) is required to complete the work.

Include the statement that "The completed work, as described, will be measured and paid for at the contract unit price using the following pay item(s)". When all significant aspects of the work have been included in the description section, and all acceptance requirements have been explained in the materials and construction sections, this statement eliminates the need to restate what is included in each pay item in the measurement and payment section. If a detailed pay item description is needed, include it after the list of pay items.

Do not state that “Payment for [item] includes all labor, equipment and materials required to complete the work as described.” This fact is covered by every Proposal cover sheet: "The undersigned hereby proposes to furnish all necessary machinery, tools, apparatus, and other means of construction, do all the work, furnish all the materials except as otherwise specified and... to complete the work ... in strict conformity with the requirements of the [year] Standard Specifications for Construction..." and by the definition of "work" in subsection 101.03 of the Standard Specifications for Construction: "Work. The furnishing of all labor, materials, equipment, and other items necessary to complete the project in accordance with the contract. This includes all alterations, amendments or extensions thereto, made by work order or other written orders of the Engineer."

If the special provision has more than one pay item, ensure the document outline from subsection 11.04.01 is used.

Pay Items	**Pay Unit**
1st pay item name	1st pay unit
2nd pay item name	2nd pay unit
Conc, Reinf, 12 inch	Square Yard
Conc, Nonreinf, 12 inch, Spec	Square Yard

11.04.06 Appendices

If a special provision includes an appendix, the page numbering continues through to the end of the appendix. Do not number the appendix separately. Section numbers in the appendix may be changed to A.1, A.2; B.1, B.2, etc.

11.04.07 Sample Special Provision

SP Identification Code: 20RD403(B510)

MICHIGAN
DEPARTMENT OF TRANSPORTATION

Special Provision Title Block

SPECAIL PROVISION
FOR
POLYURETHANE FOAM, DRAINAGE STRUCTURES

Source Code

Approval Code

Approval Header: CFS:DMG

Page Number: 1 of 3

APPR:ARB:RWS:02-25-22

a. Description. This work consists of furnishing, surface preparation and installing a spray applied rigid closed-cell polyurethane foam (SPF) to rehabilitate drainage structures or catch basins at the locations shown on the plans or as directed by the Engineer.

Section Title

b. Materials.

Subsections

1. References. Ensure the work is in accordance with the following Standard Test Methods:

- *ASTM C273/C273M.* Shear Properties of Sandwich Core Materials
- *ASTM D1621.* Compressive Properties of Rigid Cellular Plastics
- *ASTM D1622.* Apparent Density of Rigid Cellular Plastics
- *ASTM D1623.* Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
- *ASTM D2842.* Water Absorption of Rigid Cellular Plastics

2. Geotechnical Polyurethane Systems are hydro-insensitive two component isocyanate (A) and polyol (B), closed cell, rigid polyurethane foam designed for concrete raising/lifting/leveling, surface rehabilitation, void filling, and cavity filling. Ensure the SPF is in accordance with the following physical requirements:

- *ASTM D1622.* Core Density, 6 to 8 pcf
- *ASTM D6226.* Closed Cell Content, ≥ 94 percent
- *ASTM D1623.* Tensile Strength, 400 psi, minimum
- *ASTM D1621.* Compressive Strength, 130 to 180 psi
- *ASTM D2842.* Water Absorption, ≤ 0.03 psf
- Maximum Service Temperature. 180 °F

3. Furnish substrate primer as recommended by the SPF manufacturer.

4. Quality Assurance. The Contractor must have completed repairs on at least 50 drainage structures using SPF with no failure of the system for at least 3 years. The Contractor must provide contact information from past projects upon request by the Engineer.

5. Delivery, storage, and handling.

A. Deliver materials in manufacturer's original containers clearly labelled with manufacturer's name, product identification, safety information, net weight of contents and expiration date.

B. Store the materials in accordance with the manufacturer's guidelines and in a manner that will not damage or otherwise impact the performance of the SPF.

1 inch border around text

C. Remove empty containers from the site daily and dispose of properly.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with federal, state, and local requirements.

6. Manufacturers. Furnish materials from one of the following manufacturers or an approved equal:

A. NCFI Polyurethanes, Mount Airy, NC, 27030, www.ncfi.com (800) 346-8229

B. SWD Urethane, Mesa, AZ, 85210, www.swdurethane.com (800) 828-1394

c. Construction.

1. Submittals. Submit manufacturer's data sheets on each product to be used, including the following:

A. Technical data sheets and samples as required.

B. General certification in accordance with the *MQAP Manual*.

C. Preparation instructions and recommendations.

D. Storage and handling requirements and recommendations.

E. Installation methods.

2. Project Conditions.

A. Protect adjacent surfaces, equipment, and site areas from damage of overspray. Refer to *Alliance for the Polyurethanes Industry (API) Bulletin AX–119, MDI-Based Polyurethane Foam Systems: Guidelines for Safe Handling and Disposal*.

B. Refer to appropriate Material Safety Data Sheets (MSDS) for safety information.

C. Protect workers in accordance with *OSHA 29 CFR Part 1926 Safety and Health Regulations for Construction* and the manufacturer's recommendations.

D. Ensure proper disposal of waste materials and containers is conducted in accordance with manufacturer's guidelines and federal, state, and local requirements.

3. Preparation.

A. Properly prepare substrates prior to installation. Process the SPF components isocyanate (A) and polyol (B) in accordance with the manufacturer's instructions. Notify the Engineer of any unsatisfactory preparation.

B. Prepare surfaces as recommended by the manufacturer.

C. Maintain appropriate environmental conditions (temperature, humidity, ventilation,

etc.) within limits recommended by manufacturer.

4. Application.

A. Verify to the Engineer on a daily basis using calibrated certified flow meters that each pumping unit is accurately measuring and recording the amount of SPF being used.

B. Ensure the SPF covers the entire internal circumference of the drainage structure or catch basin from the top of the chimney to a depth of 3 feet. Additional depth if necessary, will be paid for separately as detailed herein.

C. Apply the SPF in at least 1/2 inch thick passes with the overall final thickness to be at least 1 inch. Complete the application of the full thickness of SPF within any given area within 1 work day or less.

D. Ensure coverage is uniform to the specified depth.

E. Ensure the filling of voids on the outside of the drainage structure is approved by the Engineer and will be paid for separately as detailed herein.

F. For void filling operations protect installed SPF until the area has been covered with backfill material.

G. Install drainage structure covers upon completion of the SPF application before moving to the next location.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	**Pay Unit**
Polyurethane Foam, Dr Structures	Each
Polyurethane Foam, Dr Structures, Add Depth	Foot
Polyurethane Foam, External Void Fill	Pound

1. **Polyurethane Foam, Dr Structures** includes preparation of the surface of a structure, furnishing and applying polyurethane foam for the depth of 3 feet below final pavement grade as described.

2. **Polyurethane Foam, Dr Structures, Add Depth** includes preparation of the surface of a structure, furnishing and applying polyurethane foam the additional depth beyond 3 feet below final pavement grade. Measurement for payment will be made to the nearest 6 inches.

3. **Polyurethane Foam, External Void Fill** includes preparation of the surface, furnishing and applying polyurethane foam to completely fill voids around the exterior of the structure and/or under the adjacent concrete slab.

11.05 PAY ITEM NAMES

11.05.01 General

(revised 8-23-2021)

The pay item code book contains a list of all "standard" pay items. These are pay items that have been given a specific pay item number and usually receive frequent use in projects. All pay items covered by the Standard Specifications for Construction book in the measurement and payment subsections will be given standard pay item numbers. Many of these contain blanks that cover many pay items that have similar names and only differ in one or more dimension/requirement. The subject matter experts for each of these subsections must fill out Form 2797 to provide a list of items to be given standard numbers when the pay item contains a blank. Other similar items not normally used often are not given a standard pay item number. For example, the pay item Bearing, Elastomeric, 5/8 inch does not have a standard pay item number. A 7000 number should be used for this pay item, but a special provision is not required because the pay item in the Standard Specifications for Construction has the item listed as Bearing, Elastomeric, [Insert Size] inch. As long as all requirements of the standard specifications still apply, and the pay item is not “Modified” or “Spec”, no special provision is required. Also, Frequently Used Special Provision (FUSP) pay items will be given a standard pay item. If the FUSP pay item contains a blank the author must fill out Form 2797 to provide a list of pay items that need a standard pay item created. The Form 2797 needs to be sent to the Preconstruction-Admin@Michigan.gov resource so standard pay item numbers can be added to the list.

11.05.02 Pay Item Modifiers

(revised 6-29-2020)

11.05.02A Modified Pay Items

If the special provision is needed to cover a standard pay item whose dimensions have been changed to match existing conditions (example: curb and gutter) the pay item is ", Modified".

If the special provision is to require or allow an alternate material for a standard pay item (example: Aggregate Base with a non-standard gradation) the pay item title is ", Modified".

11.05.02B Special Pay Items

If the special provision changes the basis of payment of a standard pay item (example: square yard instead of cubic yard or lump sum instead of each) the pay item is ", Spec".

If the special provision requires or allows an alternate construction method (example: adjusting drainage structures by breaking down the existing structure and then rebuilding it) the pay item is ", Spec".

Note: If the special provision is both modified and special, add *Spec* to the pay item. MDOT uses “, Spec” because Special has a standard abbreviation in the Pay Item Code Book.

11.05.02C Other Pay Item Modifiers

No other pay item modifiers can be used in pay items unless approved by the Quality Assurance Section prior to being used.

11.05.03 New Pay Item

(revised 6-29-2020)

If the special provision is needed to cover an item of work that is not even remotely covered in the standard specs (example: lane rental) use a new pay item.

New pay items in unique special provisions that have no direct connection to a standard pay item do not need to use the pay item modifiers “Modified” or “Spec”.

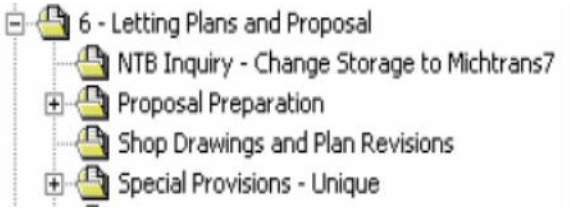
11.06 SPECIAL PROVISION APPROVAL PROCEDURE

11.06.01 Overview

(revised 12-27-2022)

All unique special provisions, except those listed as being exempt previously in Section 11.02.02A, that are part of the proposal must have approval of the Quality Assurance Section. The Project Manager is required to submit all unique special provisions, even those written by consultants, to the Quality Assurance Section at least 6 weeks prior to the plan completion date. Drafts of unique special provisions must be available for review and discussion at the Plan Review meeting.

The approval process is electronic and uses ProjectWise to route files, reviewers' comments and approvals. Special provisions must be in Microsoft Word format and must be located in ProjectWise in the "Special Provisions - Unique" folder under the "6-Letting Plans and Proposal" folder for the project it applies to. For more details or assistance with using ProjectWise, contact appropriate support staff for your office.



An overview of the approval procedure is shown on the next page.

The Quality Assurance Section will return special provisions not meeting the defined voice, outline, format or Buy America. Returned special provisions will be sent to the Project Manager for revisions. These documents will need to be resubmitted before the review and approval process can begin. See Section 11.02.05 for how to rename a special provision file name when it is resubmitted.

Project Managers are encouraged to use special provisions available on the Previously Approved Special Provisions (PASP) web page whenever possible. If any changes are made to the approved document, it must be saved with a new filename. When submitting a revised (previously approved) special provision the track changes features of Microsoft Word must be used to delineate the changes made to the original document. This will substantially expedite the approval process.

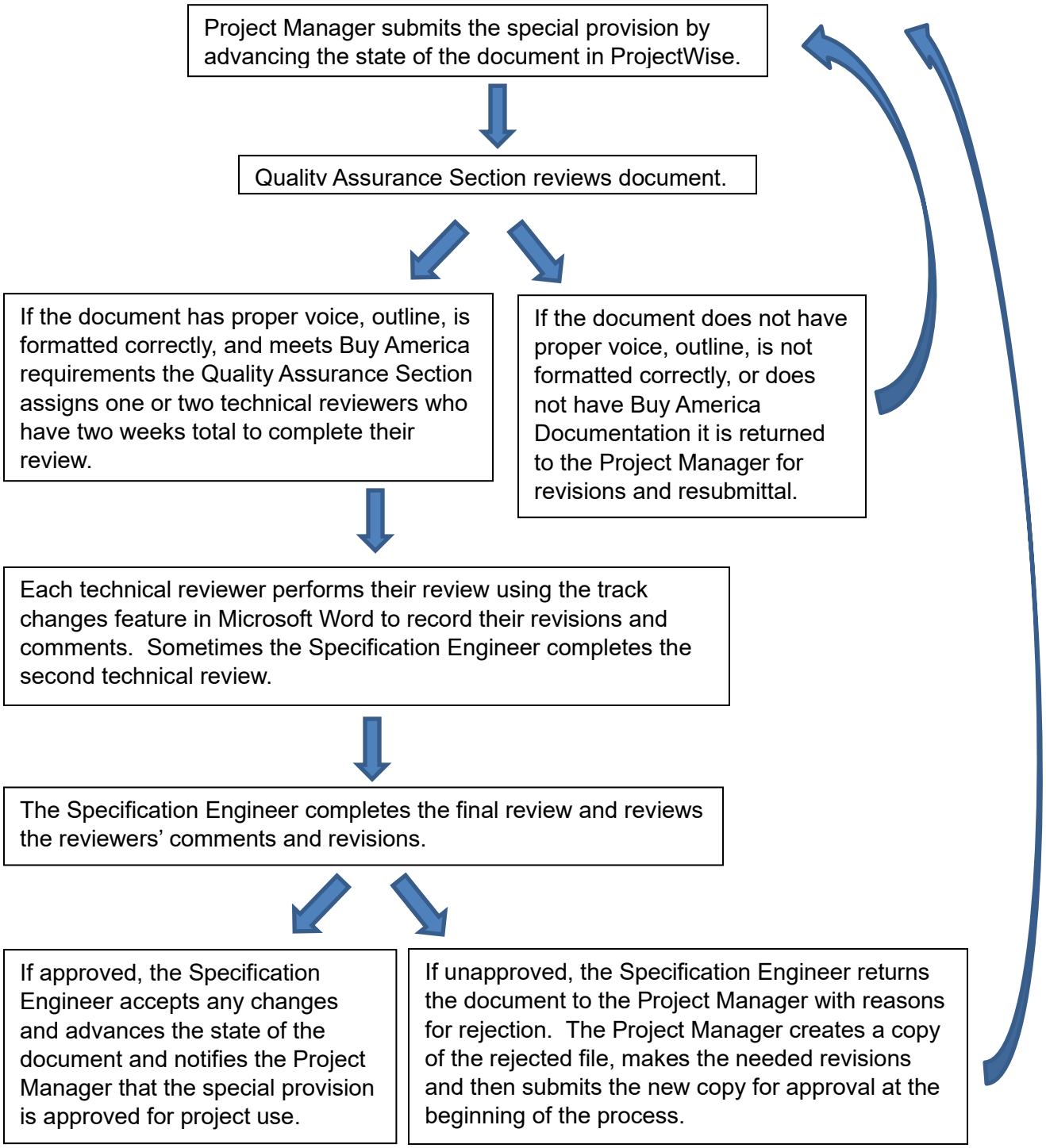
If there are special circumstances such as tight project deadlines, or related special provisions that should be reviewed together, provide this information as a comment within the Word document when submitting the documents for review. Be sure to include the name of the individual that has provided preliminary reviews if it is appropriate to have this person assigned to review the final special provision.

Unique special provisions must be approved prior to advertisement. When a project is submitted to the Specifications and Estimates Unit for advertisement with unapproved unique special provisions, the Project Manager must complete Form 2908 Special Provision - Exception Risk Analysis, including approval by the appropriate Region Engineer. Although minimal use is encouraged, this form does allow for exceptions for multiple unique special provisions. Unique special provisions for Liquidated Damages for Other Department Costs, Incentives, Lane Rental, Calendar Days of Contract Time for Opening to Traffic, and special provisions rejected during review are not eligible for the use of Form 2908 Special Provision - Exception Risk Analysis.

Unique special provisions for Liquidated Damages for Other Department Costs, Incentives, Lane Rental, and Calendar Days of Contract Time for Opening to Traffic also require the submittal of the final version of the Progress Clause and the Special Provision for Maintaining Traffic to be used for information required to approve the listed special provisions.

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UNIQUE SPECIAL PROVISION APPROVAL PROCEDURE



All Frequently Used Special Provisions (FUSPs) and all non-job related special provisions must be approved prior to being placed in a proposal just like all unique special provisions. All FUSPs must meet the requirements contained in Sections 11.02.01A, 11.09.03, and 11.10 as well as the formatting, voice and outlining requirements for unique special provisions. All non-job related special provisions must meet the formatting, voice and outlining requirements for unique special provisions.

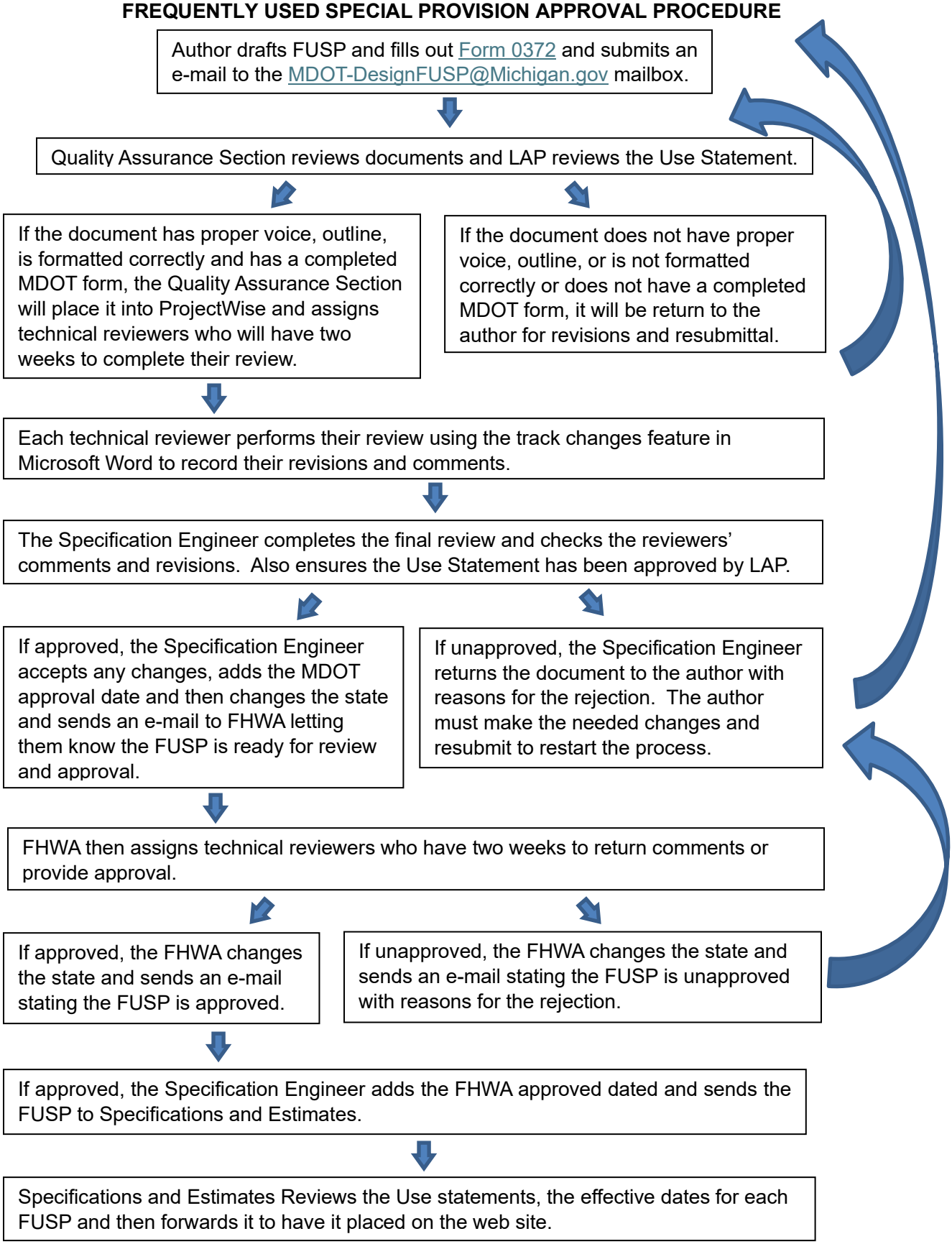
All Frequently Used Special Provisions and all non-job related special provisions should be sent by e-mail to the MDOT-DesignFUSP@Michigan.gov mail box. This e-mail should include two attachments for each special provision. The Microsoft Word file using Microsoft Word version 2016 (.docx) and the appropriate MDOT Form (Form 0372 – FUSP Request Form or Form 0373 – Non- Job Related SP Request Form) filled out by the requestor. If this information is not submitted or complete the entire package will be returned without being placed into the review process. Proper justification will be needed for FUSPs to be processed outside the annual review period as specified in Section 11.10.

Once a properly completed FUSP request is received it will be placed into ProjectWise where it will be reviewed and approved following the procedure outlined on the next page.

Once a properly completed non-job related special provision request is received it will be placed into ProjectWise where it will be reviewed and approved following the same procedure used to review unique special provisions found on the previous page.

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FREQUENTLY USED SPECIAL PROVISION APPROVAL PROCEDURE



11.06.02 Assigning Reviewers

(revised 11-26-2018)

The Quality Assurance Section assigns one, two or more technical reviewers and assigns a due date giving the reviewers two weeks total to complete their review. The reviewers are assigned by advancing the ProjectWise state of the document which sends an email to the technical reviewers notifying them there is a special provision for them to review and giving them the location in ProjectWise.

The second technical review is sometimes completed by the Specification Engineer with an emphasis on conflicts with the Standard Specifications for Construction; use of appropriate pay items and general organization of the information.

11.06.03 Reviewing the Document

(revised 6-29-2020)

Special provisions are reviewed for technical content, organization, and conflict with other specifications. The technical review is assigned to the staff person in that specialty area or to the Engineer with region responsibility for where the project is located.

Technical reviews ensure statewide alignment as well as validate technical content. They focus on constructability issues and clarity of the description of work, construction requirements and method of payment. All references to other testing or standard sources should also be checked. All revisions or comments will be made in the document using the Track Changes feature of Microsoft Word.

If the technical reviewer has questions or comments, they must place these in the ProjectWise file. Technical reviewers should then change the state when their review is completed. The QA/QC Program Analyst will follow up with the Project Manager/Author to ensure all technical comments have been addressed. The QA/QC Program Analyst will then obtain final approval from each technical reviewer after comments have been addressed.

Both technical reviews must occur within the allotted two-week time period. Each reviewer indicates approval or rejection of the special provision and advances the state of the document which generates an automated email to the Quality Assurance Section that their review is complete.

11.06.04 Preserving the Track Changes

(revised 11-26-2018)

Once both technical reviews are complete, the Specification Engineer will convert the reviewed document to portable document format (pdf) with the Track Changes information preserved and place the portable document format (pdf) file in the Changes subfolder of the Special Provisions – Unique folder. Project Managers are encouraged to share this information with consultants who may have prepared the document on behalf of MDOT to keep them informed.

11.06.05 Document Rejection

(revised 11-23-2020)

If the special provision does not have Buy America Documentation or if one or both of the reviewers or the Quality Assurance Section recommend rejection of the special provision, the Quality Assurance Section will return the document to the Project Manager with revisions and comments shown using Track Changes. An email to the Project Manager is generated advising of the need to revise and resubmit the document. The Project Manager must make a copy and revise the document as necessary and then resubmit it following the normal procedure.

The original submitted document showing changes and comments is retained for reference with the state reflected as SP Draft – Rejected - RESUBMIT.

Special Provisions that are in the state SP Draft – Rejected – RESUBMIT are not allowed to be placed in a proposal using Form 2908 Special Provision - Exception Risk Analysis.

Special provisions will be placed into the SP Draft - Rejected - RESUBMIT state when an already reviewed and approved special provision assigned a SP ID Code is modified prior to advertisement. The approved special provision will be updated to have a REJECTED watermark added to the text and the file name is modified to include the word Rejected at the end of the file name. The ProjectWise state is then changed to SP Draft - Rejected - RESUBMIT. If this rejected special provision needs to be used it must be copied out and revised using track changes and submitted for review and approval following the normal special provision process.

11.06.06 Document Approval

When the reviewers and the Specification Engineer have approved the special provision, the Specification Engineer reviews any comments and accepts changes in the document. The Specification Engineer then finishes the Identification Code, adds the approval code and returns the document to the ProjectWise “Special Provision - Unique” folder. Advancing the document state in ProjectWise will generate an email to the Project Manager advising that the special provision is approved for project use.

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11.07 SPECIAL PROVISION REVIEW CHECKLIST

(revised 7-27-2026)

Prior to submitting a special provision to the Quality Assurance Section for review and approval, the MDOT Project Manager must review it. The following checklist has been developed to assist the MDOT Project Manager in their review. It is also recommended for use by the document's authors and reviewers. Emphasis is placed on using the correct format and the appropriateness of the special provision for the specific project.

OVERALL CHECKLIST

YES	NO	N/A	Question/Item (Road Design Manual section)
			Do sections/subsections in the Standard Specifications for Construction exist that cover the work fully, or approximately needing minor modifications?
			Is there an existing special provision that covers this work or one that would need minor editing? Use an existing document when available.
			Are the margins correct? Use 1 inch margins. (Section 11.02.03 A 1)
			Are the fonts and text sizes correct? All headers use Arial 12 point, special provision text uses Arial 11 point, and table and figures use Arial 10 point? (Section 11.02.03 A 2)
			Are the tabs and indents correct? Use 0.25 inch intervals. Automated number or labeling should not be used. (Section 11.02.03 A 3)
			Is use of bold face correct? Limit to the special provision title, section labels & names, table & figure titles and pay items. (Section 11.02.03 A 4)
			Are the headers and the title block correct? (Section 11.02.03 B)
			Are digits 1 thru 7 of the Identification code entered correctly? Quality Assurance Section will enter the 4 digits in parenthesis. (Section 11.02.03 B 2)
			Is page numbering correct? (Section 11.02.03 B 5)
			Are tables and figures, if needed, formatted correctly? (Section 11.02.04)
			Is active voice used? (Section 11.03.02 and 11.03.04)
			Are words such as: may, could, and should used properly in the special provision? "Weak" words should be eliminated.
			Are proper abbreviations, acronyms and capitalization used? (Section 11.03.03)
			Are publications other than the Standard Specifications for Construction cited correctly and italicized? (Section 11.03.05)
			Is the basic 4 part outline used, with more complex special provisions including subheadings such as Design, Fabrication, Submittals, or Equipment? (Section 11.04)
			Does the text go from general to specific in a logical manner? (Section 11.04.01)
			Is verbiage directly from the Standard Specifications for Construction repeated in the special provision? **If yes, it needs to be eliminated**.
			Are the details and text in the special provision enforceable and reasonable for the contractor to satisfy?

			Is there enough information for a Contractor to formulate a reasonable bid?
			Is the text written in a manner that provides strict direction to the Contractor, not the Engineer?
			Did supporting documentation accompany the more complex special provision such as plans, industry specifications, etc. that are needed for a review to be performed in a reasonable amount of time?

DESCRIPTION SECTION CHECKLIST

YES	NO	N/A	Question/Item (Road Design Manual section)
			Is a clear, concise description of the scope of work to be done by the Contractor given? (Section 11.04.02)
			Is a general statement concerning compliance with plans and standard specifications given? (Section 11.04.02)
			Is the current "spec book" year cited? **It should not be**. Subsection 101.01 of the Standard Specifications for Construction states that the most recent version is intended unless otherwise specified. Likewise for other MDOT, AASHTO, ASTM, etc. publications. (Section 11.04.02)
			If definitions for terminology are needed, are they provided in this section? (Section 11.04.02)

MATERIALS SECTION CHECKLIST

YES	NO	N/A	Question/Item (Road Design Manual section)
			Are all materials that are used in the work specified? If there are no materials, is "None specified." stated? (Section 11.04.03)
			Are materials defined with a reference to the Standard Specifications for Construction where possible? (Section 11.04.03)
			Are references to the Standard Specifications for Construction, AASHTO, ASTMs, and other standards referenced correctly? (Section 11.04.03)
			Are AASHTO specifications referenced instead of ASTM standards whenever possible? (Section 11.04.03)
			Is the basis of acceptance for all materials included, if not using materials covered by the Standard Specifications for Construction? (Section 11.04.03)
			Is it clear who is responsible for sampling and testing "non-spec book" materials if the basis of acceptance is a test? (Section 11.04.03)
			Is the material Proprietary? Has public interest certification or finding approval been obtained? (Section 11.08)

MICHIGAN DESIGN MANUAL
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CONSTRUCTION SECTION CHECKLIST

YES	NO	N/A	Question/Item (Road Design Manual section)
			Is this section written with a focus on the end product versus being written as a method specification? (Section 11.04.04)
			Does the text follow the actual sequence of events? (Section 11.04.04)
			Is this section of the special provision the most detailed part? Are there subheadings such as General Requirements, Equipment, etc. used as necessary? (Section 11.04.04)
			If components need to be fabricated, is there discussion of tolerances?
			Are any unique issues (cure times, limitations, etc.) discussed?
			If the cost for repairing, removing, replacing or otherwise making whole an item will be borne by the Contractor, is it stated? (Section 11.04.04)
			If the Contractor is responsible for performing a design, is there adequate discussion of:
			A. what needs to be accounted for in the design?
			B. the design codes that are required to be satisfied?
			C. design criteria, such as allowable stresses and deflections?
			D. when and to whom the design must be submitted? "…to the Engineer for review and approval [Insert days] calendar days/work days prior to construction. And if "days" are used, are they "work days" or calendar days"?
			E. Are working drawings also required? If so, are the requirements for the working drawings fully described?
			F. Does the design need to be sealed by a Professional Engineer, licensed in the State of Michigan, and is this stated?

MEASUREMENT AND PAYMENT SECTION

YES	NO	N/A	Question/Item (Road Design Manual section)
			Is the statement: "The completed work, as described, will be measured and paid for at the contract unit price using the following pay item(s)" included? (Section 11.04.05)
			Do not state that "Payment for [item] includes all labor, equipment and materials required to complete the work as described." (Section 11.04.05)
			Does the text define how the work will be measured "… along the centerline shown on the plans, from the top of the wall to the top of the footing…"? (Section 11.04.05)
			Does the text define what is and is not included in the pay items? (Section 11.04.05)
			Are pay items listed using exact Preconstruction wording? Or do new pay items use MDOT nomenclature and abbreviations? (Section 11.04.05)
			Are "Modified" and "Special" on pay items used properly? (Section 11.05)

11.08 PROPRIETARY ITEMS

(revised 6-29-2020)

Materials and processes included in the Standard Specifications for Construction are selected to provide both quality and competitive bidding for construction projects. Designers are cautioned against writing special provisions that are tailored to fit products or processes that are exclusive to single source suppliers or manufacturers, whether the exclusive product or source is specifically named in the special provision or not, except as permitted herein. The restraint of free competition is prohibited by both federal and state regulations.

Use of patented or proprietary material, specifications, or processes in plans and specifications for projects is permitted only under the conditions described in this section. Otherwise, materials and processes identified in the Standard Specifications for Constructions must be used.

11.08.01 Competitive Bidding

Proprietary items may be purchased through competitive bidding with at least one equally suitable unpatented item or when two or more proprietary products are bid against each other and the specification or special provision includes the phrase “or approved equal”. The phrase would not be required when three or more proprietary items are competitively bid.

11.08.02 Proprietary Item Certification (PIC)

Proprietary items can also be permitted by certification (Form 0304) that the patented or proprietary product is essential for synchronization with the existing highway facility or that no equally suitable alternate exists.

Synchronization is based on;

- Function – The product is necessary for satisfactory operation of the existing facility, or
- Aesthetics – The product is necessary to match the visual appearance of the existing facility, or
- Logistics – The product is interchangeable with maintenance inventory, or
- Any combination of the above.

11.08.03 Experimental Application

Patented or proprietary items may be approved for research purposes or for a distinctive type of construction for experimental purposes. In addition to Form 0304, requests for experimental use require a work plan outlining objectives, measurements and evaluations. Experimental status justifications should be subsequent to a recommendation for pilot implementation via the Evaluation of New Materials and Products process (MDOT Guidance Document 10031). All submittals from manufacturers seeking evaluations will be processed through the New Products Evaluation webpage to allow a single source submittal process. The Project Manager should consult with the appropriate subject matter experts for guidance on the suitability of the product or process for pilot use. Resource contacts can be found either in the Special Provision Technical Reviewers Listing in the Plan Development SharePoint site or the Employee Contact – Area of Responsibilities list on the Construction Field Services site.

11.08.04 Public Interest Finding (PIF)

A specific material or product may be specified even when other acceptable materials or products are available if the specific choice is approved as being in the public interest. Form 0304 is required to document that use of the proprietary product would be in the public's best interest despite the availability of equally suitable products. Public interest findings include limited situations other than those previously listed. Examples include; timeliness of product availability, engineering or economic analysis findings, project logistical concerns, unique safety performance as well as other justifiable situations.

11.08.05 MDOT Supplied Products

When the Department purchases proprietary products under separate contract and subsequently supplies them to a contractor for project use, competitive bidding or a proprietary item request is required. Examples include items obtained by blanket purchase order, purchase of steel beams or other specialized materials requiring separate advanced purchase. Although uncommon, these purchases may be required for synchronization, project timeliness, logistics, etc.

11.08.06 Blanket Approval

Certification and Public Interest Findings for use in multiple projects (Corridor, region-wide, statewide) must include a sunset date at which time it may be resubmitted for extension.

11.08.07 Procedure

Proprietary Item Certification (PIC) and Public Interest Finding (PIF) are both requested by using MDOT Form 0304.

- Examples of supporting justification include;
- Description of how the product will benefit the public.
- Unique needs that result in the absence of equally suitable alternatives.
- Safety locations that would justify higher standards.
- Evaluation of potential products and reasons why alternatives do not meet the project needs.
- Estimate of additional costs incurred as a result of the proprietary product.

The approval authority for requests to specify proprietary items is listed below.

Proprietary Product Approval Authority

Basis for Request	Project Application	Approval
Synchronization or No Equally Suitable Alternative	Proprietary Item Certification (PIC) MDOT and Local Agency	Retain Certification for Project File Only with Project Manager signature.
Experimental *Justification must include an experimental work plan.*	MDOT	MDOT Engineer of Design
Experimental *Justification must include an experimental work plan.*	Local Agency	MDOT LAP Engineer
Public Interest Finding (PIF)	MDOT	MDOT Engineer of Design
Public Interest Finding (PIF)	Local Agency	MDOT LAP Engineer

11.09 GUIDELINES FOR FHWA APPROVAL OF SPECIFICATIONS

11.09.01 Standard Specifications

The Federal Highway Administration (FHWA) will be represented on committees established to review and revise the Standard Specifications for Construction. New versions are sent in their entirety to FHWA for approval prior to publishing.

11.09.02 Supplemental Specifications

Supplemental Specifications are issued by the Specification Engineer. These specifications require a rigid review procedure which includes reviews by MDOT experts and experts from the industry. After this thorough review, FHWA approval is requested. After receiving FHWA approval, the Supplemental Specification can be used in all applicable projects. When a supplemental specification is developed or when a frequently used specification is proposed to be elevated to supplemental status, MDOT, industry associations and FHWA are provided a 60-day review and comment period. All comments returned from reviewers are considered by the composer and Specification Engineer prior to implementation of the supplemental specification.

11.09.03 Frequently Used Special Provisions (FUSP)

The FUSP process includes a 10 business day FHWA review period with follow up, and approval is required prior to inclusion on the FUSP list. This list is maintained through the Design Supplemental Specifications and Special Provisions Package Creation System. The use statement which provides guidance on when the FUSP is to be used will also be reviewed by FHWA. Reviewers may work directly with the specification composer to resolve questions or concerns or may coordinate these comments through the Specification Engineer.

11.09.04 Developmental Special Provisions

(revised 11-26-2018)

Most routine or project specific special provisions developed for a specific project will not require FHWA approval. However, there are certain specifications for which approval has not been delegated to MDOT.

These special provisions are generally developed by committees with input from industry and FHWA representatives. This FHWA input will form the basis for eventual approval of the special provisions as either project specific or FUSPs and the Quality Assurance Section will be notified of this approval.

If FHWA has not participated in the development of these special provisions, they will go through the same review and approval process as described for FUSPs prior to being used on NHS projects. If required, this review will be coordinated through the Specification Engineer.

Developmental specifications are used to implement unique, innovative or experimental contracting or construction methods and have included warranty specifications and acceptance (QA) specifications.

11.10 ANNUAL REVIEW OF FREQUENTLY USED SPECIAL PROVISIONS

(revised 11-26-2018)

Any special provisions recommended for frequently used status will be submitted to the MDOT-DesignFUSP@Michigan.gov mailbox. A completed Form 0372 recommending adoption as a FUSP and criteria for use must accompany the new special provision. The Specification Engineer will discuss the recommendations with the appropriate technical reviewers and Quality Assurance Section managers. If approved, the special provision will be added to the FUSP list. FUSPs should be established or revised prior to July of each year in order to be incorporated into projects for the following construction season. The Design Division's Quality Assurance Section will coordinate all requests for additions or revisions to the FUSP list.

Only those changes necessitated by Department policy changes, health and safety issues, regulatory changes or documented materials or construction defects will be made to FUSP during the first two quarters of the fiscal year. Under no circumstances will addendums be issued to projects after advertising in order to insert a revised FUSP for any but these reasons.

NOTE: Contact the FUSP author and provide justification for the modification to receive approval to modify a FUSP and create a unique special provision to be used in lieu of using the FUSP. Notify the Specification Engineer that approval for the revision has been received from the author before submitting a project specific special provision in lieu of the FUSP.

11.11 CHANGES TO SUPPLEMENTAL SPECIFICATIONS

(revised 11-26-2018)

Changes to supplemental specifications are sometimes required to fit specific project conditions. If this is necessary, the supplemental specification should be rewritten as a project specific special provision. This procedure will maintain the integrity of the supplemental specification.

For any modification that changes the status of the specification from a supplemental to a special provision, remove the source code, approval code and the supplemental specification identification code and add source code of the composer responsible for the changes.

In the case of a modification to a supplemental specification, the Specification Engineer and originating composer must confer to establish an understanding of the modification.

When submitting a modified supplemental specification for review and approval, the document must be transmitted electronically in Microsoft Word format with the changes clearly identified. All changes must be made using the track changes feature of Microsoft Word. Once the changes are completed it must be submitted using the normal procedure for review and approval of unique special provisions.

Any major change in a standard contract item or a work feature, method, or practice should be sent out for industry notification well in advance of implementation. This should be accomplished by transmitting a notification of change along with the new special provision and signature by the Bureau of Development Director. This will alert the industry of the change and our reasons for the change before they are actually asked to bid on the new item. In the past, contractors have faced major changes in a letting with no prior information. This often resulted in material or construction problems. The only exception to this notification procedure is for specifications developed jointly with industry, such as is often done in their regular joint MDOT/Industry meetings.

CHAPTER 12 • MISCELLANEOUS ROADS

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Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

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12.14 TRUCK TRAPS

12.14.01 Purpose and Description

12.14.02 Design Details

CHAPTER 12 • MISCELLANEOUS ROADS

12.01 SERVICE ROADS

12.01.01 General

A service road is defined as "a roadway adjacent to and generally parallel to a limited-access road, expressway, freeway, parkway, or through street, that is designed to intercept, collect, and distribute traffic desiring to cross, enter, or leave such a facility and to furnish access to property that otherwise would be isolated as a result of controlled-access features." Since the through highway, usually an expressway, definitely forms a cross-traffic barrier, it is necessary to provide outlets where the existing facilities will be served by the through highway. These service roads are either continuous roads, or non-continuous header streets to avoid dead-ending residential streets. The service road is often designed as a one-way thoroughfare when serving as a ramp to a street connection.

12.01.02 Local Jurisdiction

(revised 12-15-1997)

Because service roads will eventually be under the jurisdiction of the local agency, the local agency must be afforded the opportunity for input during the planning, design, and construction stages. Generally, service road standards will not be lower than the local agencies' own standards, which can be ascertained or verified through the Local Agencies Unit or by contacting the local agency directly.

12.01.03 Design Speed

(revised 12-15-1997)

The Department is usually reluctant to assign a design speed to a service road for two reasons:

1. Geometry and available sight distances often control rather than a predetermined speed capability.
2. The service road alignment may contain flat curves and therefore be engineered for a comparatively high speed, except for the possibility of an unavoidable geometric feature such as a sharp curve concentric with the curvature of an interchange ramp.

Urban service roads will usually be designed using the same criteria as used for city streets and for the character of traffic that they will serve. One extreme might be a simple connection between two severed streets in a residential area, where a speed greater than 45 mph would be difficult to achieve in a one-block area. The opposite extreme might be a service road functioning as an arterial street with a posted speed of perhaps 45 mph.

Because most urban service roads are located in congested areas, the development along the roadside will often become the controlling factor in determining design speed, as opposed to curvature and roadway alignment or sight distance. Conversely, a rural service road design speed is likely to be controlled by the horizontal curvature since vertical sight distance can usually be obtained at an acceptable cost.

12.01.04 Design Considerations

(revised 12-22-2011)

The criteria for designing service roads is usually the same for trunklines with comparable trunkline traffic volumes, except for some low-volume service roads, there are no comparable trunklines. Some criteria specifically applicable to service roads are:

A. Clear vision ROW. is rarely acquired for a service road connection to another local road. In some instances, limited access ROW. will be acquired for high-volume service roads in urban areas.

B. Access gates in the limited access fence should swing toward the expressway. Adequate stops should be provided to prevent the gate from swinging into the service road.

C. It is desirable that rural service roads intersecting a crossroad in an interchange area be located at least 300 feet from ramp terminals. Service road intersections closer than 300 feet increase the potential for turning movement conflicts and driver confusion.

D. The typical cross section width for a 30-foot concrete service road should specify one longitudinal pavement joint located at the centerline. See Section 6.04.07B(1) for concrete pavement design applicable to service roads.

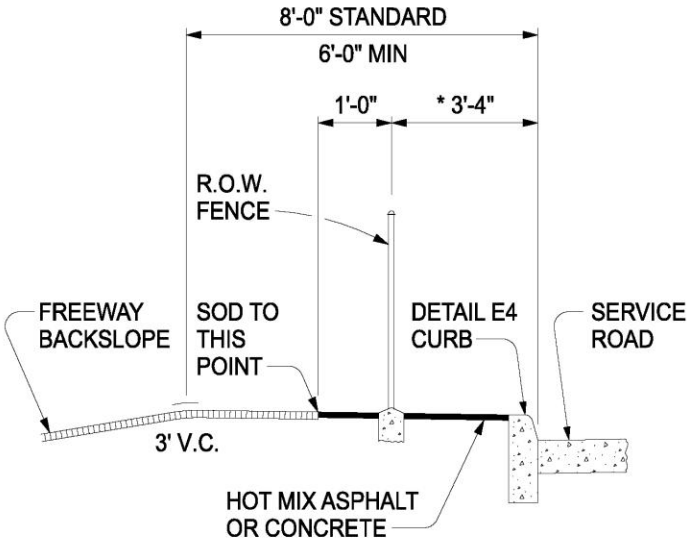
E. See Section 5.14.03 to Monument ROW. limits on service roads.

12.01.05 Detroit Metropolitan Area

(revised 12-15-1997)

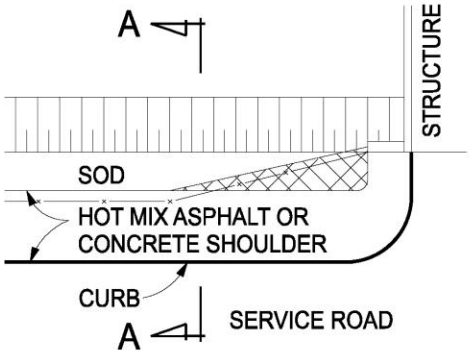
See sketches showing surfacing between the service road curb and the ROW. fence for freeway projects in the Detroit Metropolitan area. The cross-hatched area shown in the Plan View should be graded so that the fence is at or near shoulder elevation. When this area is less than approximately 50 square yards, the entire area should be surfaced. When this area is larger than 50 square yards, place a 2-foot wide strip of surfacing only under the fence.

The City of Detroit prefers a monolithic concrete curb rather than separate curb and gutter.



* USE 4'-6" WHERE THE SEWER IS UNDER SERVICE ROAD SHOULDER AND IN CERTAIN OTHER DESIGNATED AREAS TO BE DETERMINED DURING THE DESIGN PHASE.

SECTION A-A



PLAN VIEW

12.02 LOCAL ROADS AND STREETS

12.02.01 References

(revised 11-28-2022)

A. Geometric Design Guide GEO-640 Series, "Turned-in Roadways"

B. Geometric Design Guide GEO-650 Series, "Flares and Intersection Details"

C. "Act 51, P.A. of 1951, As Amended, a Part of Michigan Highway Law"

D. ***A Policy on Geometric Design of Highways and Streets***, AASHTO, 2018 7th Edition

E. Standard Plan R-30-Series, “Concrete Curb and Concrete Curb & Gutter”

12.02.02 General

(revised 12-15-1997)

The design of local roads and streets, as with service roads (Section 12.01) and turnbacks (Section 12.03), should be compatible with the design standards of the local agency having jurisdiction. While some counties and cities have design standards equal to trunkline standards, others do not. Usually, a county's primary road standards will be higher than its secondary road standards. The agency's standards can be determined by direct contact or by checking with the Local Agencies Unit.

The Local Agencies Unit maintains up-to-date maps of all counties, cities, and villages. In addition, it has individual maps showing all roads certified by the local agency as part of the basis for Michigan Transportation Fund distribution. The city and village maps are authoritative for determining corporate limits.

Whenever a portion of a local road must be reconstructed as part of a trunkline project, the Department does not assume temporary jurisdiction. It is therefore unnecessary to return jurisdiction on completion of the construction. (An exception is when a local road may be taken over as a temporary trunkline where freeway construction ends.)

12.02.03 Intersection Approaches

(revised 12-15-1997)

Where a trunkline resurfacing project and a local road intersect, the Region/TSC Traffic and Safety Engineer will designate an Approach Treatment Detail I, II, or III, from Geometric Design Guide GEO-650 Series.

Approach Treatment Detail I is a "minimum" treatment. It is intended for use only when it is requested by the Region/TSC (therefore it should not be set up initially on preliminary plans). It is applicable at an unimproved gravel road or a limited use sand trail. The paved apron is widened to one paver-width and is intended to reduce the incidence of gravel and sand tracking and washing onto the trunkline pavement.

The Approach Treatment Detail II is a "minimum paved approach" and uses limited arcs without curb and gutter. Approach Treatment Detail II is intended for improved, maintained local roads where it is felt that Approach Treatment Detail III is not warranted. It should be noted that the 30-foot radius is designed for the wheel path of a single unit commercial vehicle. It fits a turning

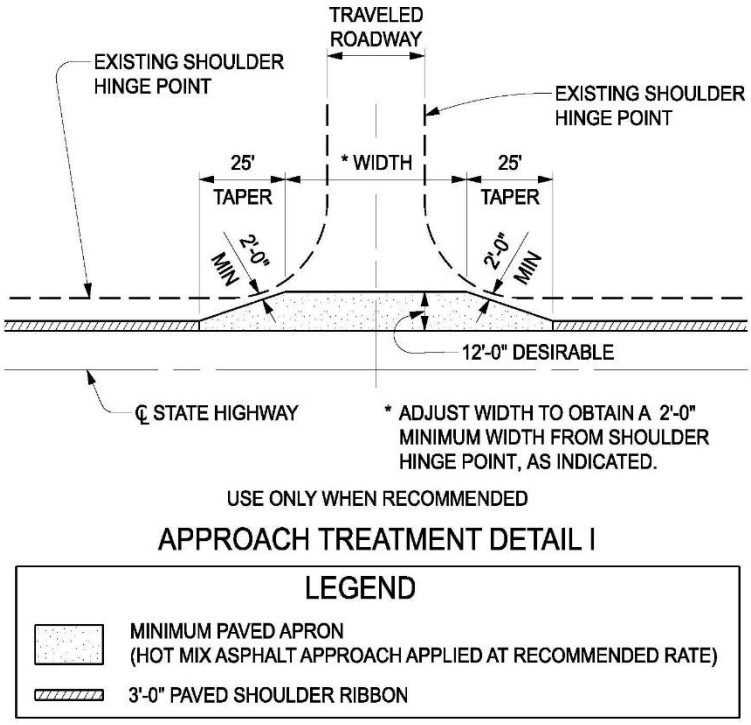
school bus if the bus encroaches beyond the crossroad centerline.

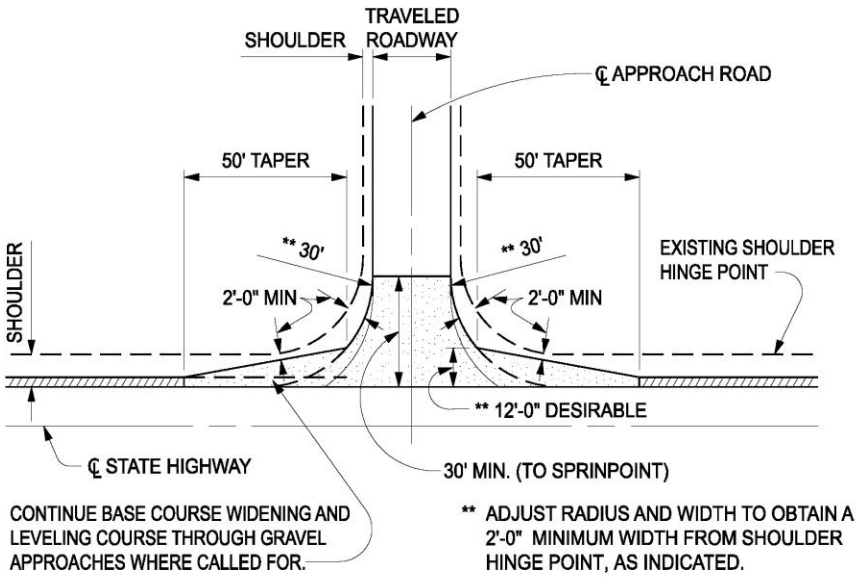
The Approach Treatment Detail III is generally used on federal aid primary and secondary roads that intersect a trunkline and includes arcs of Roll Curb & Gutter, Detail B, to help delineate the local road opening. See Standard Plan R-30-Series.

When Approach Treatment Detail III is called for, use Curb & Gutter, Detail B1 for rigid approach road pavements, and Curb & Gutter, Detail B2 for flexible approach road pavements. See Standard Plan R-30-Series.

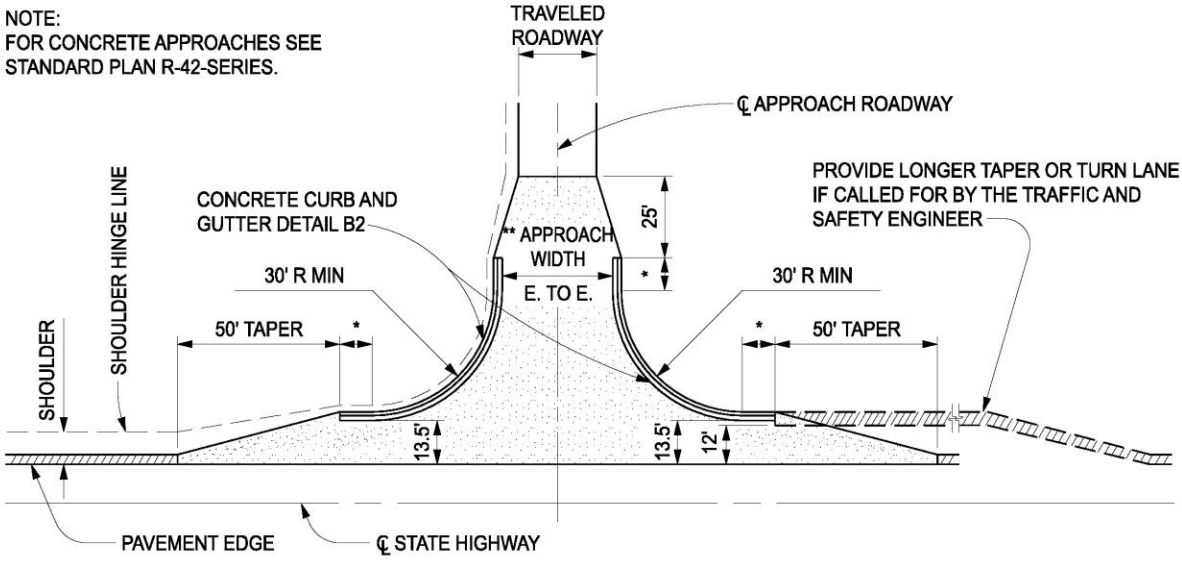
The local road names are to be shown:

1. On the title sheet map.
2. On the plan sheet just below the border, above the plan view of the intersection.





APPROACH TREATMENT DETAIL II



* 10' CURB ENDING, SEE STANDARD PLAN R-30-SERIES.

** 30' MIN OR AS RECOMMENDED BY LOCAL JURISDICTION OR TRAFFIC AND SAFETY DIVISION.

APPROACH TREATMENT DETAIL III

LEGEND

MINIMUM PAVED APRON
(HOT MIX ASPHALT APPROACH APPLIED AT RECOMMENDED RATE)

3'-0" PAVED SHOULDER RIBBON

12.02.04 City of Detroit

(revised 12-15-1997)

The following guidelines should be considered applicable to city streets and service roads in the City of Detroit.

12.02.04A Sodding

Slopes should be sodded, not seeded. Use Class A or B Sod depending on side conditions; i.e., residences, commercial areas, etc.

12.02.04B Grades

The desirable minimum grade across bridges is 0.6%. Alley grades, between the curb and the sidewalk, may vary from 2% minimum to 12.5% (+) maximum.

12.02.04C Temporary Roads

Use 8-inch thick concrete pavement, nonreinforced, if the temporary road will carry more than minimal traffic. Temporary concrete barrier, guardrail or curb should be placed between the temporary road and a sidewalk.

12.02.04D Sidewalks

The standard sidewalk width is 6 ft.-0 in. When utility poles are in sidewalk areas, the plans should include ½-inch expansion fiber for placing around the utility poles and, in addition, that the poles be centered in a 30-inch square of sidewalk also surrounded by ½-inch expansion fiber.

12.02.04E Curb Returns

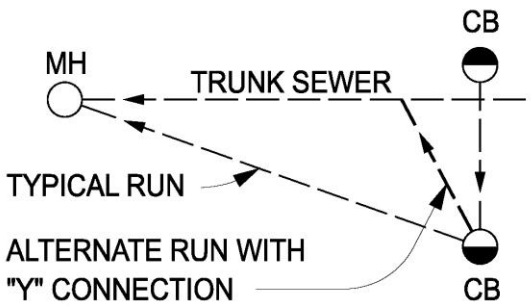
The standard city curb radius is 20 feet at returns. The property corner should be a minimum of 10 feet from the face of the curb at returns.

12.02.04F Utilities

In order to allow more room for utilities, eccentric (straight on the outside) catch basin corbels should be used.

The Detroit Water & Sewerage Department does not want less than 3 ft.-0 in. separating a water main from another utility, except for a 1 ft.-0 in. clearance at manholes.

The City will allow "Y" connections to sewers, without a manhole, if it means avoiding a long typical run as shown below:



12.02.04G Alleys

Alleys are to be constructed of 8-inch thick nonreinforced concrete pavement.

12.02.04H SCANDI

The acronym SCANDI is derived from "Surveillance, Control, and Information." The system, which is operational but not complete as envisioned, consists of wires and sensors buried in the freeway. Any project that involves a freeway in Detroit should be examined for its possible impact on the SCANDI system. Metro Region/TSC Traffic and Safety can advise Design as to whether or not the SCANDI system is involved in the proposed project limits. As part of a normal Region/TSC plan review, SCANDI personnel will participate, as appropriate.

Whenever SCANDI facilities are affected by a proposed project, a special provision is required to warn the contractor of their responsibilities. This write-up is usually furnished by the Metro Region/TSC to ensure the latest information is provided.

Additionally, the following note should be shown on plan sheets showing SCANDI facilities:

> Warning: The SCANDI project employs extensive cabling on Detroit freeways. The contractor will be held responsible for repair expenses. See General Plan Notes for notification procedure.

There is a companion "General Plan Note" entitled, "Underground Cables Warning."

For general information, the SCANDI system currently involves the following Detroit freeway segments:

1. I-94 (Ford Freeway) from the west city limits of Detroit to the northeast city limits
2. US-10 (Lodge) from 8 Mile Road to Cobo Hall
3. I-75 (Chrysler) from Wilkins Street (just north of I-94) south including I-375
4. I-75 from the Chrysler to the Jeffries

12.03 TURNBACKS

12.03.01 References

A. Department Regulation 2520.02, "State Trunkline Jurisdiction Transfer"

B. Bureau of Highways Operating Instruction, "Turnback Review Committee"

C. Bureau of Highways Operating Instruction, "Lump Sum Payment on Turnbacks" (see Section 12.03.04)

12.03.02 General

(revised 12-15-1997)

When it is determined that a road presently under state jurisdiction does not serve the function of a trunkline, it is the policy of the Department to effect its transfer to local jurisdiction. Examples of such roads are short segments replaced by relocated new construction, short trunklines that should never have been trunklines by current definition, and longer trunklines that were replaced by freeways.

Negotiations for turnbacks are handled by the Turnback Review Committee, which presently consists of representatives from the Design Division and the Region/TSC Engineer in the affected area. The Committee works under Act 296, P.A. of 1969, which provides that the road being turned back must be "relatively free of extraordinary maintenance for a period of 5 years" following turnback. This requirement forms the basis for negotiating the scope of the rehabilitation project. The law provides slightly different criteria for relocation turnbacks, as opposed to classification turnbacks, although the Department by policy treats both the same.

Service road jurisdiction is transferred the same as conventional turnbacks, except that the Turnback Review Committee does not usually become involved unless the Department has retained jurisdiction for a number of years with the result being the service road requires rehabilitation.

12.03.03 Turnback Letter

When the Turnback Review Committee reaches agreement with the local agency regarding the scope of the rehabilitation project, a "Turnback Letter" is written to management setting forth the agreement details of the proposed project. When approved by management, this letter sets in motion the programming of the project and assignment in Design.

While generally avoiding details, the Turnback Letter will contain certain details, notably thicknesses of hot mix asphalt (HMA) surfacing and pavement widths. These items will have been agreed to and ***should not be changed*** during design. As a general rule, designers should not violate any of the recommendations of the Turnback Letter. If circumstances arise that may indicate a revision is desirable, the Chairman of the Turnback Review Committee should be contacted for concurrence.

Aside from these restrictions and the items mentioned under Sections 12.03.04 and 12.03.05, a turnback project will be handled the same as any other project in Design, including statutory funding participation by the local agency, when applicable.

When assigned the design of a turnback project, the designer should review any correspondence in the files for helpful background information and useful design data. The files of the Turnback Review Committee Chairman will also occasionally prove to be a valuable source of information.

12.03.04 Roadway Cross Sections

Act 296 provides that a lump sum payment to the local agency is an alternative to a rehabilitation project. This is usually attractive to the local agency when it desires a major reconstruction, something more than the Department is bound by law to provide. The Bureau of Highways, Office Informational Memorandum (O.I.) "LUMP SUM PAYMENT ON TURNBACKS" will be used to determine the fair and equitable amount of a lump sum payment. The designer's responsibilities are outlined in the O.I.

12.03.05 Right-of-Way

As a general policy, the Department will not acquire additional R.O.W. on turnbacks. If additional R.O.W. is required, it must be obtained by the local agency. There are a couple of exceptions to this rule, however:

A. If in fact it develops that the Department does not own all of the R.O.W. shown as "existing" in the R.O.W. map book, we may acquire, at project cost, that which we assumed was ours, but isn't.

B. Grading permits may be obtained at project cost. Management has applied the restriction that grading permits must be approved by the Chairman of the Turnback Review Committee.

   On completion of the turnback project and transfer of jurisdiction, any transferable interest in the R.O.W. will be conveyed by the Department. Title to excess R.O.W. will remain with the Department.

12.03.06 Bicycle Facilities

(revised 5-26-2015)

Bicycle facilities may be included on turnback projects if recommended by the Bureau of Transportation Planning Bicycle/Pedestrian Coordinator and provided the path does not itself require additional R.O.W. Generally the funding for these facilities would come from the Transportation Alternatives Program.

12.04 TEMPORARY ROADS

12.04.01 References

(revised 12-22-2011)

A. Road Design Manual, Chapter 6

- Section 6.03.16, "HMA Curb"
- Section 6.04.07C, "Temporary Concrete Pavement"

B. Geometric Design Guide GEO-690 Series "Temporary Runaround"

12.04.02 General

(revised 12-15-1997)

The need for temporary roads and structures should be determined and programmed during project scoping when factors pertaining to maintaining traffic are discussed. Designers should also be alert to situations where a temporary road might be required. The need for a temporary road, along with its geometrics and cross section, should be reviewed and finalized with the Region/TSC during preliminary design.

Numerous failures of temporary roads have occurred due to lack of attention to drainage and structural adequacy. A barely adequate road, reconstructed a second time and/or requiring continual maintenance, may cost as much or more than an initially higher class facility that was properly constructed.

12.04.03 Design Considerations

(revised 1-23-2023)

The temporary road should be designed according to the designated design speed. Final plans should show alignment, grade, appurtenances and the proposed typical cross section of the temporary road. Any temporary Right-of-Ways should also be shown.

If the temporary road's usage is only for minor or local traffic needs during one construction season and if base soils are good, a minimum- type road will perhaps suffice. A minimum cross section would consist of 6 inches of granular subbase with an additional 6 inches of gravel (22 ft.-0 in. wide), plus 4 ft.-0 in. wide gravel or earth shoulders. A quantity of maintenance gravel should be provided, as well as a dust palliative (see Section 6.02.11B).

Generally, if traffic volumes are substantial, an HMA or concrete pavement recommendation should be provided as part of the scoping. A paved surface may vary in design from a single-course HMA mat to 8-inch reinforced concrete. An 8-inch non-reinforced concrete pavement is common in the Detroit metropolitan area.

Cross drainage must be accommodated by means of temporary culverts. Culvert end treatment may be omitted except in the case of flowing streams, where sandbags or bag riprap may be warranted in lieu of end sections.

Ensure the needs of multi-modal users are considered when designing a temporary road.

12.04.04 Removal of Temporary Roads and Structures

(revised 12-22-2011)

Removal of a temporary road may be done by using either of the items, "Obliterate Old Road" or simply paying for it as "Excavation, Earth", as provided in the plans. The Construction Field Services Division seems to favor removal as Earth Excavation. If the surfacing material is more than 5 inches thick, the removal is usually paid for separately.

Removal of temporary structures is included in the pay item: Structure, Temp, Rem (Structure No.).

12.05 DETOURS

12.05.01 Reference

A. Department regulation 5200.01, "Maintaining Traffic in Construction Zones."

12.05.02 General

(revised 12-15-1997)

The Department's definition of "detour" is the utilization of existing roads to carry trunkline traffic during construction. Lane closures, weekend shutdowns, or the use of a temporary road are not considered detours. The need for a detour must be considered and finalized during the scoping process so that the detour route can be reviewed during the preliminary design. If local roads are to be utilized, the local agency should be informed early by the Region/TSC of the Department's proposed use of its facility, and there should be agreement as to the extent and character of the route improvements or restoration that will be needed.

When a detour is recommended, a public hearing may be required. Approval of the detour route by local officials does not always satisfy "public hearing requirements". The final detour should be submitted, as soon as possible, to the Public Involvement Section even though the Environmental Impact Statement may contain references to the detour. If a public hearing is required, the Public Involvement Section will take care of the details. Also, the Federal Highway Administration should be kept informed on non-exempt projects.

12.05.03 Design Considerations

(revised 1-23-2023)

All aspects of the detour should be considered during the design stage. The detour quantities and the plans for detour signing should be included in the project plans.

The detour route should be shown on the title sheet project location map with small directional arrows. (Formerly the route was labeled "possible detour," but the word "possible" should not be used because of its connotation of uncertainty as to where the detour route will be located.)

If the detour is along local roads and the existing facility is adequate to handle the diverted trunkline traffic, the local agency will often agree to rehabilitation ***after*** the detour is taken out of use. This is preferable to upgrading the detour before use because it enables an accurate assessment, after project construction, as to what repairs are needed. The local agency also has the advantage of a renovated facility rather than one that has suffered the wear and tear of detour traffic.

An important consideration when comparing the merits of a detour versus a temporary road is the residual value of any improvements made to the detour.

Ensure the needs of pedestrians, other non-motorized, and transit users are incorporated in the detour process. When providing a pedestrian detour route, the detour route should have a level of accessibility consistent with the original route being closed. See the Work Zone Safety and Mobility Manual for more information.

12.05.04 Federal Participation

(revised 12-15-1997)

Federal participation is available on federal-aid projects for construction, reconstruction, restoration, pavement marking, and signing of detours. It is essential, however, that such work be programmed and the cost estimate submitted at the time of scoping as part of the total project package. The FHWA must be afforded the opportunity of a plans-in-hand inspection on non-exempt projects.

12.06 HAUL AND ACCESS ROADS

12.06.01 Department Involvement

There are three principal reasons for the Department becoming involved in haul and access roads:

A. The Department furnishes the borrow area and designates the haul route. In this case, the Department will also obtain the necessary ROW. or grading permit.

B. The haul route uses Department designated local roads and the contract may include quantities of gravel, dust palliative, etc., for maintenance and quantities for restoration. Restoration would be handled similar to that of a detour (see Section 12.05.03).

C. The local unit of government is paid on a force account basis to maintain and restore designated access roads located between an existing trunkline and a new roadway under construction. (Usually the access roads are to carry the contractor's materials and overloaded equipment)

The costs for maintenance and restoration of a Department haul or access road are eligible for federal participation, when the roads are included in the programming and a plans-in-hand inspection is held.

When a haul route crosses a railroad and is the responsibility of the Department, the Department will contact the railroad to make the necessary crossing arrangements. The project should include a special provision for the pay item "Railroad Crossing, Temporary" (each). However, the Department prefers the haul route be the responsibility of the contractor, making the contractor responsible for making the arrangements with the railroad.

12.07 TURNAROUNDS AND CUL-DE-SACS

12.07.01 Department Involvement

The Department's use of the terms "cul-de-sac" and "turnaround" are similar in that they describe a treatment at the end of a dead end road, that will enable a vehicle to turn around and exit from the dead end road.

A cul-de-sac allows a vehicle to circle and return without reversing. While turnarounds can be circular, they can also be a "turn-in, back-out" T-shaped configuration.

12.07.02 Location

(revised 12-15-1997)

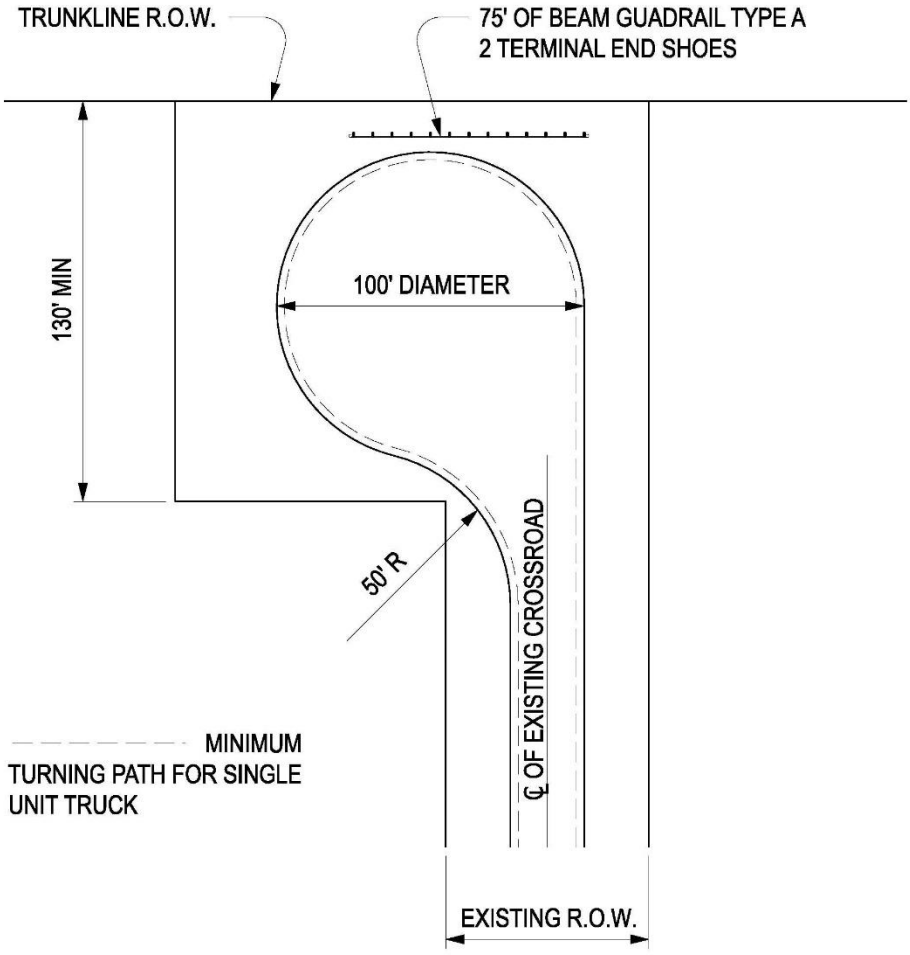
Turnarounds are constructed on the ends of a local road that has been severed by a limited access roadway. This happens when the local road does not warrant a grade separation. The turnaround treatment will be shown in the Engineering Report and is approved by the local agency during the Early Preliminary Engineering stage.

12.07.03 Design of Turnarounds

(revised 12-15-1997)

The design of a typical turnaround is illustrated on the next page. By offsetting the turnaround to one side of the local road, only one steering reversal is required and additional ROW. need only be obtained from one side of the road. The turnaround may be centered on the local road if ROW. is tight on both sides, but this is the least preferable of the two alternatives.

Turnarounds in urban areas may be of special design as requested by the local agency. An example might include a curbed island in the center, with 27-foot wide roadways. This would discourage using the turnaround as a playground.



TYPICAL TURNAROUND OR CUL-DE-SAC

12.08 DRIVEWAYS

12.08.01 References

(revised 7-10-2006)

A. "Administrative Rules Regulating Driveways, Banners and Parades On and Over Highways" Effective November 20, 1998, and based on Act 200, P.A. of 1969. Published by Utilities Coordination & Permits Section.

B. Standard Plan R-29-Series, "Driveway Openings, Driveways and Concrete Sidewalks."

C. Standard Plan R-95-Series, "Culvert Sloped End Sections"

D. Geometric Design Guide GEO-680 Series

12.08.02 General

(revised 12-15-1997)

Through the issuance of permits, the Department controls the construction and alteration of private drives that open onto state trunklines. These permits refer to and are based on the Administrative Rules (Reference A, above). All costs for these drives are the responsibility of the abutting property owner.

When road construction affects a drive, the cost of the required work becomes the responsibility of the Department. The Administrative Rules are quite specific with respect to geometry and surface thickness. The designer can sometimes deviate from the rules regarding surface thickness and should see Administrative Rule 23, to be certain the Rules allow the deviation. The location and geometrics of any affected driveways should be coordinated with the Region/TSC Traffic and Safety Engineer. The Designer also needs to review any unique drives (high fills, etc.) with the Geometrics Unit.

12.08.03 Urban Drives

(revised 5-27-2025)

12.08.03A Location – ROW. Encroachment

In urban areas where narrow building lots may prevail, driveways may need to be located close to the property line. Administrative Rule 31, provides that the driveway approach including the radii shall be located entirely within the area between the owner's property lines extended to the street centerline. A driveway radius may extend outside this area only if the adjacent property owner certifies in writing that they will permit such extension. This permission is obtained by the Development Services Division at the time of negotiation for driveway permits with the affected property owners.

12.08.03B Extent of Surfacing

When it becomes necessary to alter drives on urban road projects, it is the Department's policy to provide hard surfacing adjacent to the traveled roadway. This is done to avoid the washing of stones and dirt onto the pavement. See rules 51 & 52, of Administrative Rules.

The limits of residential driveway surfacing will usually be determined during preliminary design. Paving should extend at least 10 feet from the edge of pavement. If a few additional feet of surfacing is needed to meet an existing or imminently proposed sidewalk, the surfacing between the curb and the sidewalk should be completed.

Existing surfacing on commercial drives will usually have to be replaced to the extent that it is disrupted by road construction.

12.08.03C End Treatment

When upgrading the ends of urban driveway culverts see MDOT Drainage Manual Section 5.3.5 and Table 5-1.

12.08.03D Surface Type

Residential driveways will normally be surfaced to match the existing surfacing type, i.e., HMA if the existing is either HMA or gravel, and concrete if the existing drive is concrete.

The type of surfacing at commercial drives is dependent upon the existing surfacing, the potential weight of vehicles using the drive, and the availability of paving material on the project. If concrete paving is the principle item used, then concrete should probably be used. If HMA paving is the item used, then HMA base course and top course would probably be more economical. The type of paving material to use on commercial drives will generally be determined at scope verification.

12.08.03E Surface Thickness

1. The designer should use the following guidelines for concrete drives.

Residential Drives

* Between curb and sidewalk (sidewalk same thickness)	6 inches or thicker if locally required
* Back of sidewalk	5 inches or match existing thickness

Commercial Drives

As determined at scope verification and in compliance with local requirements, suggested thicknesses are:

* Heavy trucks	8 inches or 9 inches
* Medium and light trucks	7 inches
* Passenger cars	6 inches

*Reinforcement shall be omitted unless locally required, necessary to match the construction of the existing drive, or recommended during preliminary design.

When reinforcement is called for, conventional pavement reinforcement shall be used in 8-inch or 9-inch thick driveways, and conventional 6-inch x 6-inch sidewalk mesh shall be used in 5-inch, 6-inch, and 7-inch thick driveways.

2. Hot Mix Asphalt

Residential drive approaches should be paved with the mainline top course, placed according to design guidelines using 250 lbs/syd min. Surfacing required beyond the sidewalk, may be reduced to 170 lbs/syd.

Commercial drives should be paved with a minimum of 330 lbs/syd, or as determined during preliminary design. In poor soils as much as 990 lbs/syd of base might be warranted. It should be topped with the mainline top course.

A more economical mix than what is specified for the mainline may be used on projects where drive approach quantities are large enough to justify a separate HMA mix.

12.08.03F Curb

See Rules 51 and 52, of the Administrative Rules. Curbing should be as provided in the rules or as modified during preliminary design.

12.08.03G Curb Openings

Drives	Concrete Driveway Opening,
Residential	Detail L
Commercial	Detail M

(Note that drive opening Detail M is a pay item, whereas Detail L is not.)

See Section 6.06.19 for Driveway Openings.

12.08.03H Associated Tapers and Deceleration Lanes

Deceleration lanes and tapers at drives should generally be the same material and same thickness as the drive. Where an auxiliary lane or taper could be used as a driving lane, as might occur in the vicinity of multiple drives to a large shopping center, the auxiliary paving should match the type and thickness of the adjacent roadway lane.

12.08.03I Grades

Maximum driveway slopes are shown on Standard Plan R-29-Series. The combination of maximum change in slopes should be checked particularly when the sidewalk is close to the curb, the street is in superelevation sloping toward the drive, or the street crown is severe.

If a combination of changes in slope is adequate for a large car, it follows that it will probably be adequate for a smaller car, which usually has a shorter overhang.

12.08.04 Rural Drives

(revised 7-10-2006)

12.08.04A Grading Drives

On free access projects involving heavy grading, the location or relocation of drives is an important function of the design process. A major grade change can easily create an impossible or unacceptable drive situation necessitating a relocation. The designer may have his or her ingenuity tested in an attempt to avoid steep grades and circuitous routes while aligning the drive with the property owner's garage or parking area. The property owner should be advised to the advantages and disadvantages of the various alternatives. Since the property owner is the one having to live with the resulting conditions, their preference should be adhered to, provided it is within the bounds of sound engineering.

Whenever grading for a drive must be done beyond the ROW. line, a grading permit must be obtained.

If possible, 8 seconds of sight distance onto the roadway should be provided for vehicles exiting a drive. (The 8-second distance should be based on the posted speed of the roadway.)

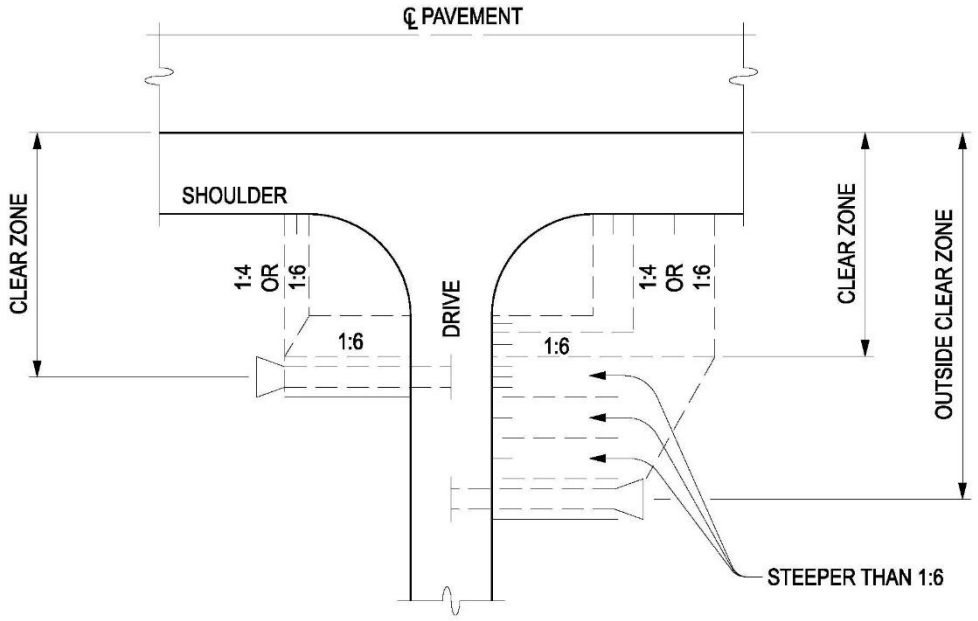
12.08.04B Surfacing

Residential drives and field drives are often surfaced with an Aggregate Surface Course, 4 inches thick.

When the drive grade ascends or descends from the roadway at a gradient steeper than 5%, the drive should be HMA surfaced at the rate of 170 lbs/syd for the length of the regrading. This practice, which is applicable to reconstruction projects only (not to resurfacing projects that do not normally involve regrading), controls washouts and the depositing of sand and topsoil on the road shoulder. It also aids in negotiating with a property owner who is faced with the prospect of a steeper drive.

12.08.04C Driveway Fill Slopes

Driveway slopes should be traversable (1:6 or flatter) to minimize the hazard to an out of control vehicle straying from the highway (see sketch below). Note that while both side slopes should be traversable on two-way roadways, it is only necessary that the approach side have traversable slopes when the drive is on a dual highway. See Rule 61, of the "Administrative Rules Regulating Driveways, Banners, and Parades on and over Highways", November 20, 1998.



12.08.04D Driveway Culverts

1. Minimum size

South of M-46	12-inch
North of M-46 in lower peninsula	15-inch
Upper peninsula	18-inch

The rationale for larger size minimum culverts in the northern part of the state is based upon the potential for a greater ice build up and from a greater runoff of spring rains caused by the ground being frozen.

2. Cresting Drives

Driveway culverts can often be eliminated by placing the drive at the crest and by using independent ditch grades. This practice is acceptable, but should not be carried to extremes.

3. End Treatment

See MDOT Drainage Manual Section 5.3.5 and Table 5-1.

12.09 CROSSOVERS

12.09.01 References

A. Geometric Design Guide GEO-670 Series

12.09.02 General

(revised 12-22-2011)

Permanent crossovers are of two types: the emergency and maintenance crossover, commonly associated with limited access roadways and the periodic local traffic crossover that is a necessary adjunct to free access divided roadways. In urban areas, the designer should coordinate crossover locations with the Region/TSC Traffic and Safety Engineer, the local community, and/or the county road agency. The final location of crossovers needs to be coordinated with the Design Division's Geometrics Unit.

12.09.03 Free Access Divided Highways

(revised 12-22-2011)

On the premise that an extra travel distance of up to 1/4 mile is not excessive when crossing a free access divided highway, the following criteria for crossover spacing should apply:

12.08.03A Medians Less Than 30 feet in Width
Crossovers may be constructed, as determined by the Design Division's Geometrics Unit, opposite driveways and side roads or streets.

12.08.03B Medians 30 feet or More in Width
Crossovers may be provided every 1/8 mile (660 feet) in urban areas and every 1/4 mile in rural areas. They may be adjusted 100 feet either way to conform to existing street or road returns or driveways. No two crossovers should be closer than 500 feet apart. Public roads should take priority over private drives in the event of a location conflict.

Crossovers for through cross streets may be closer than 500 feet apart.

Additional crossovers may be provided for large developments, e.g., shopping centers, as approved by the Design Division's Geometrics Unit.

If constructed on an existing road, the cost of a new crossover should be borne by the adjacent property owner or developer requesting the crossover, unless the original road construction failed to provide the theoretical 660 feet spacing.

It is desirable that medians over 30 feet in width be constructed to physically prohibit random crossing of the median. This can be done with either a ditch or a barrier.

12.09.04 Limited Access Divided Highways

(revised 3-24-2011)

Crossovers on limited access divided highways are for the use of maintenance, police, and emergency vehicles. It is illegal for the public to use them. To discourage such unauthorized use it was Department practice, until May 1985, to simply gravel surface crossovers to make them as unobtrusive as possible. This led to increased maintenance and it became debatable whether it discouraged unauthorized use by a motorist that was determined on making a U-turn.

The Engineering Operations Committee (E.O.C.) decided that rural maintenance crossovers will be paved.

These crossovers are to have 3-inch thick HMA surfaces, laid on 8 inches of Aggregate Base - HMA 1.5 feet wider on each side than the HMA mat. While an application rate of 330 lbs/syd is usually associated with a 3-inch thickness, consideration should be given to using the application rate of the top two courses of mainline HMA surfacing, even if the combined rate is 290 lbs/syd and only approximates 3 inches.

On resurfacing projects, existing crossovers are surfaced at a rate determined during preliminary design.

Thickness of subbase should be as recommended by Region/TSC Soils Engineer, but should not be less than the mainline subbase thickness. The entire crossover embankment may be made from granular material, if the fill is not very long nor very high.

To reduce unauthorized crossover maneuvers, eliminate existing unnecessary crossovers when possible based on the same general rules below for locating crossovers. The determination to eliminate existing crossovers should be made after contacting local agencies providing emergency response services. The notification to remove existing crossovers should be in writing with a request to respond within 30 days. Specify that absence of a response to the notification will be considered concurrence with removal of the crossovers.

When considering construction or elimination of crossovers, locations are based on the following general rules:

A. The crossover location shall be a minimum of 1500 feet beyond the end of the acceleration lane and 1500 feet ahead of the beginning of the deceleration lane. Where there are ramps on both sides of the highway, the 1500 feet requirement shall apply to the ramp which gives the greatest distance from the crossover to the structures.

B. Crossovers are to be placed at the ends of maintenance sections. These are to be dual crossovers spaced 500 feet on each side of the point of jurisdictional change. See Figure 4.

C. At rest areas, one crossover is to be placed at least 1 mile in advance of the beginning of the deceleration lane for the entrance ramp into the rest area. The other is to be placed 1500 feet beyond the end of the acceleration lane of the exit ramp from the rest area. Omit this crossover when there is another downstream crossover within a mile.

D. Weigh station exit and entrance ramps are to be considered as interchange ramps. Two crossovers are required and located as in A. preceding. Existing crossovers built in conjunction with weigh stations that are no longer in use may be obsolete. Contact the Project Planning Division to confirm the status of the facility before removing the exiting crossover.

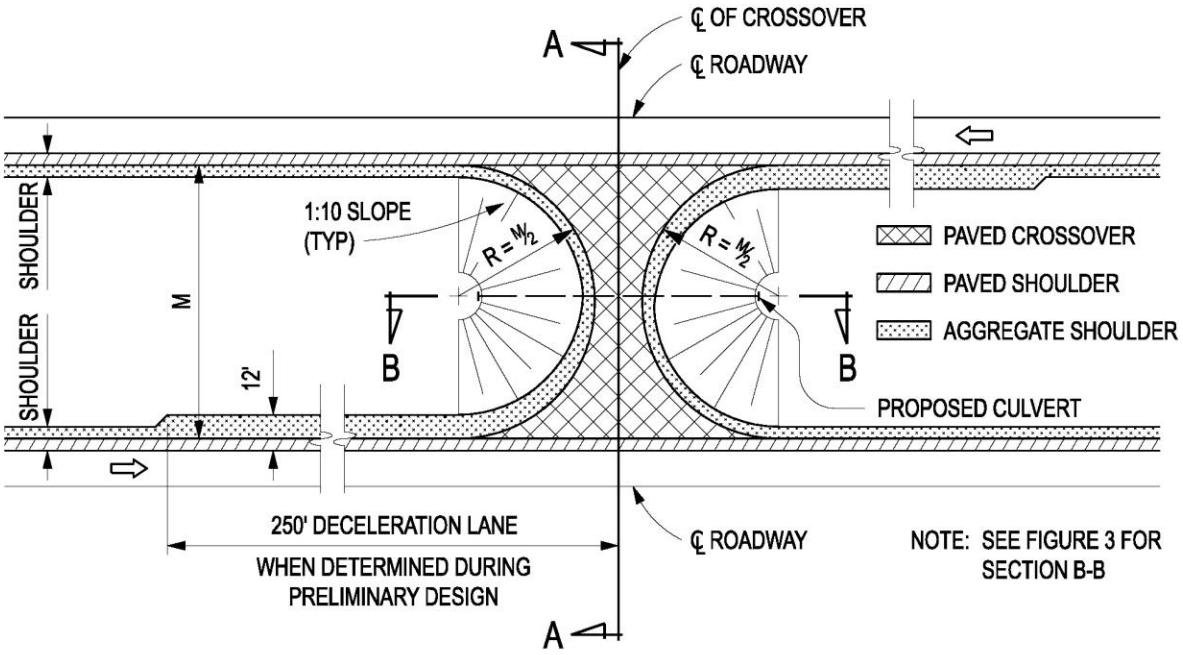
E. Crossovers placed as in A to D above should be spaced such that maintenance or emergency vehicles are provided crossover opportunities within 5 miles either by an interchange or a subsequent median crossover. When constructing new or eliminating existing crossovers, additional consideration should also be given for specific requests from local emergency response providers.

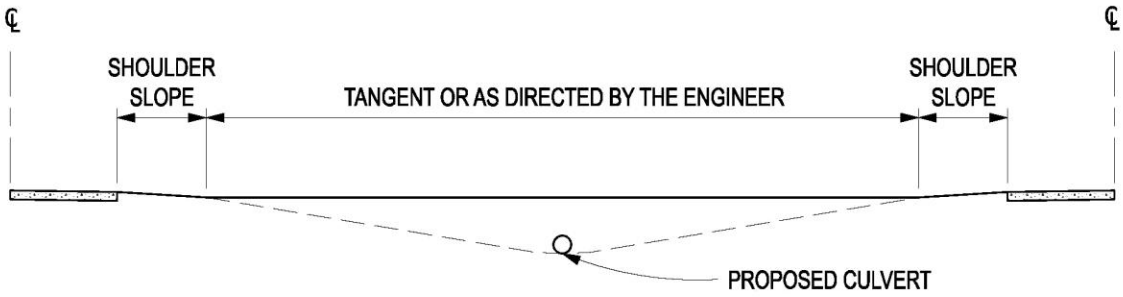
When choosing a specific location, sight distance, grade, topography, etc., must be taken into consideration. It is allowable to shift the location of crossovers 200 feet to 300 feet to take advantage of more favorable topography. The Region/TSC Maintenance Engineer should be consulted, during preliminary design relative to exact location of crossovers.

Examples of rural crossovers are sketched on the following pages.

Figure 1

TYPICAL DESIGN OF MAINTENANCE CROSSOVER WHERE M IS 100' OR LESS

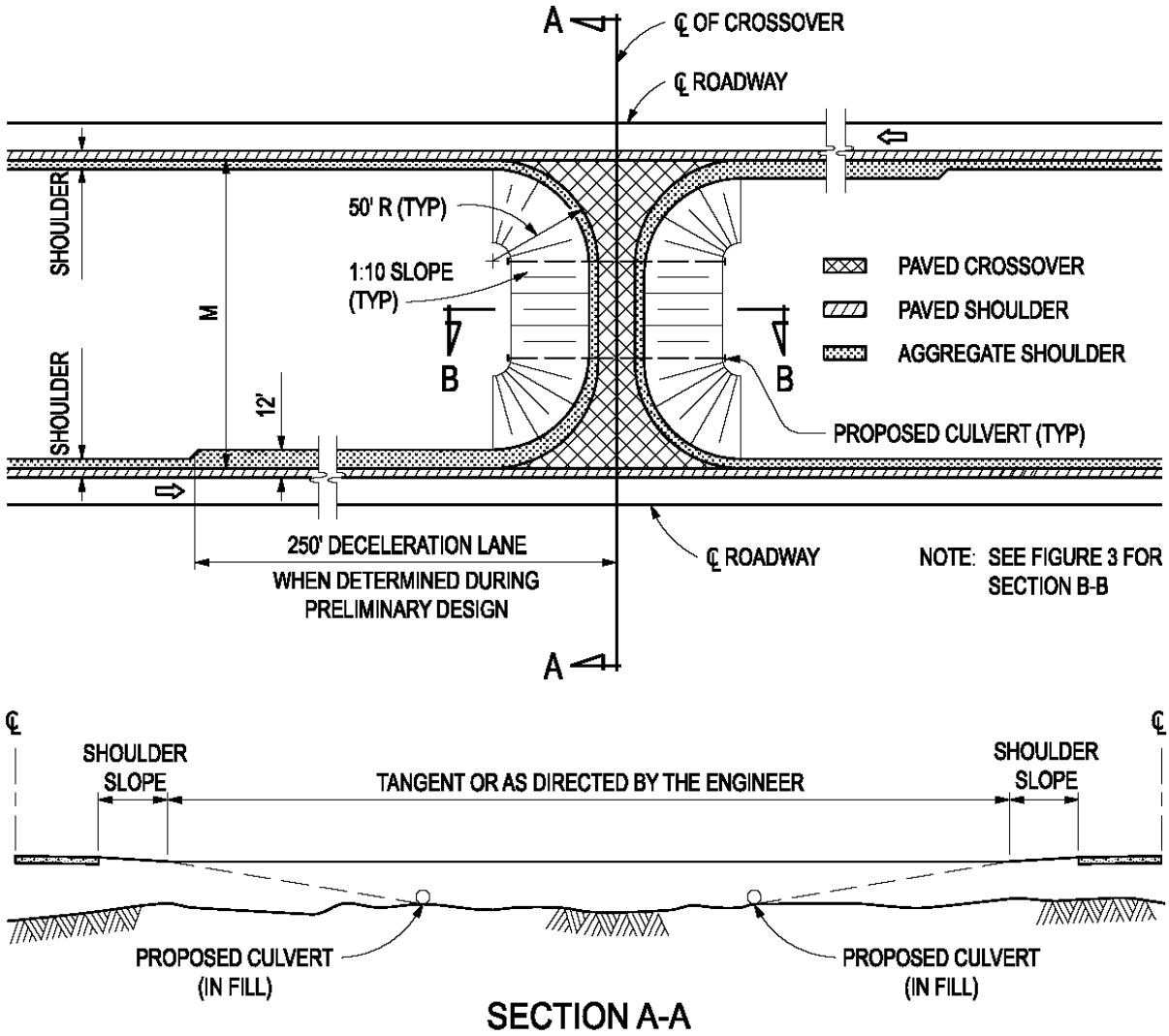




SECTION A-A

Figure 2

TYPICAL DESIGN OF MAINTENANCE CROSSOVER WHERE M IS GREATER THAN 100'



SECTION A-A

Figure 3

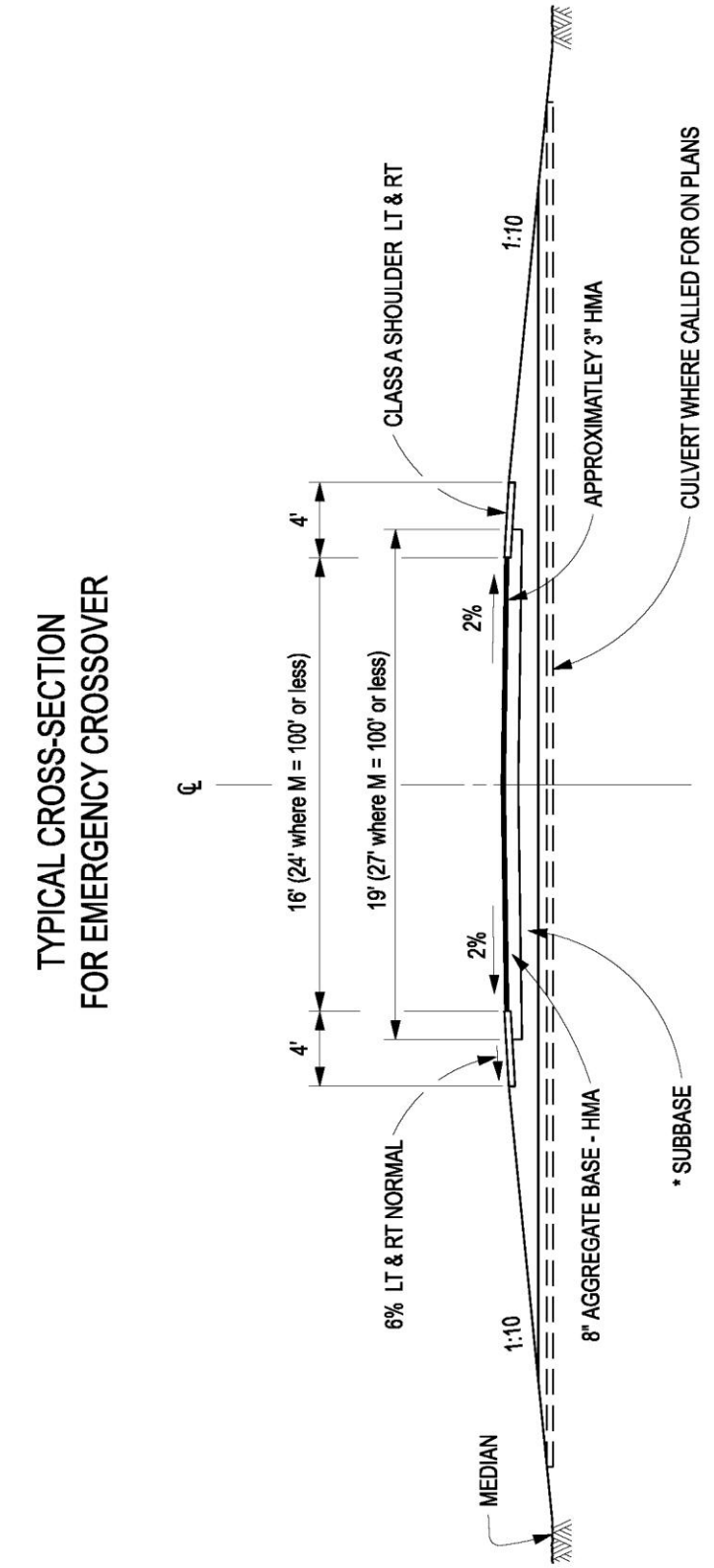

TYPICAL CROSS-SECTION
FOR EMERGENCY CROSSOVER
℄
4'
16' (24' where M = 100' or less)
19' (27' where M = 100' or less)
4'
CLASS A SHOULDER LT & RT
1:10
APPROXIMATLEY 3" HMA
CULVERT WHERE CALLED FOR ON PLANS
2%
2%
6% LT & RT NORMAL
8" AGGREGATE BASE - HMA
* SUBBASE
1:10
MEDIAN
SECTION B-B
* SUBBASE THICKNESS SHOULD NOT BE LESS THAN THE MAINLINE THICKNESS - IF THE FILL IS NOT VERY HIGH NOR VERY LONG, THOUGHT SHOULD BE GIVEN TO MAKING THE ENTIRE EMBANKMENT OUT OF GRANULAR MATERIAL.

Figure 4

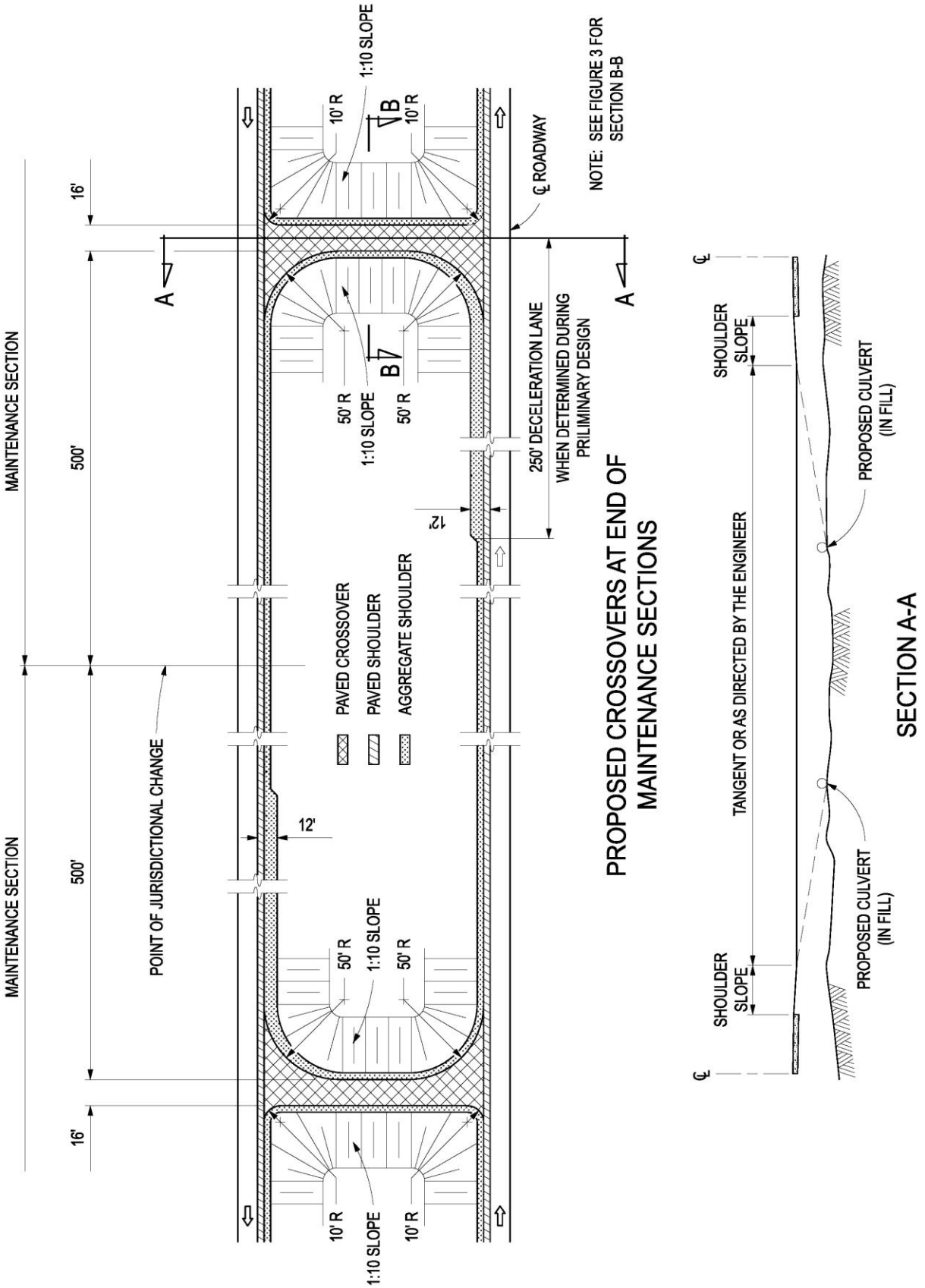
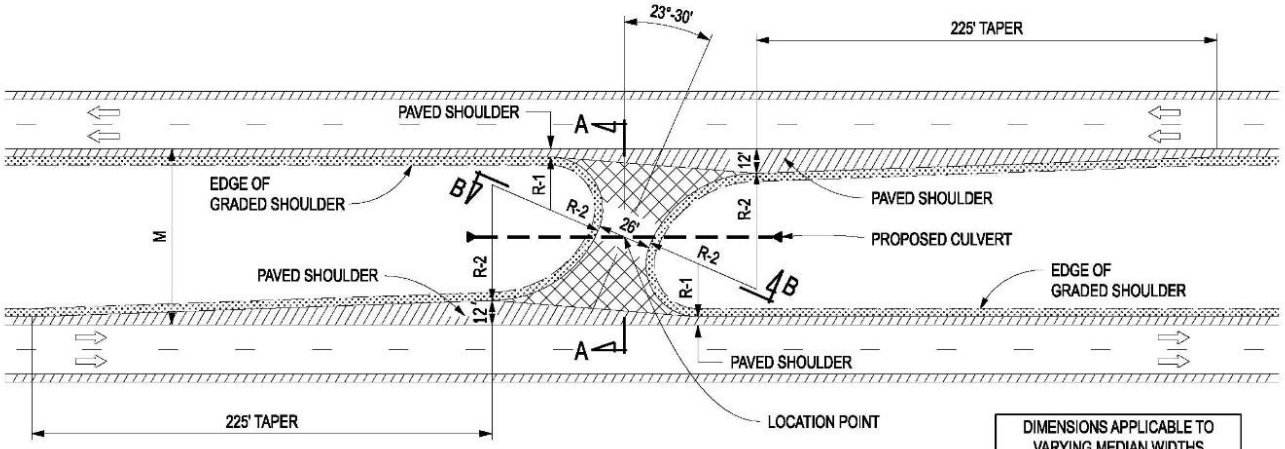

MAINTENANCE SECTION
16'
500'
POINT OF JURISDICTIONAL CHANGE
500'
MAINTENANCE SECTION
16'
A
A
B
B
10' R
1:10 SLOPE
50' R
1:10 SLOPE
50' R
12'
℄ ROADWAY
NOTE: SEE FIGURE 3 FOR SECTION B-B
250' DECELERATION LANE
WHEN DETERMINED DURING PRILIMINARY DESIGN
PAVED CROSSOVER
PAVED SHOULDER
AGGREGATE SHOULDER
PROPOSED CROSSOVERS AT END OF MAINTENANCE SECTIONS
℄
SHOULDER SLOPE
PROPOSED CULVERT (IN FILL)
TANGENT OR AS DIRECTED BY THE ENGINEER
SHOULDER SLOPE
PROPOSED CULVERT (IN FILL)
℄
SECTION A-A

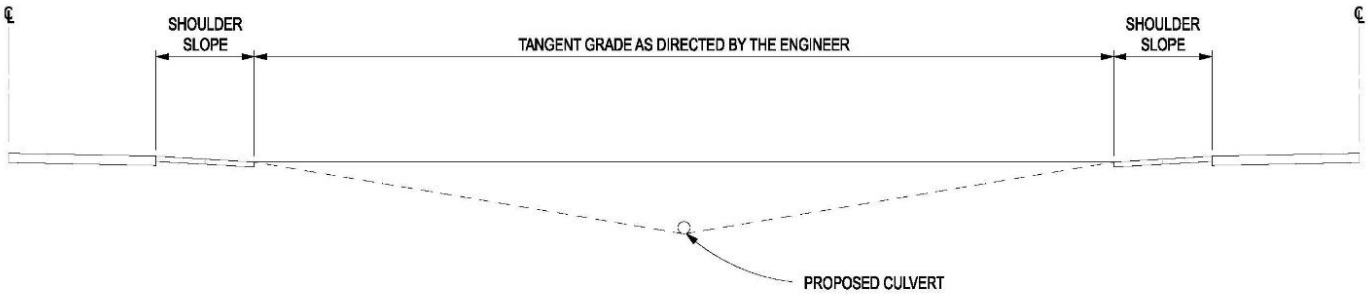
Figure 5

TYPICAL DESIGN OF MAINTENANCE CROSSOVER
(PAVED ENTRANCE OPTION)

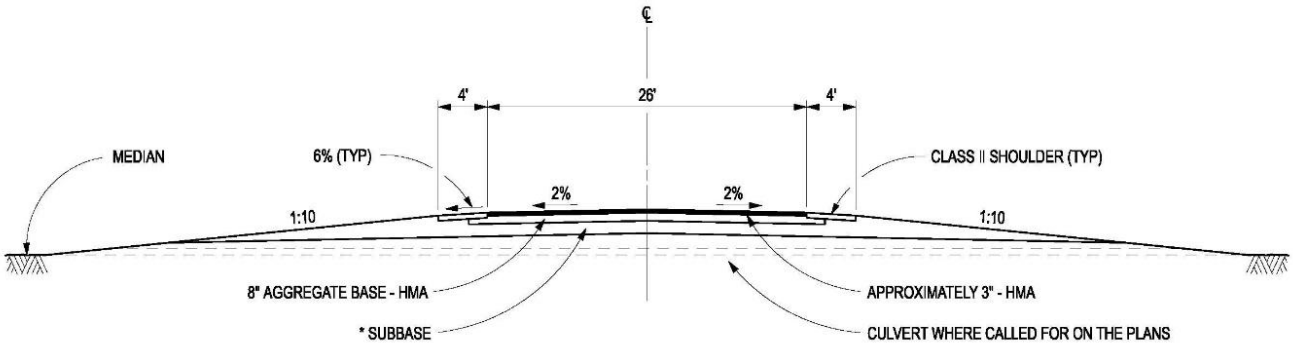


PLAN VIEW

DIMENSIONS APPLICABLE TO VARYING MEDIAN WIDTHS		
M	R-1	R-2
94'	28.48'	63.45'
70'	19.89'	43.51'
60'	16.31'	35.24'
50'	12.73'	26.93'
40'	9.16'	18.61'



SECTION A-A



SECTION B-B

* SUBBASE THICKNESS SHOULD NOT BE LESS THAN THE MAINLINE THICKNESS - IF THE FILL IS NOT VERY HIGH NOR VERY LONG, THOUGHT SHOULD BE GIVEN TO MAKING THE ENTIRE EMBANKMENT OUT OF GRANULAR MATERIAL.

12.10 REST AREAS AND WEIGH STATIONS CROSSOVERS

12.10.01 References

(revised 11-19-2009)

A. Geometric Design Guide GEO-500 Series “Rest Area”

12.10.02 General

(revised 11-19-2009)

The location, building design, and layout of rest areas are the responsibility of Region/TCS and the Roadside Development Unit. The latter does the horizontal and vertical design, including grading contours and sidewalk layout, and coordinates the lighting, water supply, and sewage disposal design. The Designer has the responsibility of performing engineering calculations and assembling and completing the project plans and specifications. Obviously, there must be close coordination between the Designer and the Roadside Development Unit.

Operation of truck weigh stations is under the Department of State Police. MDOT is responsible for the infrastructure including ramps, static scales, electronic weighing sensors in the pavement, parking lots, signing and the building structures. The Department of Transportation's weigh station activities are centralized under a Commercial Vehicle Strategy Team (CVST). There are two basic types of weigh stations: those that require the truck to be stationary during weighing and the more sophisticated type that is capable of weighing the vehicle while it is in motion. The Designer has the principal responsibility for layout of the weigh station area, initiating and coordinating utility and building design, performing engineering calculations with respect to ramps and parking areas, and coordinating all of the plans and specifications into a project. As with rest areas, the Design Utility Units will provide lighting, water, and sewage disposal plans. The designer must place heavy reliance on the CVST.

12.10.03 Location with Respect to Interchanges

(revised 12-15-1997)

If possible, rest areas and weigh stations should be located such that there will be a minimum of 3000 feet, and preferably more than 4000 feet, between the gores of the ramps to an interchange and the rest area or weigh station.

12.10.04 Selection of Pavement Type in Rest Areas

The Engineering Operations Committee has decided (April 3, 1985) that no standard for paving rest areas should be adopted. Rather, each individual location should have a case by case determination of pavement type depending on the density of both passenger and commercial traffic, the character of the soils, and other cost considerations. Concrete and HMA surfaces are considered as equals, in terms of service, so local conditions and the cost analysis will determine the type of pavement to be used.

12.10.05 Curb Type in Rest Areas

Curb and Gutter, Detail C, which has a 7-inch curb face, will normally be used in rest areas.

12.10.06 Pending

Pending.

12.10.07 Selection of Pavement Type in Rest Areas

(revised 12-15-1997)

To protect the occupants of the building, 120 feet of reinforced concrete barrier should be constructed in advance of the building, flared from the ramp roadway on a 1:15 taper.

12.10.08 Portable Intermittent Truck Weigh Stations (PITWS) General Information

(revised 12-16-2019)

SITE SELECTION

- In considering the safety of officers and passing motorists, the desired order of preference for new PITWS locations is in a rest area, a recognized Safe Enforcement Site, MDOT and county garages, carpool parking lots.
- PITWS will not be permitted on a freeway shoulder. Due to traffic volume, PITWS will not be installed in the shoulder of any road unless supported by a low ADT, or installed in a recognized Safe Enforcement Site.
- PITWS will not be permitted in the mainline.
- The finished site must allow a minimum 3 feet safe working area on all sides of a target vehicle. This area must be a reasonable grade and levelness, allowing the officer to operate safely around the target vehicle with a 12-foot work area on the vehicle travel side.
- Concrete pads less than 200 feet shall not be installed in asphalt. However, concrete pads of at least 60 feet may be installed into asphalt with a concrete base with proper anchoring into the existing concrete base.

MICHIGAN DESIGN MANUAL
ROAD DESIGN

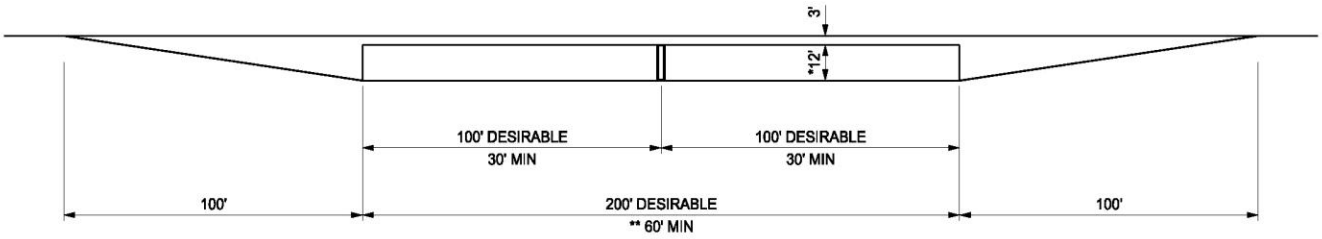
GENERAL REQUIREMENTS

- PITWS LOCATION:
    - In all cases, the PITWS shall be centered within the joint spacing.
- LANE WIDTH:
    - A minimum of 12 feet, with 14 feet being desirable not including work area. See SITE SELECTION.
- LANE LENGTH:
    - The desirable length of straight pavement is 200 feet (100 feet on either side of the PITWS), not including approach and departure tapers, with a minimum length of 60 feet (30 feet on either side of the PITWS).
- PAVEMENT COMPOSITE & THICKNESS:
    - It is recommended that the area meet or exceed the thickness and composite specifications of the existing pavement slab.
    - New slabs, not proximate to any pavement, shall be designed consistent with the current full depth mainline concrete pavement standards.
- CONCRETE REINFORCEMENT:
    - Reinforcement is not required or recommended, except at concrete joints, particularly in the center slab where the cut out will be located.
    - Concrete anchoring between poured slabs is REQUIRED on all new concrete, and between new concrete and existing concrete. All cut locations must be projected prior to pour so that proper reinforcement can be installed.
- TAPER(S):
    - Adequate tapers must be provided, before and after the desired 200 feet of straight pavement, to allow the vehicle to remain straight while on the pad. Vehicles approaching and/or leaving the 200 feet pad in a straight-line need no taper(s).
    - Generally, 100 feet of taper into the straight approach pad and 100 feet of departure taper beyond the departure pad is recommended.
- LEVELNESS:
    - A concrete scale pad shall not be placed in a vertical curve section. The desired area 100 feet on both sides of the scale trench shall be preferably in one plane and within the specified grades.
- GRADE:
    - Lateral - A zero grade is desirable, with a maximum of 5%.
    - Longitudinal – For newly placed slabs, as close to a flat grade as possible is recommended to maintain stationary vehicles without brakes being applied, up to a maximum of 0.2%. For existing slabs a maximum of 0.2% is recommended.

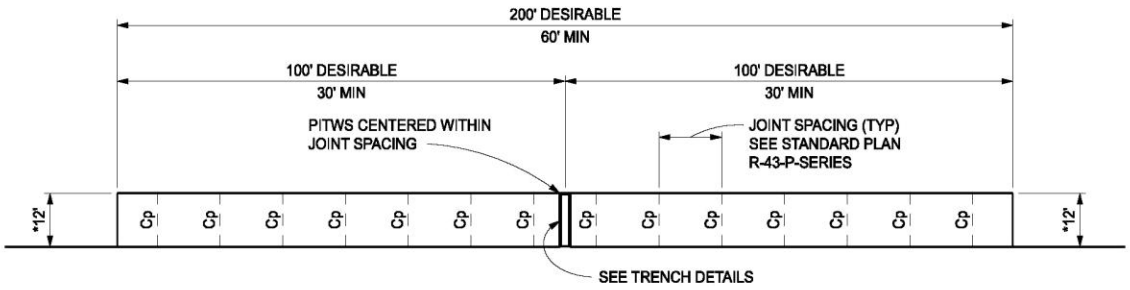
- ONDITION:
    - All pavements, new and existing, must be free of cracks, bumps or dips that may cause distinct elevation changes.
- SMOOTHNESS
    - Pavement surface must be level within ± 1/16-inch from center of slab to 30 feet in either direction. The remainder of the pavement (excluding tapers) must be within ± 3/16-inch.
    - Pavement surface should receive a light broom finish. Tining is not recommended.
- PAVEMENT REMOVAL (if applicable):
    - Pavement removal, replacement, reinforcement, and tied joint, when specified shall meet current MDOT design specifications, unless otherwise noted.
    - Regardless of depth, all pavement removal will be included in the pay item “Pavt, Rem”.

Standard pay items should be used for payment, however modification may be required in order to meet the requirements of this section.

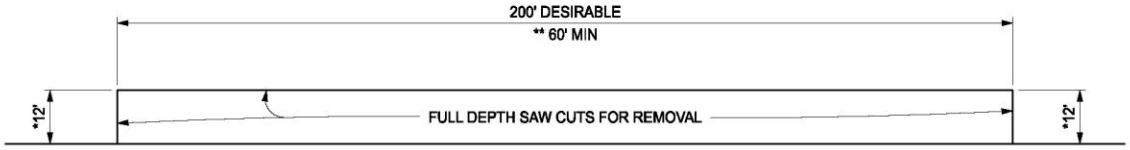
- PITWS Inspection:
    - Contact CVST for inspection of PITWS.



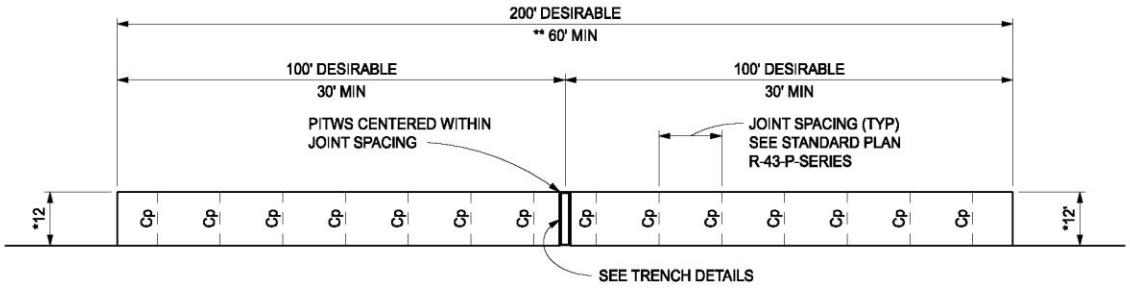
PITWS PLAN VIEW



CONCRETE SCALE PAD AND JOINT LOCATION IN NEW CONSTRUCTION



AREA OF REMOVAL FOR CONCRETE SCALE PAD USING EXISTING PAVEMENT



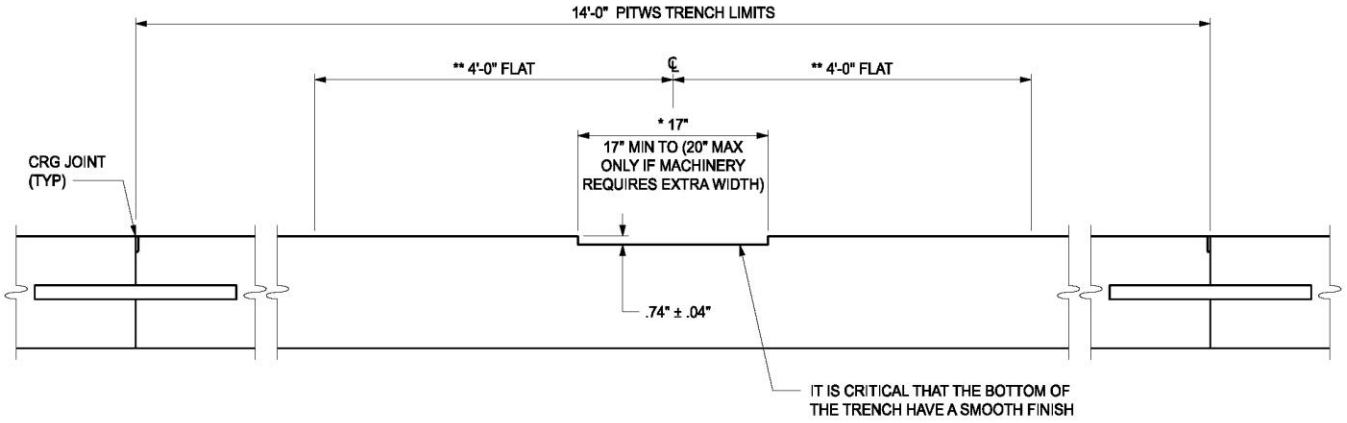
CONCRETE SCALE PAD AND JOINT LOCATION USING EXISTING PAVEMENT

LONGITUDINAL GRADE THROUGHOUT TAPERS AND SCALE PAD SHALL BE IN ONE PLANE WITH A 0.2% MAXIMUM GRADE

* 12' MINIMUM WITH 14' DESIREABLE.

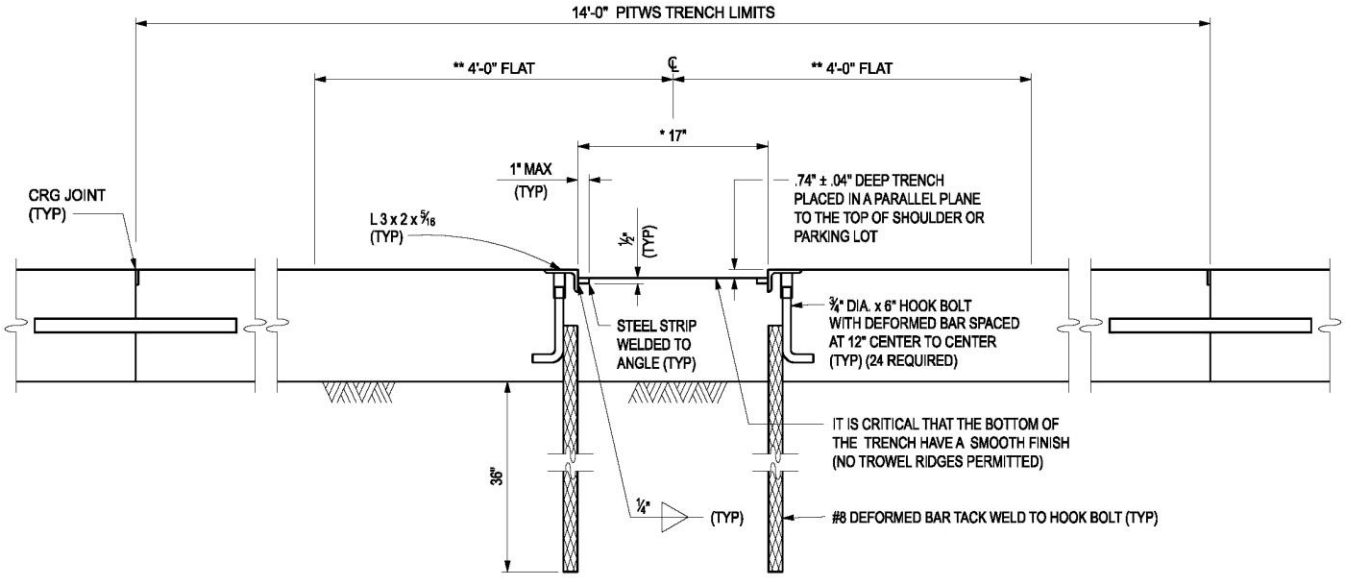
** A 9' MINIMUM LENGTH OF NEW CONCRETE PAD OR A DIRECT GRIND INTO THE ROADWAY (FOR THE SCALE ITSELF WITH NO NEW CONCRETE) ARE SITE SPECIFIC OPTIONS TO BE USED ONLY AS A LIMITED ALTERNATIVE TO THE RECOMMENDED OPTIONS.

NOTE: ANY EQUIVALENT DESIGN OF THE PITWS MUST BE SUBMITTED TO THE CVST FOR APPROVAL.



1. MACHINE CUT TO ⅝" WITH 17" CUTTING HEAD
2. FLOOR GRIND TO 0.74" DEPTH
3. HAND GRIND ISOLATED HIGH SPOTS TO 0.74" DEPTH OR WITHIN TOLERANCES
4. SEAL CONCRETE

1) DIRECT GRIND METHOD

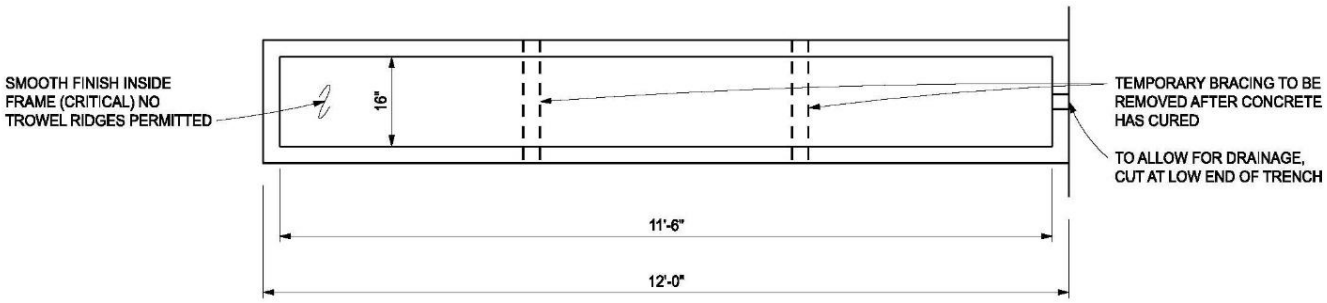


1. PLACE METAL FRAME TO PROPER GRADE
2. TO KEEP THE FRAME FROM SETTLING IN THE CONCRETE:
   DRIVE #8 DEFORMED BAR 36" BELOW THE BOTTOM OF THE CONCRETE PAVEMENT
3. TACK WELD THE HOOK BOLTS TO THE #8 DEFORMED BAR
4. CHECK GRADE
5. POUR CONCRETE
6. HAND GRIND TO 0.74" DEPTH OR WITHIN TOLERANCES
7. SEAL CONCRETE

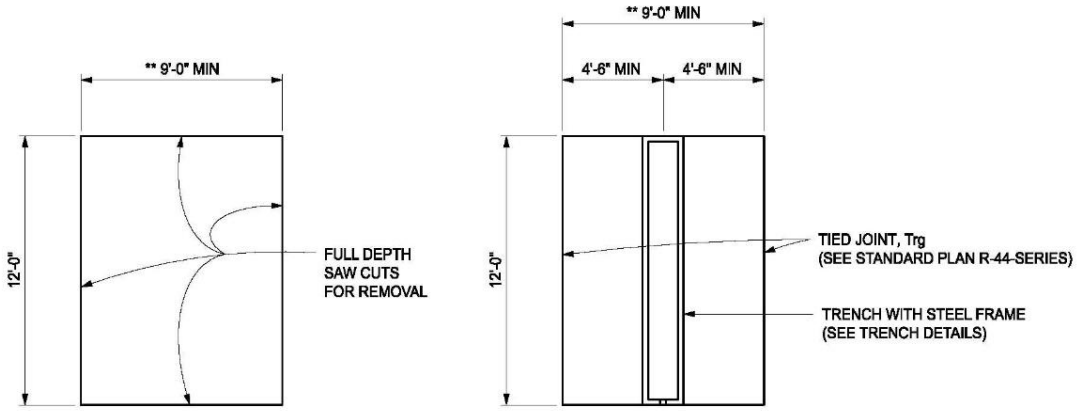
2) METAL FRAME METHOD

* DRAINAGE AND OTHER STRUCTURES ARE NOT ALLOWED IN THE TRENCH.
DRAINAGE IS NOT REQUIRED BUT IF DESIRED, CUT A GROOVE OR SLOT AT THE LOW END OF TRENCH.

** THE CONTRACTOR SHALL INSURE THAT THE ELEVATION OF THE CONCRETE OUT TO A DISTANCE OF 4'-0" EACH SIDE OF CENTERLINE OF THE PIT IS IN THE SAME ELEVATION AS THE METAL FRAME.



PREFABRICATED PIT TRENCH PLAN VIEW



NEW CONCRETE PAD

** THE FULL 9' LENGTH OF SLAB SHALL BE REPOURED IF THE INITIAL INSTALLATION IS NOT ACCEPTABLE.

12.11 RAILROAD CROSSINGS

12.11.01 References

(revised 11-22-2021)

A. Standard Plan R-121-Series, "Track Crossings"

B. Standard Plan R-122-Series, "Railroad Crossing Signals"

C. Michigan Manual of Uniform Traffic Control Devices, Part VIII

D. Michigan Department of Transportation, Guidelines for Highway-Railroad Grade Crossings

E. Federal Highway Administration, Railroad-Highway Grade Crossing Handbook

F. American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets

G. American Railway Engineering Association, Manual for Railway Engineering

H. Association of American Railroads, Signal Manual

12.11.02 General

(revised 11-22-2021)

By law, a new highway-railroad crossing must have approval by the Department. Determination of the necessity and feasibility of the crossing will be by the MDOT Office of Rail, Rail Safety Section. The Rail Safety Section will determine the required traffic control devices that are appropriate at the location. The costs associated with the new crossing will be at the expense of the requesting party.

When a roadway improvement project requires a change greater than 1-inch to the elevation of the tracks or roadway, lengthening of the crossing, or changes in alignment the cost is the responsibility of the road agency (Department/requesting party).

Existing agreements may dictate the cost responsibilities at crossings. Certain safety improvements at highway-railroad crossings may be funded with federal or state grade crossing account funds. Also, federal funds may be used for crossing improvements required in connection with road improvement projects. The MDOT Office of Rail, Rail Infrastructure Section must be consulted about laws, agreements, and funding. Work and coordination with the railroad pertaining to roadway improvement projects will comply with MCL 462 including Act 354 of 1993 (Michigan Railroad Code), 23 CFR 635.309(b) and 23 CFR 635.307.

Costs associated with maintaining traffic or detour traffic signing and roadway approach work for the railroad crossing improvements necessitated by the project will be included in the roadway project costs. Railroad Force Account work could potentially fund required improvements being performed by the railroad. Railroad payments will be in accordance with Master Agreement between the Railroad and the Department.

12.11.03 Railroad Coordination (PPD Task Description 3650)

(revised 12-27-2021)

Contact by the Department with the railroad company is required any time a railroad crossing is within a highway project Construction Influence Area (CIA). Coordination may also be required if queuing is expected to extend beyond the CIA and impact crossings. Contact and negotiations with the railroad company are made by the MDOT Office of Rail, Rail Infrastructure Section.

For at-grade crossings and grade separations, the railroad contact information is provided by the MDOT Office of Rail, Rail Infrastructure Section.

Any changes in the railroad facilities, including rail elevations, superelevation, or relocation, must be discussed with the Trunkline Grade Crossing Engineer and must have railroad approval.

In the case of at-grade crossings the Design Unit must:

1. Contact the Railroad MDOT Office of Rail, Rail Infrastructure Section. Although initial contact should occur during the scoping process, the designer must still contact this office very early in the design stage to alert the Trunkline Grade Crossing Engineer that a crossing is involved and to afford the opportunity for early project input and coordination. The Rail Infrastructure Section must also be notified during scoping to discuss impacts at the railroad crossing and determine how to best reduce impacts to the project.

2. Complete Notification of Proposed Projects Involving a Public Railroad Crossing (Form 1425) approximately one year minimum to two years maximum prior to construction and submit to the MDOT Office of Rail, Rail Safety Section for determination if a Diagnostic Study Team Review (DSTR) meeting is warranted. Notification will be forwarded to the Project Manager and the impacted railroad company. If there are safety improvements warranted than a DSTR meeting will be scheduled and ultimately, lead to the issuance of a regulatory order by the Department.

3. Provide electronic plan set access including the title sheet, typical cross section, maintaining traffic, signing plan sheets, and plan and profile sheets for the affected railroad crossing with a memorandum to the Rail Infrastructure Section indicating the proposed roadway improvements to be made. The Rail Infrastructure Section will advise the Design Unit as to what preliminary additions and alterations are desirable to satisfy the particular railroad company involved. Even if little or no impact on the railroad is expected, the railroad must be notified, and a coordination clause typically will be required.

4. Always show track elevations and profiles on the plans when work is anticipated to impact the crossing. If sufficient survey is not available, write a note to this effect on the plans. If track adjustments in excess of 1-inch are required, detailed existing and proposed elevations are required on the plans.

   It is particularly important that both existing and proposed utility crossings under and over the railroad be shown. Details of those crossings must also be included and approved by that railroad company.

5. After the plan notes have been completed to the satisfaction of the Rail Infrastructure Section, provide electronic plan set access to the Rail Infrastructure Section for their use in contacting the railroad. Any required Special Provisions will be supplied to the Design Unit by the Rail Infrastructure Section for inclusion in the Proposal

6. While the general design of the railroad crossing should be set after The Plan Review, it should be noted that railroad negotiations will take a minimum of six months to complete. Early notification and coordination can reduce this timeframe. If an agreement is required, it will take a minimum of one year. The Design Unit must take this into account by timely submittal of the plans to the Rail Infrastructure Section.

The Office of Rail, in coordination with the railroad, will determine if an at-grade crossing is adequate, should be extended, or warrants a new crossing. An observation may be made regarding the condition of the crossing and compatibility with the proposed project, but it is the responsibility of the Rail Infrastructure Section to determine the actual work required at the crossing.

If there are changes required at the crossing during construction notify Rail Infrastructure, TL Grade Crossing Engineer and the Railroad. Provide updated plans as necessary to convey the changes so that the modification can be reviewed by the railroad. The Railroad Infrastructure Unit will negotiate with the railroad how these changes to the plans can best move forward.

12.11.04 Design of At-Grade Crossings

(revised 9-17-2012)

12.11.04A Track Elevations on Plans

The existing track profile(s) should be shown on the road plans extending 1000 feet each side from the crossing, if possible. Occasionally track profiles are not available. If track adjustments in excess of 1-inch are required, track elevations should be requested.

12.11.04B Track Raises

Existing track elevations usually must be met at grade. Studying the top of rail profile will frequently disclose that a raise in track elevations may be as beneficial to the railroad as to the highway. Small raises in track elevation can be made at no large expense, but this is not true when tracks are lowered. Railroads almost never lower their tracks, but are usually cooperative when a small raise is considered.

On those projects involving a track raise of any consequence (in excess of 1-inch), both the existing track profile and the new track profile through the crossing should be shown. In the case of new grade crossings, the existing track profile should be shown whether a track raise is required or not. This information is usually required by the various railroads for review when determining the need for adjusting the track profiles with respect to their own requirements.

12.11.04C Establishing Grade

The highway grade should be established to pass through the plane of the rails and at an elevation that is equal to the highest elevation of the two rails. See the details on Standard Plan R-121-Series, when establishing the highway grade to meet an at grade railroad crossing.

A very good study can be made of the crossing by plotting profiles and cross sections to a scale of 1:125 horizontal and 1:12.5 vertical. A profile should be plotted for the centerline and each edge of a 2-lane pavement and in addition, along each joint line or lane line for pavements more than 2 lanes in width. The location, top of rail elevations, and cross surface should be carefully shown on each profile. Show adjusted profiles to meet the edge of crossing by means of irregular or French curves. Distances of approximately 100 feet should be used on both sides of the crossing to warp the grade from the edge of crossing surface to the grade established through the top of rail plane. Avoid "humping" the grade any more than necessary. After profiles have been established, plot cross sections at frequent intervals so that the amount of warp and maximum crown may be visually assessed for the entire irregular section. After the sections are plotted, an adjustment in the profiles, other than the centerline profile, will usually have to be made to avoid an excessively tilted pavement.

If the proposed pavement is only 2 lanes in width, it is necessary to warp out the crown at the outer edges of the pavement, which is easily accomplished. The crown on multiple-lane pavements vary from 4 inches to 6 inches, and unless the warping transition is of considerable length, the riding qualities of the outer lanes will not be good at high speeds. One point that is not always given sufficient consideration in discussing the riding qualities of a railroad crossing is that of speed. Crossings that ride well at slow speed to moderate speeds may ride badly at high speeds and vice versa. Crossings of multi-lane highways, especially if relatively long due to a skew, should be designed so that a minimum longitudinal grade is called for on the rails. Drainage is an important consideration in selection of grades because it directly affects crossing stability. Runoff should be intercepted where possible to prevent drainage into the crossing area.

12.11.04D Superelevation

Where crossings are complicated by inclined grades on both the railroad and highway, by skew crossings, by multiple tracks, and/or by railroad superelevation in a plane opposite to that of the highway grade, a difficult problem results that usually cannot be completely and satisfactorily resolved.

In establishing preliminary grades to eliminate or reduce existing track superelevation, the grade should always be laid to meet the high edge of the crossing, knowing that it will be necessary to request a raise in elevation. The Railroad Coordination Unit – Office of Rail can explore superelevation changes with the railroad. Main line track superelevation normally must be maintained, but the superelevation on switch tracks and side tracks can sometimes be reduced or eliminated entirely.

Where the plane of superelevation of the tracks is counter to that of the highway grade, it is necessary to establish a short grade tangent to the top of both rails. At the intersections of this short tangent with the longer approaching grades, short vertical curves are used. If this treatment results in an undesirable "hump" it can be minimized somewhat by careful adjustment of the tangent intersections and the skillful choice of vertical curves. Sometimes the use of vertical curves with unequal tangents will make a much smoother crossing (i.e. detail grades).

12.11.04E Types of Crossings

Three principal types of crossings are now used: hot mix asphalt with guard log or three rail, the prefabricated sectional treated timber crossing and the proprietary crossing surfaces. The proprietary crossing surfaces are generally considered to be superior, but their price is also greater. The selection of the type of crossing material will be as agreed upon between the Railroad Coordination Unit – Office of Rail and the Railroad.

12.11.04F Railroad Owned Materials

Occasionally the plans will call for the contractor to remove railroad owned materials, principally rails, fittings, and ties, during the progress of the work. In most cases the railroad company wants these materials salvaged for its future use.

Ordinarily the disposition of such material will be covered in an agreement or by letter communication with the Department. The proposed disposition of such material should be indicated on the plans so the contractor will not assume that the salvaged material is to become the contractor's property.

When the disposal becomes the responsibility of the contractor, railroad ballast, railroad ties, treated wooden piles and treated wood posts disposition shall be as follows:

1. Railroad Ballast

   Design should request the Region/TSC Resource Specialist to make a preliminary field inspection of the crossing. Then, unless there is obvious contamination or reason to suspect a problem, the project should proceed as if the material were clean. If, on construction, contamination is encountered, the cleanup will be done by force account.

2. Railroad Ties or other Treated Wood

   Railroad ties and other treated wood that are in good condition may be separated from the junk and may be used for landscaping purposes, retaining walls, etc. The contractor should not be allowed to dump the ties (or piles, posts, etc.) in a pile for future sorting since this could be considered improper disposal of contaminated waste material.

3. Disposal

   Licensed Type II landfills are the appropriate disposal areas for railroad ties, treated wood piles, treated wooden guardrail post, etc. The appropriate disposal area for contaminated ballast will be determined after the contaminants are identified.

Designers should use the following General Plan Note:

Railroad Ties and Other Treated Wood

Railroad ties and other treated wood that are in good condition may be separated from the junk and may be used for landscaping purposes, retaining walls, etc. The contractor will not be allowed to dump the ties (or piles, posts, etc.) in a pile for future sorting since this could be considered improper disposal of contaminated waste material. Licensed Type II landfills are the appropriate disposal areas for railroad ties, treated wood piles, treated wooden guardrail post, etc.

12.11.04G Traffic Control Devices (Railroad Signals and Gates)

The Railroad Coordination Unit – Office of Rail will locate the traffic control devices with respect to the road and tracks. These signal locations should be shown on the plans to assist in determining conflicts with utilities, drainage, driveways, etc.

Standard railroad pavement markings and signing should be included in the design of the crossing.

12.11.05 Railroad Grade Separations

(revised 9-28-2026)

On limited access highways, all at-grade Railroad-Highway crossings are to be eliminated per federal guidelines. Grade separations must be constructed at these locations unless the railroad can relocate or abandon their tracks.

On free access roads, grade separations must be economically justified by a benefit/cost ratio of 1.0 or more. Benefit/cost ratios will be calculated by the Economic Analysis Unit, Program Planning Division, Bureau of Transportation Planning. Ratios will divide the value of highway-user delay, operating cost and accident savings, by the Department's life-cycle cost, discounting to present value, over a period of 20 years.

For highway bridges over railroads a vertical clearance of 23 feet is required. When laying a preliminary road grade over a separated railroad, the designer should assume the road grade to be 28 feet above the top of rail elevation. This is generally adequate for a skew crossing of perhaps two sets of tracks. For a 90 degree crossing of a single track an allowance on the order of 27 feet will be close.

For railroad side clearances, see Bridge Design Guides 5.24.03 and 5.24.04.

See also Chapter 11 of the Bridge Design Manual.

12.12 BICYCLE & SHARED USE FACILITIES

(revised 8-23-2021)

12.12.01 Legislation

(revised 3-18-2013)

Section l0k of Act 327, P.A. of 1972 amended the basic Act 51, by providing that ½ of 1% of the gas and weight tax returns made to the Department, counties, cities, and villages be spent for non-motorized transportation. Act 444, P.A. of 1978, further amended Act 51 by increasing the percentage to 1%. PA 135 of 2010 again amended Act 51, Section 10k and added Section 10p. The 2010 amendments define the concept of complete streets and outline coordination requirements on projects involving multiple agencies/jurisdictions.

Attorney General Opinions

Various Attorney General Opinions have stated the following:

A. The term "highway" includes facilities for non-motorized transportation; thus, the right of eminent domain applies. (November 1, 1973)

B. Participating cities must participate in the cost of a non-motorized path as if it were a highway. (April 29, 1974)

C. The Department must pay the entire cost of a railroad crossing required for a new bicycle path. (July 24, 1975)

D. A non-motorized facility must adjoin, be in close proximity to, or cross over roads, streets, or bridges in order to be considered a "reasonable appurtenance" to roads, streets, or bridges. (June 19. 1980)

E. A trail separated somewhat from its highway which demonstrably accommodates non-motorized traffic which would otherwise use the highway should satisfy the close proximity requirement. (Sept 3, 1992)

12.12.02 References

(revised 8-23-2021)

A. Act 51, P.A. of 1951 as amended, Section 247.660k

B. Act 51, P.A. of 1951 as amended, Section 247.660p

C. "Guide for Development of Bicycle Facilities, 2012 4th Edition," AASHTO

D. Standard Specifications for Construction – Current Edition

E. “Guide for the Planning, Design, and Maintenance of Pedestrian Facilities”, 2004 AASHTO

F. State Transportation Commission Policy on Complete Streets; Policy number 10214, dated July 26, 2012

G. State Transportation Commission Policy on Context Sensitive Solutions; Policy number: 10138, dated May 26, 2005

H. 23 CFR 652.5

I. Guidelines for Requesting Alternate Use of Limited Access Right-of-Way: Non-motorized Facilities

12.12.03 Types of Bicycle Facilities

(revised 3-18-2013)

Bicycle facilities can be classified as off-road or on-road facilities. On-road facilities are the preferred design options in urban areas.

Off-Road Facilities

A shared-use path is a facility that is physically separated from motorized vehicular traffic by an open space or barrier - either within a highway Right-of-Way or within an independent Right-of-Way. Shared-use paths are also used by pedestrians, skaters, wheelchair users, joggers, and other non-motorized users.

On-Road Facilities

A bike lane is a portion of a roadway that has been designated for preferential or exclusive use by bicyclists by pavement markings and signs (optional). It is intended for one-way travel, usually in the same direction as the adjacent traffic lanes, unless designated as a contra-flow lane.

A shared lane is any roadway that is open to both bicycle and motor vehicle travel unless bicyclists are prohibited by statute or regulation. A shared lane can be widened, marked and/or signed to enhance the roadway to better accommodate bicycle mobility.

Paved shoulders accommodate stopped vehicles, emergency use, and provide lateral support of the roadway structure. Paved shoulders are often used by bicyclists. For bicycle use, paved shoulders are appropriate on rural highways that connect cities and other major attractors.

12.12.04 Non-motorized Transportation Project Review

(revised 8-23-2021)

In compliance with the State Transportation Commission Policy on Complete Streets, dated July 26, 2012, all projects regardless of scope, or length should be considered for the accommodation of bicyclists, pedestrians and all legal users of the roadway.

Factors such as location, connection to other facilities and use are considered when deciding to include a non-motorized facility in a project. The Bicycle/Pedestrian Coordinator and/or Pedestrian and Bicycle Safety Engineer can assist with recommending a type, location, or width.

The Bicycle/Pedestrian Coordinator and/or the Pedestrian and Bicycle Safety Engineer may assist the Region or TSC staff in their efforts to review and discuss the project in detail, and solicitation of input from local governmental units and user groups. The Region or TSC should consider the availability of funds and the accumulated total of funds previously committed.

Any Alternate Use of Limited Access Right-of-Way requires coordination with, and approval from, the Development Services Division for all types of Limited Access Right-of-Way. Non-motorized facilities placed within Interstate Right-of-Way are additionally required to have approval by FHWA for a change in use (non-highway) of the Right-of-Way. This change of use (temporary breach) also requires a public interest finding as to the reason the non-motorized facility must be placed within the Limited Access Right-of-Way. This use involves ingress, egress, and occupancy within the Limited Access Right-of-Way of the non-motorized facility. The request for FHWA approval should be coordinated between the Region or TSC and the Development Services Division for any required breach(es) early in development of the project. FHWA approval is required even if there is no additional Right-of-Way required. Non-motorized facilities placed within non-Interstate Limited Access Right-of-Way do not require FHWA approval, but still requires a public interest finding and approval by the Development Services Division. The process should closely follow those documented in the Guidelines for Requesting Alternate Use of Limited Access Right-of-Way: Non-Motorized Facilities. Steps 7-16 in the flowchart at the end of the guideline will typically be accomplished through the plan development process. Part of FHWA approval requires Local agreements, see Section 12.12.07.

12.12.05 Deleted

Section deleted.

12.12.06 Deleted

Section deleted.

12.12.07 Agreements - Shared Use Paths

(revised 8-23-2021)

Whenever it is proposed that an independent shared-use path be constructed, it will be necessary to obtain from the local unit of government, a commitment that it will not enact any ordinances prohibiting bicyclists from using shared-use paths constructed by the Department. In addition, the local unit of government must agree to repeal any such existing ordinances that might apply to the path in question.

The designer should provide the Governmental Coordination Unit with a description of the facility being constructed, including a print of the title sheet (if available) so that the necessary documents may be secured from the involved local unit of government. These documents should also include agreements with the municipalities relative to maintenance of shared-use paths. The Department will not construct, with State trunkline funds, independent shared-use paths (i.e., back of curb or beyond the shoulder) unless a local governmental agency accepts the responsibility for maintenance of the facility on completion of construction. This description of the facility should be forwarded early in the design stage to ensure that the local governmental agency will have sufficient time to act prior to our scheduled advertising date. Local rejection of such an agreement will have the effect of immediately terminating the shared-use path project.

In instances where agreements can’t be reached or the need is not immediately evident, the designer should be cognizant of the potential to accommodate a facility in the future. This can be done by locating utilities, storm drains, signal controllers and other items outside of the area where a shared use path or sidewalk might be located in the future.

See Section 12.03.06 for Department "policy" for constructing bicycle facilities on turnbacks.

To adhere to FHWA guidelines and Michigan law (MMVC 750.419), it is suggested that all state/local agreements for projects with shared-use paths contain a prohibition against use of the path by motorized vehicles, except maintenance vehicles.

Act 51 participation (cities over 25,000 population) is required for bicycle facilities, the same as for any other highway construction project. Separate agreements are used for funding, maintenance, and operations. The maintenance and operation agreement should be secured from the local unit prior to the design of the facility. Participation agreements are usually secured at a later date and are included with the major project.

If the shared-use path crosses a railroad, either by grade separation or at grade, the Railroad Coordination Unit – Office of Rail should be informed as soon as possible so that the proper arrangements and agreements can be made.

Local agreements for Maintenance and Operation of Shared Use/non-motorized facilities placed in Limited Access Right-of-Way are required for the change of use (non-highway use) in Limited Access Right-of-Way. The request for the Operation and Maintenance Agreement should be coordinated between the Region or TSC and the Development Services Division-Governmental Coordination Unit prior to issuance of the Right-of-Way Construction Permit.

12.12.08 Deleted

Section deleted.

12.12.09 Design Features of Shared-Use Paths

(revised 4-22-2019)

The basis for the design of bicycle facilities is the AASHTO "Guide for the Development of Bicycle Facilities, 4th Edition 2012. Although formal design exceptions or variances are not required for off road facilities, designers should document in the project file when minimum criteria for elements listed in A-F below cannot be met.

The National Association of City Transportation Officials (NACTO) also provides helpful recommendations. The NACTO Urban Street Design Guide, and Urban Bikeway Design Guide are useful tools and resources for consideration in the development of context sensitive multi-modal facilities. However, the American Association of State Highway and Transportation Officials (AASHTO) national guides remain the standard for planning and designing Michigan roadways and multi-modal facilities.

Generally, it is poor practice to attempt to utilize portions of existing sidewalk in front of homes for a shared-use path. If it is proposed to build a shared-use path in front of homes, the Region/TSC, and Design should coordinate the proposal with local officials. If favored locally, the local officials should contact affected property owners to discuss the shared use path and land requirements with them, and include those results in a response to MDOT. This information will be used to determine if an MDOT public hearing is required prior to initiating ROW. acquisition by MDOT.

12.12.09A Design Speed

The desirable design speed for bicycle paths should be 18 mph. Where descending grades are over 6%, the design speed should be increased to 30 mph. On paths where a high concentration of pedestrian users is anticipated, lower design speeds may be considered.

12.12.09B Grades

Grades, in general, should follow the lay of the land or grade of the roadway. The grade of the path should not exceed 5%, but if the roadway exceeds 5% the path should be less than or equal to the adjacent roadway grades. Except for short distances, grades greater than 5%, either ascending or descending, are undesirable. Certain conditions such as physical constraints or regulatory constraints may prevent full compliance with 5% maximum grade and must be documented (ADA Statement of Accessibility Constraints, Form 0370).

For grades greater than 5%, consider level landing, rest areas or increased path width where feasible.

12.12.09C Horizontal Alignment

When curvature is required, compound or spiral curves are preferable to simple circular curves. Tight, short-radius curves should be avoided, if possible. For a design speed of 18 mph, a minimum radius on the order of 60 feet is recommended.

Design Speed (mph)	Minimum Radius (ft)
12	27
14	36
16	47
18	60
20	74
25	115
30	166

12.12.09D Crown and Superelevation

For drainage, a 1.5% to 2% cross-slope should be used. The crown point is located at one edge of the path (unidirectional crown) for ease of construction. Superelevation is not needed for horizontal curvature within the minimum radius. The direction of cross-slope should be switched as necessary to match the direction of curvature.

12.12.09E Width

The minimum paved width of a two-way path should be 10 feet. This width may be reduced to 8 feet for short distances to avoid inordinate cost, related to widening structures or other physical constraints. Where large numbers of bicyclists can be expected, e.g., adjacent to a college campus, or other significant traffic generators, 11 feet to 14 feet widths may be justified. Widths should be uniform for ease of construction.

12.12.09F Clearances

Lateral clearance from the edge of path to adjacent obstructions should be 2 feet minimum. If this clearance cannot be obtained at bridges or in tight ROW. that is fenced the side obstruction should be made as smooth as possible and marked with retroreflective markings.

Vertical ground clearance should be 8 feet minimum, with 10 feet desirable.

12.12.09G Grading

If the subgrade contains vegetative cover or root mat, all such material should be removed to a depth of at least 6 inches and the subgrade smoothed and compacted and a soil sterilant applied. A minimum of 4 inches to 6 inches of "Coarse Aggregate 6A (LM)," should be used to provide an adequate base.

A minimum 2-foot width of graded area should be provided adjacent to the path. The paved surface should be close to the same elevation as the adjacent ground, consistent with good drainage.

12.12.09H Surface Type

A smooth path is considered paramount. To achieve the required smoothness of a HMA surfaced path, machine spreading should be specified. Most agencies opt for the HMA surfacing because it lacks joints.

If concrete is used, it is built much like sidewalk, except that sawing of joints should be specified to eliminate the depression that is characteristic of a jointing tool. A joint down the center of the path should be avoided unless saw cut.

12.12.09I Drainage Structures

Drainage grates should not be located in the traveled portion of the shared use path. Any grates within the path must be ADA compliant. Horizontal openings should be ≤ 0.5 inches and elongated openings perpendicular to the path of travel.

Occasional temporary flooding of the path, is acceptable provided it is not frequent and that no objectionable deposits are left on the path. Drainage courses should be accommodated by culverts and bridges. These structures need not be elaborate; e.g., end treatments may often be omitted on culverts. For ease of maintenance, culverts should be used rather than bridges. Where small bridges are required, the Roadside Development Unit of Design Division should be consulted. Use of prefabricated structures should be considered.

When a typical timber structure for shared-use paths over small streams is called for, the designer should inform the Region/TSC Soils and Materials Engineer. The Soils and Materials Engineer will then conduct an investigation to determine if the assumed soil capacity is adequate. This investigation may range from a site inspection and review of previously made culvert borings to borings made with a continuous flight auger. In those rare cases where a complete foundation investigation is required, it will be requested by the Region/TSC Soils and Materials Engineer.

The minimum information for timber shared-use structures to be included in the plans consists of:

1. Complete alignment ties
2. Plan and profile
3. Design loading
4. Foundation design, including soil information and footing pressures.

Ditch crossings, if not via embankment and culvert, should be on a flat angle across the ditch.

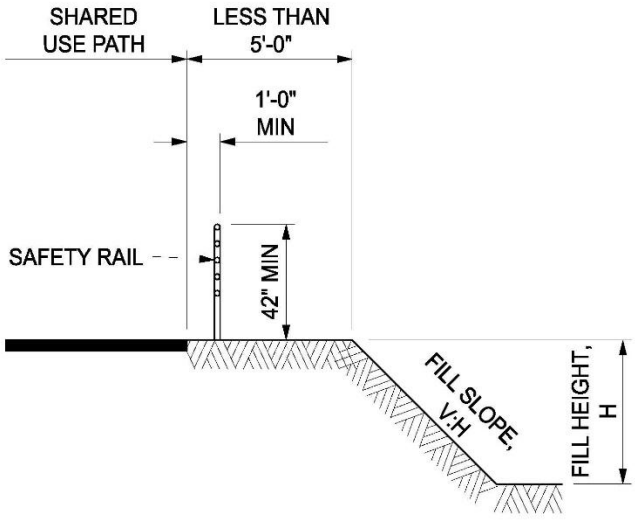
12.12.09J Railings

Railings or fencing are required on structures and should be considered to protect bicyclists from steep side slopes, water or other non-traversable features

Barriers or railings on structures should be a minimum height of 42 inches with 2-foot minimum offset from the edge of the path. Fence or rail openings should be such that a 6-inch sphere cannot pass through. For portions of a railing higher than 27 inches, openings may be spaced such that an 8-inch sphere cannot pass through them.

Where a bicyclist's handlebar may come in contact with a railing or barrier, a smooth rub rail should be provided beginning at 36 inches and ranging to a height of 42 inches to 44 inches to reduce the likelihood that a bicyclist's handlebar will be caught by the railing.

For treatment of side slopes, when the edge of the path is less than 5 feet from edge of slope, physical barriers or safety rail is recommended in the following situations.



Safety Rail Warrants – Steep Side Slopes with Hinge Line Offsets < 5 feet	
Fill Slope, (V:H)	**Fill Height, H**
1:3 or steeper	≥ 6 feet
1:2 or steeper	≥ 4 feet
1:1 or steeper	≥ 2 feet

For any application, the ends of the barrier or fence should be flared away from the path edge. Barrier or fence endings less than 2 feet from the path edge should be marked with object markers.

12.12.09K Shared-Use Facility Railroad Crossings

Shared-use paths should cross between 60°-90° angles to the tracks. ADA compliance is required according to Standard Plan R-28-Series. The Railroad Coordination Unit – Office of Rail should be contacted for design details of the crossing, including crossing material, flange filler, and appropriate signing and warning devices.

12.12.09L Interchanges

An important principle in designing interchanges that accommodate shared use paths is to reduce motor vehicle speeds at locations where pedestrians and bicyclists either cross the road, or merge with traffic. For this reason, urban interchange design with conventional 90 degree intersections (instead of free flow merge lanes) is preferable for pedestrian and bicycle safety. Interchange designs that enable motor vehicles to maintain speeds above 30 mph without stopping are not conducive to pedestrian and bicycle access and should be avoided. Shared use paths should cross interchange ramps at a 90° angle.

12.12.09M Curb Cuts and Bollards

Curb cuts for shared-use paths are the same as for sidewalk ramps (See Standard Plan R-28-Series). Detectable warnings or truncated domes provide identification of the intersection of a pathway with a roadway or signalized or stop controlled driveway for persons with sight impairments.

Restricting access of motor vehicles through the use of bollards or similar barriers placed within the travel portion of the shared-use path is dangerous for the bicyclists and is discouraged. Efforts should be made to design the path-roadway intersection so that it does not look like a vehicle access point.

Directional strategies include signing or splitting the pathway entrance into two one-way pathways through the use of a median with natural landscaping at the roadway. The split entry way should consist of two 5-foot cross sections with approximately 4 feet of low landscaping in the middle. Emergency or maintenance vehicles can enter by straddling the landscape.

12.12.10 Design Features of On-Road Bicycle Facilities

(revised 12-21-2017)

On-road facilities include bicycle lanes, paved shoulders or marked shared lanes.

Facilities should be designed with the context of the location in mind and in coordination with the Region, TSC, Pedestrian and Bicycle Coordinator and the Pedestrian and Bicycle Safety Engineer.

The basis for the design of bicycle facilities is the AASHTO "Guide for the Development of Bicycle Facilities, 4th Edition, 2012". Bicycle design standards for most critical criteria are met or exceeded by MDOT standards required for the roadway. Formal design exceptions or variances for "lane width" are required when standard bicycle lane widths are not met. If a roadway width or bridge width is insufficient to accommodate minimum bicycle lane widths, the bicycle lane may be eliminated or alternatives may be investigated such as intermittent bike lane termination or transition to shared lanes. This situation should be considered in coordination with the Bicycle/Pedestrian Coordinator and/or the Pedestrian and Bicycle Safety Engineer.

12.12.10A Facility Type – Posted Speed

If properly designed for motor vehicles, roadway design elements such as stopping sight distance, horizontal and vertical alignment grades, superelevation and cross slopes will meet or exceed the minimum design standards applicable to bicyclists.

Rather than being a basis for determining the design of the bicycle facility's geometric features, the roadway posted speed is a basis for selection of on-road facility type.

Bicycle lanes can be used on any road. For roads with higher posted speeds (greater than 35 mph) and/or volumes additional bike lane width or buffered bike lane should be considered.

Marked shared lanes can be used on roads with posted speeds 35 mph or less.

12.12.10B Width

1. Bike Lanes

   For roadways with no curb and gutter and no on street parking, the minimum width of a bicycle lane is 4 feet. Along sections of roadway with curb and gutter, a usable width of 4 feet measured from the edge of gutter pan to the center of the bike lane line is required. For roadways where the bicycle lane is adjacent to curb, guardrails or other vertical surface, the minimum bicycle lane width is 5 feet.

   Where on-street parking is allowed, the bicycle lane should be placed between the parking lane and the vehicle travel lane. The minimum width of the bicycle lane next to a parking lane is 5 feet with 6 feet recommended.

2. Shared Lanes

   All vehicle travel lanes where bicycles are permitted, whether they are marked or unmarked, are considered shared lanes.

   Shared-lane markings can be used in situations where it is desirable to provide higher level of guidance to bicyclists and motorists, but the roadway lacks sufficient width to provide bicycle lanes. Shared lanes can be marked using the shared-lane marking ("sharrows"), regardless of width. See the MMUTCD or AASHTO Bicycle Guide for guidance on proper marking placement.

   Wide (13 feet or greater) lanes, marked or unmarked, can better accommodate the passing of bicycles and decrease or eliminate vehicle encroachment into the adjacent lane. Bike lanes are recommended when shared lane widths are 15 feet or greater, whether they are marked or unmarked. Wider shared lanes may encourage increased motorist driving speeds and may increase the level of bicyclist discomfort.

3. Paved Shoulders

   Paved shoulder width minimum is 4 feet, or 5 feet wide on curbed roadways or were vertical obstructions such as guardrail, signs or bridge abutments are adjacent to the roadway. Shoulders should be 6 feet where rumble strips are used (see Standard Plan R-112-Series). Paved shoulders in rural locations are generally not designated as a bicycle lane.

12.12.10C Intersections

Special attention should be given to on-road bicycle travel when designing intersections whether traditional or a roundabout. At a traditional signalized intersection, when the signal is actuated it is essential to consider the ability of a bicycle in the roadway or bicycle lane to activate the signal. Consult the MMUTCD and 2012 AASHTO Guide for the Development of Bicycle Facilities for guidance on intersection design and signals.

At signalized intersections with a designated right turn lane, the bicycle lane should be transitioned to the left of the designated right turn lane. If ROW is not sufficient to allow for a designated bicycle lane and a right turn lane, the bicycle lane can be terminated prior to the right turn lane and started again on the far side of the intersection. This situation should be carefully consider and designed in coordination with the Bicycle and Pedestrian Coordinator and/or the Pedestrian and Bicycle Safety Engineer.

12.12.10D Roundabouts

Bicycle lanes should not be located within the circulatory roadway of roundabouts. Bicycle lanes should be terminated 100 feet in advance of the circulatory roadway. At roundabout exits, an appropriate taper should begin after the crosswalk and the bicycle lane resume as soon as the normal bike lane width is available.

Some bicyclists may not feel comfortable riding through the roundabout. Bicycle ramps can be constructed to allow access to the sidewalk or shared use path at the roundabout. Bicycle ramps should be placed at least 50 feet prior to the crosswalk and at the end of the full width taper at a 35° and 45° degree angle to the roadway. Bicycle ramps at the roundabout exits should be built with similar geometry and ramp placement as entries. Bicycle ramps should be placed at least 50 feet beyond the crosswalk at the roundabout exit.

12.13 CARPOOL PARKING

12.13.01 General

(revised 12-15-1997)

The energy crisis of the early 1970s led to the development of a number of ridesharing programs such as Park and Ride in urbanized areas and the Statewide Carpool Parking Lot Program in rural areas. Park and Ride lots serve carpoolers, vanpoolers, and local bus commuters by providing vehicle parking at commuter transit stops. These lots are financed with transit funds and are eligible for federal funding. In the past, UPTRAN coordinated lot development with local agencies which often assumed maintenance responsibilities. State involvement in Park and Ride development has been limited in recent years. The Statewide Carpool Parking Lot Program was established in 1974 and provides vehicle parking for carpool and vanpool participants. These lots are not served by transit. Planning administers the Carpool Parking Lot Program using state trunkline funds. Federal funding is now available through the Congestion Mitigation and Air Quality Improvement Program (CMAQ) of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) for the three non-attainment areas in Michigan.

The planning process for new lots begins with requests from the Department's Region/TSC Offices, public agencies, legislators, and individual citizens. These requests are reviewed by Planning in accordance with site selection criteria such as demonstrated demand, location, accessibility, land availability/ cost, topography, construction costs, alternative sites and future road improvement plans. These criteria are used to evaluate the feasibility of excess ROW. parcels as potential lots (the preferred method), as well as privately owned property where leasing or buying is under consideration. Property of adequate size for future expansion (if use warrants it) is also desirable.

12.13.02 Design Considerations

(revised 10-18-2010)

12.13.02A ROW

Of first importance when starting a project, the designer should check the status of the proposed ROW. If indeed the proposed excess ROW. is no longer available, the parking lot may be canceled at this stage, and any prior design work would be wasted.

12.13.02B Borings

Too often in the past it has been assumed that property outside the limits of previous construction has remained in an untouched, natural state in the interval. Park and ride lots are usually low-budget projects anyway, and to discover 4 feet of previously wasted topsoil during construction can impose a severe strain on both the allotted funding and perhaps on a small contractor who does not possess large earth-moving equipment. The Region/TSC Soils and Materials Engineer should be requested to provide foundation recommendations for the proposed site development.

12.13.02C Survey

Usually, because of the desire to minimize engineering costs, little has been done in the way of obtaining a survey of the parking lot site. This has resulted in some lots being poorly fit to the site. If possible, Surveys should be asked to provide cross sections of the site, as well as topography, which will usually be minimal. Construction Survey personnel are sometimes available at the Region/TSC level to assist in establishing boundary lines, taking topo, or furnishing grades. (Such assistance should be requested through the Region/TSC Field Engineer.) At the least, the designer should take a few hand-level shots of the area.

12.13.02D Surfacing

Surfacing type on a park and ride lot is determined by its relative importance; minor lots for which funding is limited will usually have a gravel surface, while major ones near urban areas may be gravel and hot mix asphalt. The Region/TSC Soils and Materials Engineer may recommend increased surface thickness, edge drains, or geotextiles to correct unsuitable conditions. As a minimum, 6 in of gravel should be used for surfacing. If an HMA surface course is added, it should be in at least two courses totaling 250 lbs/syd. When the lot is served by local transit service buses, which weigh an estimated 47,000 lbs when fully loaded, the paving of driving lanes used by these buses should be based on recommendations of the Region/TSC Soils and Materials Engineer.

Driveway approaches to all park and ride lots should be paved, whether the lot is paved or not. The approach paving should extend from the roadway pavement edge to the outside edge of the parking lot. Curb and gutter on the approaches may be considered on a project-by-project basis.

When the parking lot is to be used in conjunction with an urban bus route, serving as a transfer point, a concrete pad should be provided for the bus stand. Experience has shown that under extensive use, leaking diesel fuel can deteriorate a hot mix asphalt pavement within one year. Provide a concrete pad of 9-inch thick reinforced concrete, 60 feet x 12 feet for one bus, or 120 feet x 12 feet for two buses. Because buses are only loading and unloading and then moving on in most cases, there is no need for more than two pads.

Tar emulsion protective seal coat should be omitted on park and ride lots.

12.13.02E Cross-slope

A change of 1% cross-slope over the expanse of a parking lot will have a pronounced effect on the elevation at the edge of the lot. This is why existing ground cross sections are valuable in determining the direction of desirable cross-slope and whether the lot should slope all one way, towards one corner, or be sloped both ways from a center high point. Cross-slope should be on the order of 1.5% or 2%.

12.13.02F Pavement Markings

The layout of a typical paved parking lot is shown under Section 12.13.02I. Pavement markings are customarily included in the contract. See Traffic and Safety Pavement Marking Standards for details of pavement marking layouts.

Contrary to previous determination, the Attorney General's Office has advised that under subsequent and current federal law (28 CFR Part 36), accessible parking at MDOT car pool / park and ride lots is required. The number of accessible parking spaces required by the federal code is shown below.

Total Parking in Lot	* Required Minimum Number of Accessible Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2 percent of total
1001 and over	20, plus 1 for each 100 over 1000

* 1 in 6 accessible spaces are van accessible.

12.13.02G Signing

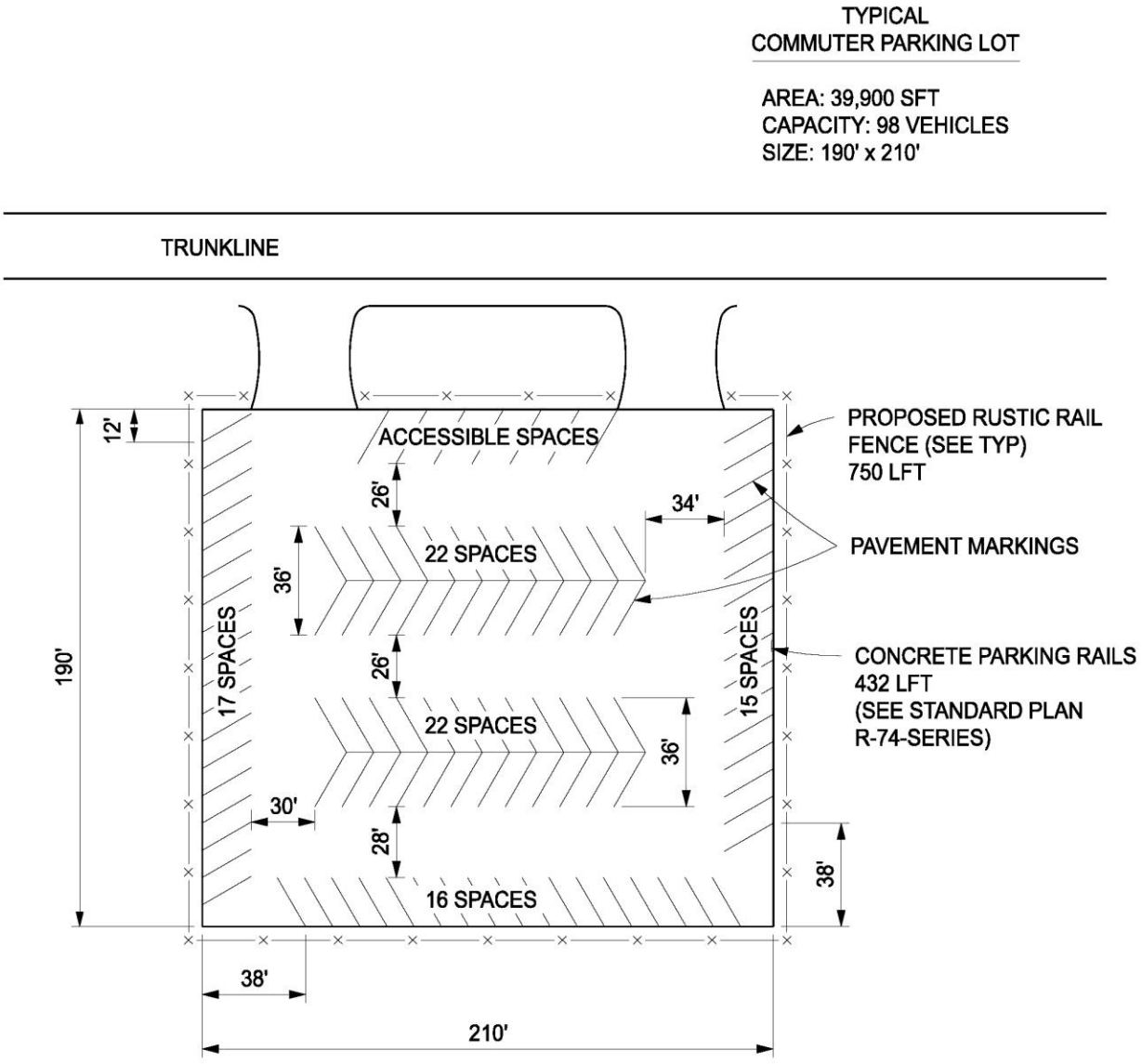
Signing for lots and all signing directing transit users to the lot should be included with the lot construction contract to ensure that it is in place when the lot is opened for use.

12.13.02H Landscaping

Use of landscaping, curbed islands, etc., should be kept to a minimum to reduce maintenance.

12.13.02l Typical Parking Lot

A typical park and ride lot layout is shown below. If this lot were to be served by bus transit, the 26 feet wide outside aisle (parallel to the trunkline) would be increased to 30 feet wide. If the lot was in an urban area close to a residential zone and buses served the lot, the rustic rail fence should perhaps be deleted in favor of a screening wall or an earth berm (if room permits).



12.14 TRUCK TRAPS

12.14.01 Purpose and Description

Truck traps, also known as truck escape ramps and arrester beds, are relatively new in Michigan. They are placed on long, steeply descending grades to arrest the progress of a runaway truck that has lost its brakes. The presence of a town, village, or major intersection at the bottom of the grade will usually be a determining factor governing the construction of such a facility.

The trap consists of a ramp leading to a bed of "soft" gravel in which the truck will mire down and be stopped. If the ramp and arrester bed can be on an upgrade, so much the better.

There is one truck trap in Michigan on M-72 west of Traverse City and west of the M-22 intersection. It was constructed in 1978 at a cost of $66,400.

12.14.02 Design Details

(revised 12-15-1997)

The aggregate in the truck trap should be a rounded, gap-graded natural stone to render the bed both unstable and immune to freezing. Crushed aggregate should definitely ***not*** be used.

The trap at Traverse City utilizes a bed of peastone 485 feet long. The bed has 1:2 sloping sides in cut, and the bottom width is 30 feet. The bottom slopes to one side at 2%. The depth of peastone varies from 1-foot at the beginning to approximately 3.5 feet at the end. The ramp leading to the trap is hot mix asphalt, 20 feet wide, with 5 feet gravel shoulders.

CHAPTER 13 • MISCELLANEOUS PAY ITEMS

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13.03.02 Selective Thinning - Type I

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13.04.02 Removing Trees and Stumps

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13.04.03 Removing Culverts and Sewers

13.04.03A Removing Pipe Culverts

13.04.03B Removing Culverts Other Than Pipe

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13.04.03E Salvaging Culvert End Sections

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13.05 OTHER COMMONLY USED MISCELLANEOUS ITEMS

13.05.01 Obliterating Roadway

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13.05.05 Mobilization

13.05.06 Escalator Clauses - Fuel, Asphalt, Cement, and Steel

13.05.07 Deleted

CHAPTER 13 • MISCELLANEOUS PAY ITEMS

13.01 REFERENCES

(revised 12-22-2011)

A. Guide to Management of Roadside Trees in Michigan, MDOT

B. MDOT Soil Erosion and Sedimentation Control Manual, Construction Field Services Division

C. Roadside Design Guide, Current Edition

D. Standard Plan R-96-Series “Soil Erosion & Sedimentation Control Measures”

E. “Soil Erosion & Sedimentation Control Measures”

F. Standard Specifications for Construction, Current Edition

13.02 CLEARING

13.02.01 General

(revised 7-10-2006)

All wooded and brushy areas, individual trees, and rows of trees within the construction limits should be set up for clearing or removing trees. The Standard Specifications for Construction state that the clearing limits shall extend 10 feet outside the slope stake line or to the Right-of-Way line, whichever is less. For design purposes, it has been determined that clearing should be figured to 5 feet outside the slope stake line. Contact the Roadside Development Unit for limits of clearing in parks, rest areas, and other environmentally sensitive areas.

The pay item “Clearing” is measured by the acre. Clearing measured by the station should be avoided because of possible confusion over what vegetation needs to be removed. It is intended that clearing measured by the station will only be used for long narrow strips of brush, such as along fence rows or in other similar conditions. See Section 13.02.07, Clearing for Fence. When the designer determines that clearing measured by the station is desirable a special provision is required.

13.02.02 Clearing in Water Storage and Wetland Mitigation Areas

(revised 12-22-2011)

Generally, vegetation in storm water storage areas should be removed if the area will have standing water from a few days to possibly a month. This needs to be done since the trees, if left in place, may die as a result of being in standing water. Consult the Region/TSC Resource Specialist to determine if any vegetation should remain in place.

Clearing for wetland mitigation areas should be discussed with the Design Division Environmental Specialist and with the Region/TSC Resource Specialist. The clearing limits can then be determined.

13.02.03 Clearing for Vision on Horizontal Curves

The quantity for clearing in clear vision areas should be shown separately and the limits indicated on the plans as "Clearing for Clear Vision." The quantity for clearing in clear vision areas may be included in the clearing quantity or considered included in other pay items. Horizontal sight distance should be examined throughout the project, including horizontal curves, intersections, and clear vision corners.

See Section 3.03.01D for sight distance considerations.

13.02.04 Clearing – Disposition of Timber

(revised 12-22-2011)

The Standard Specifications for Construction provide various methods of disposing of merchantable timber depending on ownership and type of Right-of-Way. These are summarized below:

13.02.04A Land Owned by the USDA Forest Service or DNR

Merchantable timber is the property of the USDA Forest Service or DNR and shall be cut and disposed of as agreed to by the Department and the USDA Forest Service or DNR.

13.02.04B Private Land

1. ***Right-of-Way Easements*** - Merchantable timber shall be cut and piled outside the Right-of-Way for the abutting property owner. The Contractor shall provide the Engineer with the property owner's written direction for the disposal of the marketable timber. If the owner does not want the marketable timber, it will become property of the Contractor and shall be salvaged and made available to wood using industries or individuals.
2. ***Right-of-Way Purchased in Fee Simple*** - Merchantable timber shall become the property of the contractor and be made available to wood using industries or individuals.

13.02.05 Clearing - Showing of Plans

(revised 2-27-2012)

In preparing plans with the pay item "Clearing," designers are to be governed by the following instructions:

1. Plans that call for Clearing in land owned by the USDA Forest Service or DNR should show USDA Forest Service or DNR ownership.
2. Clearing quantities should be broken down in area for land owned by the USDA Forest Service, DNR, or private ownership. This breakdown is for the information of the bidder only. There will be only one bid item for Clearing, which will include the total area shown in the plans.
3. The Department attempts to buy all Right-of-Way that is to be used for highway purposes in fee simple (except for land owned by the USDA Forest Service or DNR). However, there may be cases, such as widening jobs on existing Right-of-Way, where easements have been obtained. In such cases, the bidder should know the areas where the easement specification for Clearing applies. Any question relative to whether the Right-of-Way is easement or fee simple may be referred to the Technical Unit of the Development Services Division.
4. When surveys provide classification on tree and brush information (see following table), this information should be shown on the plans. This information helps the contractor determine the clearing bid price.

CLASSIFICATION OF TREES AND BRUSH

CLASSIFICATION	CLEARING SIZE	AVERAGE SPACING OF TREES CENTER TO CENTER LIGHT	AVERAGE SPACING OF TREES CENTER TO CENTER MEDIUM	AVERAGE SPACING OF TREES CENTER TO CENTER HEAVY
1ST CLASS	Diameter Greater Than 36 inches	15 feet or More	10 feet to 15 feet	10 feet or Less
2ND CLASS	Diameter Greater Than 18 inches to 36 inches	20 feet or More	10 feet to 20 feet	10 feet or Less
3RD CLASS	6 inches to 18 inches Diameter	10 feet or More	3 feet to 10 feet	3 feet or Less
4TH CLASS	Brush Less Than 6 inches In Diameter	One Half Covered	Two Thirds Covered	Completely Covered

13.02.06 Clearing - Recheck

(revised 4-20-2015)

When more than one year has elapsed between the time of The Plan Review and the advertising date of a project, it may be necessary to request a field recheck on the clearing limits and classification of the trees and brush.

13.02.07 Clearing for Fence

Clearing for Fence is the removal and disposal of trees, brush, stumps, and other vegetation located along a fence line. It also includes treating stumps and stubs within 1 foot of the fence line with a material to prevent the sprouting of new growth. Maximum width of the clearing zone is 8 feet within the Right-of-Way. Measurement for Clearing for Fence will be by station.

13.02.08 Clearing and Removing Trees on Freeway New Construction of Reconstruction Project Types

(revised 9-22-2025)

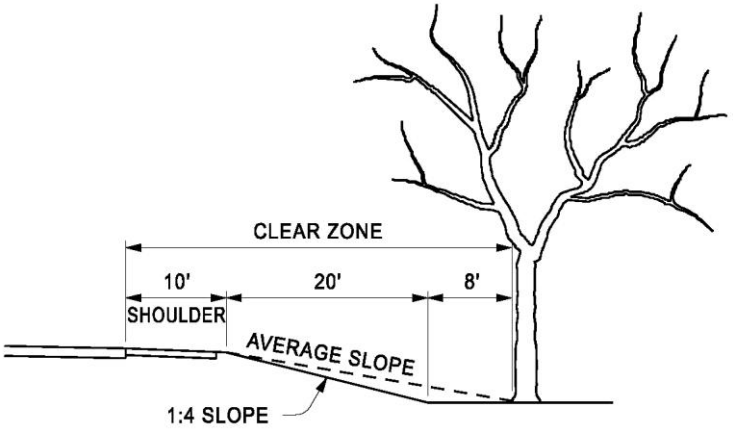
The following guidelines were developed for a 1991 resurfacing project on I-75 north of Grayling. These guidelines have the approval of FHWA and concerned Department scenic and environmental specialists.

The designer should develop a special provision based on the following guidelines, and input from the Region/TSC Resource Person, the Roadside Development Unit, and Traffic and Safety using the following criteria based on existing slopes:

Slopeline	From Pavement Edge Clear to [number] feet Fill Slope	From Pavement Edge Clear to [number] feet Cut Slope
1:3	N/A	25
1:4	40	26
1:5	38	30
1:6	33	30

These distances are within the range of acceptable clear zone distances given in Table 3.1 of the AASHTO ***Roadside Design Guide***. Note that the above distances are on the mid to low side of the range of values from the table. Higher values should be considered on the outside of horizontal curves with a radius of 2900 feet or less or where there is a crash pattern.

Variable slopes should be averaged before applying the above guidelines. Slope averaging applies from the shoulder point out. For example: a 1:4 slope meeting a flat slope for some distance before meeting the tree line would be averaged to something flatter than a 1:4. The following sketch gives an example of slope averaging.



NOTE:
SLOPE AVERAGING IS FROM THE SHOULDER POINT OUT.

EXAMPLE:
20' AT 1:4 SLOPE = 5' DROP
8' FLAT = 0' DROP
AVERAGE SLOPE 28/5 = 5.6 SLOPE
1:4 SLOPE REQUIRES 40' CLEAR ZONE
1:5 SLOPE REQUIRES 38' CLEAR ZONE
EXAMPLE HAS 38' CLEAR ZONE WITH 1:5.6 AVERAGE SLOPE
THEREFORE THE TREES CAN BE LEFT

Because of the sensitive nature of tree removal, both to the Department and to the public, good information is necessary before the design can be completed. The designer should obtain the following information:

1. Crash history covering at least a five-year period.
2. Accurate measurements from the edge of pavement to individual trees and tree lines.
3. An accurate slope survey indicating slopes and changes in slopes from the shoulder point to the trees. This information should be complete enough so that slopes can be averaged.
4. A list of environmental concerns from the Region/TSC Resources Specialist.

For additional background information the designer should refer to Chapter 3, Geometrics, Section 4 of the current edition of the AASHTO ***Roadside Design Guide*** dealing with “Trees”, and MDOT's ***"Guide to Management of Roadside Trees in Michigan"***.

13.03 SELECTIVE THINNING

13.03.01 General

(revised 11-28-2001)

Selective Thinning is the removing and disposing of dead, diseased, poorly formed or undesirable trees outside the area designated for clearing. This item also includes removal of undergrowth, stumps of uprooted trees, all debris and treating stumps and stubs with a growth preventive material where required.

The Roadside Development Unit and the Region/TSC Resource Specialist should be consulted when setting up areas for selective thinning.

The Standard Specifications for Construction provide for two types of selective thinning.

13.03.02 Selective Thinning - Type I

(revised 11-28-2001)

This is to be used in areas within the highway Right-of-Way where a stump not more than 6 inches above existing ground level may be left in place and treated the same day with a material to prevent new growth.

13.03.03 Selective Thinning - Type II

(revised 11-28-2001)

This is to be used in rest area sites and in other areas where it is desirable to have the stump removed to 4 inches below the proposed ground level.

13.04 REMOVAL ITEM

13.04.01 Removals

(revised 11-28-2001)

The extent of removals should be shown or noted on the plans using the conventional "legend sheet" symbols. Any information concerning removals, such as pavement thickness, types, and depth of structures, thickness of hot mix asphalt (HMA) surfacing, etc., should also be shown on the plans. Removal limits, if possible, should be made at existing construction joints of concrete items.

13.04.02 Removing Trees and Stumps

(revised 11-1-2002)

The plans should indicate which trees and stumps will be removed within the Right-of-Way and outside of areas estimated for clearing. Removing trees and stumps less than 6 inches in diameter will be included in other contract pay items. All fruit trees within the Right-of-Way shall be removed.

13.04.02A Tree Removal for Completely New Construction for Rural Projects

1. Remove all trees within the established clear zone. See Section 7.01.11.
2. Remove all trees less than 50 feet from the nearest edge of pavement on limited access highways.

13.04.02B Tree Removal for Other Roadways

Tree removal, especially in urban areas and along scenic highways, can be an extremely sensitive item. The designer should use the information available for guidance when setting up tree removal. This information is contained in Section 3.09.03.

13.04.03 Removing Culverts and Sewers

(revised 4-20-2015)

13.04.03A Removing Pipe Culverts

The removal of driveway and crossroad culverts will be paid for separately when the old culvert is 12 inches or greater in diameter. Culverts less than 12 inches in diameter will not be paid for separately if any portion of the existing pipe is within the excavation limits of the new structure, culvert or sewer. The pay items "Culv, Rem, Less than 24 inch", "Culv, Rem, 24 inch to 48 inch", and "Culv, Rem, Over 48 inch" will include removing the pipe and any end section treatments.

If the grade of an existing roadway cross-section is changed sufficiently to cause the removal of a pipe culvert in normal grading operations, its removal will be classed as earth excavation and measured and paid for as such.

13.04.03B Removing Culverts Other Than Pipe

The pay item of "Culv, Other than Pipe, Rem" is for removal of Box and Slab Culverts. If the culvert is to be removed it will be paid for separately.

If the structure is to be extended or otherwise incorporated in the new work, only a part of the existing structure need be removed to provide a proper connection for the new work.

13.04.03C Removing Culvert Ends

It is the intent of the Standard Specifications for Construction that the pay items "Culv, End, Rem, Less than 24 inch", "Culv, End, Rem, 24 inch to 48 inch", and "Culv, End, Rem, Over 48 inch" apply only to pipe culverts and should be used whenever an end section must be removed, to extend a culvert, or change the end section. Where box or slab culverts are concerned, the pay item of "Culv, Other than Pipe, Rem" shall apply. The appropriate Culv End Rem pay item is used when the entire culvert is to be removed or when just a portion is to be removed. A note describing what is covered will help the contractor to bid the item. The Culv End Rem pay item includes the removal of any end treatment regardless of size, including end sections, sloped end sections, and headwalls.

13.04.03D Removing Sewers

The pay items “Sewer, Rem, Less than 24 inch”, “Sewer, Rem, 24 inch to 48 inch”, and “Sewer, Rem, Over 48 inch” are covered in the Standard Specifications for Construction. The provisions are very similar to the culvert removal items. The pay unit for the Sewer, Rem pay items is in "feet", however, instead of the "each" pay unit used for removing culverts.

13.04.03E Salvaging Culvert End Sections

Culvert end sections to be salvaged and re-used shall be removed without damage and stored outside the construction limits. The designer should consider salvaging end sections if The Plan Review or other field inspections show ends to be in good condition, but need to be reset because of culvert extensions or other reasons.

13.04.04 Removing Culverts and Sewers

(revised 4-20-2015)

13.04.04A Pay Items

Pay items for removing miscellaneous structures include the following:

- Pavt, Rem
- Curb, Rem
- Gutter, Rem
- Curb and Gutter, Rem
- Sidewalk, Rem
- Basement Cleanout
- Track, Rem
- Utility Pole, Rem
- Structures, Rem
- Structures, Rem Portions
- Culv, Other than Pipe, Rem
- Masonry and Conc Structure, Rem
- Guardrail, Rem
- Fence, Rem
- Concrete Barrier, Rem
- Glare Screen, Rem

13.04.04B Removing Pavement

Removal of HMA pavements and concrete or masonry pavements is covered in the Standard Specifications for Construction. The specifications for HMA pavements are somewhat confusing as they include both removing pavement and removing HMA surface items. The table in Section 6.03.04B(6) shows clearly the proper pay items for different situations.

13.04.05 Vertical Exploratory Investigation for Relocation

(added 6-24-2024)

If the designer has reason to believe that proposed work may require relocation because of a conflict with existing features (abandoned facilities, foundations, etc.) during construction operations, the Special Provision for Vertical Exploratory Investigation for Relocation should be used.

Use of this special provision includes, but is not limited to, the following situations.

- Exposing culverts, sewers, etc.
- Exploratory situations (moving planned work and a utility conflict is uncertain)
- When existing survey information may be incomplete
- When drainage patterns may be unknown
- When SUE is unable to be performed because of existing traffic constraints
- Areas of congested utilities where identification of all probable conflicts could not be reasonably identified per our design process

The pay item will compensate the Contractor to locate and expose underground infrastructure and obstructions, such as culverts, sewers and utilities, as needed. The special provision is not to compensate the Contractor for the Contractor's responsibilities in subsection 107.12 of the Standard Specifications for Construction. The special provision and pay item are not to be used to expose existing marked utilities as that is a requirement in subsection 107.12.

13.05 OTHER COMMONLY USED MISCELLANEOUS ITEMS

13.05.01 Obliterating Roadway

(revised 4-20-2015)

Obliterating Roadway is completely eliminating old roads or temporary roads that are no longer needed. It shall apply only to those portions of the existing or temporary road outside the limits of the new roadway. The old road to be obliterated shall be graded to provide suitable drainage and produce an appearance of blending into the adjacent terrain. During The Plan Review, it should be discussed whether to bury the road surface or remove the road surface. When burying the road is not a viable option, the road surface should be set up for removal and paid for separately before obliteration begins. Ditches should be filled or graded to give a natural appearance. Old Structures should be broken down and buried or removed. The removal of large structures may be paid for separately. Obliterated areas shall be topsoiled, seeded, fertilized and mulched which will be measured and paid for separately. Obliteration may be accomplished by breaking the pavement surface to provide drainage and covering the roadway to a depth of at least 12 inches with suitable material.

13.05.02 Project Cleanup

"Project Cleanup" consists of cleaning up the project, including roadsides, prior to final acceptance. Project Cleanup provides for the removal of all debris, including old fences, fallen timber, logs and rubbish, within the Right-of-Way up to 50 feet beyond the grading limits. This work also includes the clean out of all culverts, sewers, and drainage structures that contain sediments from the contractors operations.

Project Cleanup should be included as a pay item on most projects.

13.05.03 Field Offices and Laboratories

(revised 4-20-2015)

Field Offices and Laboratories are needed on some projects for making field tests and housing office activities. Usually, facilities are available to the Department and the Contractor is not required to furnish a separate field office. The designer should place a note on The Plan Review prints asking if a field office is required.

13.05.04 Transporting Salvaged MDOT Material

(revised 8-19-2013)

Salvaged MDOT material, specifically signs and sign supports, are removed, transported and stockpiled during construction. The storage location for these items on all projects will be the MDOT Overhead Sign Shop in Lansing. Federal participation in the cost of this work is limited to a five mile haul distance. Therefore the pay item should always be considered 100% state funded. The designer should specify the storage location by note. See Traffic Signing General Notes.

13.05.05 Mobilization

Mobilization is to reimburse the contractor for initial costs incurred prior to starting work on the project. This consists of preparatory work and operations for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of the contractor's offices, buildings, and other facilities necessary to undertake the work on the project. It also includes other work and operations that must be performed, or for expenses incurred, prior to beginning work on the various contract items on the project site. This item applies to all projects.

13.05.06 Escalator Clauses - Fuel, Asphalt, Cement, and Steel

When Management determines material price inflation is a concern, it is sometimes desirable for the Department to let contracts with escalator clauses. These escalators allow for adjustments in prices of basic materials that may inflate during the life of the contract. This allows contractors to bid certain items to allow for inflation during the life of the contract.

When management determines that an escalator clause will be used, a special provision will be required setting forth the terms and methods of determining applicable price adjustments.

13.05.07 Deleted

Section deleted.

CHAPTER 14 • PROCEDURES FOR PLAN PREPARATION

14.01 GENERAL
14.02 DESIGN PACKAGE EVALUATIONS
14.03 ESTIMATES
14.03.01 Definitions
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14.12.01 Road
14.12.02 Bridge
14.13 PROJECT AREA CONTAMINATION SURVEY
14.14 REVIEW / REVISE PLANISWARE NETWORK
14.15 CHANGE REQUEST (REVIEW OF PROJECT SCOPE, COST AND SCHEDULE)
14.16 REQUEST FOR UTILITY INFORMATION
14.17 FAA OBSTRUCTION EVALUATION
14.18 PAVEMENT DESIGN
14.19 REQUEST FOR PAVEMENT CORES / SOIL BORINGS
14.20 RECEIPT OF SURVEY / MAPPING DATA
14.21 BRIDGE REVIEW
14.21.01 Review by Bridge Design
14.21.02 Historic Bridges
14.21.03 Bridge Loading and Under Clearance Review
14.21.04 Special Structures/Footing Design

14.22 RAILROAD COORDINATION

14.23 REQUEST FOR TRAFFIC VOLUMES

14.24 REQUEST FOR CRASH ANALYIS AND SAFETY REVIEW

14.25 REQUEST FOR SPECIAL SOILS INVESTIGATIONS AND/OR DESIGNS

14.26 DISTRIBUTION OF PRELIMINARY PLANS TO UTILITIES AND UTILITY COORDINATION MEETING

14.27 VALUE ENGINEERING

- 14.27A Definitions
- 14.27B Federal Regulation
- 14.27C Procedures

14.28 REQUEST FOR PRELIMINARY MAINTAINING TRAFFIC

14.29 PRELIMINARY GEOMETRIC REVIEW FOR NEW CONSTRUCTION, RECONSTRUCTION, OR CONSTRUCTION ON EXISTING ROAD PROJECT TYPES

14.30 PRELIMINARY CONSTRUCTABILITY REVIEW

14.31 ENVIRONMENTAL REVIEW AND CLEARANCE

- 14.31.01 Environmental Classification
  - 14.31.01A Preliminary Design Activity
  - 14.31.01B Mitigation Requirements
  - 14.31.01C Special Design Considerations Memo
- 14.31.02 Environmental Certification

14.32 MDOT ENVIRONMENTAL PERMITS

- 14.32.01 Clearance
- 14.32.02 Oversight
- 14.32.03 Application
- 14.32.04 Duration
- 14.32.05 Issued Permits

14.33 PRELIMINARY ROW SUBMITTAL

14.34 DELETED

14.35 FINAL ROW SUBMITTAL

14.36 THE PLAN REVIEW

- 14.36.01 Requirements
- 14.36.02 Procedure

14.37 REVIEW OF PROJECT SCOPE, COST AND SCHEDULE

14.38 ROW REVISIONS

14.39 UTILITY STATUS REPORT CERTIFICATION
14.40 EGLE PERMITS FOR SEWER AND WATER MAINS
14.41 PARTICIPATION AGREEMENTS
14.41.01 General
14.41.02 Estimates
14.41.03 Act 51 Participation
14.41.03A Participation Items
14.41.03B Non-Participation Items
14.41.04 Deleted
14.41.05 Extra Width Construction or Resurfacing
14.41.06 100% Betterment for Local Party (non-trunkline work)
14.41.07 Municipal Utilities
14.41.08 Bicycle Paths
14.41.09 Turnbacks
14.41.10 Parking
14.41.11 Special Maintenance and Operational Obligations
14.41.12 Michigan Institutional Roads (MIR Program)
14.42 SPECIAL USE PERMITS
14.43 SPECIAL DRAINAGE DESIGNS
14.44 COUNTY DRAIN REVIEW
14.45 MAINTAINING TRAFFIC AND CONSTRUCTION STAGING
14.46 FINAL GEOMETRIC AND SAFETY REVIEW
14.47 RIGHT-OF-WAY MONUMENTING
14.47.01 New Construction
14.47.02 Improvements Requiring ROW Acquisition
14.47.03 Improvements Not Requiring ROW Acquisition
14.47.04 Coordination
14.48 REQUEST FOR TURF ESTABLISHMENT RECOMMENDATIONS
14.49 DELETED
14.50 FINAL CONSTRUCTABILITY REVIEW
14.51 INCENTIVE AND LIQUIDATED DAMAGES CLAUSES
14.51.01 Guidelines
14.51.02 Applications
14.51.03 Procedure

14.52 REVIEW OF PROJECT SCOPE, COST AND SCHEDULE

14.53 DELETED

14.54 FINAL PROJECT COORDINATION (FPC)

14.54.01 Requirements

14.54.02 Procedure

14.54.03 Attendees

14.55 CONTRACT SELECTION TEAM (DBE PROGRAM)

14.56 PACKAGING OR CONSOLIDATING PROJECTS

14.57 PLAN COMPLETION & DESIGN PLAN SUBMITAL – CERTIFICATION ACCEPTANCE

14.57.01 Procedure

14.58 APPROVAL OF SPECIAL PROVSIONS

14.59 SHELF PROJECTS

14.60 SUBMISSION OF COMPLETED PLANS

14.60.01 General

14.60.02 Requirements

14.60.03 Exceptions

14.60.04 QA/QC Review

14.60.05 AASHTOWare Project (AP) Preconstruction Files

14.61 PRE-LETTING BRIEFING/PRE-BID MEETING

14.61.01 Procedure

14.62 CONTRACTOR INQUIRIES

14.63 ADDENDA

14.64 POSTPONEMENT, WITHDRAWL, OR REJECTION FROM LETTING

14.65 REFERENCE INFORMATION DOCUMENTS

14.66 TABULATION OF BIDS

14.67 PRE-CONSTRUCTION MEETING

14.68 DESIGN ERRORS PROCESS

14.69 DESIGN PROJECT RECORD

14.70 PLAN REVISIONS

14.70.01 Procedure

14.71 CONTRACT MODIFICATIONS

14.72 POST-CONSTRUCTION REVIEW MEETING

14.73 MARKED FINAL PLANS

14.73.01 Mark-Up Standards
14.73.02 File Standards and Requirements
14.73.03 As-Built Turn In Process
14.73.04 Design Division Review and Approval Process
14.74 DOCUMENT RETENTION
14.74.01 Permanent Records
APPENDIX D – LIST OF ACRONYMS

CHAPTER 14 • PROCEDURES FOR PLAN PREPARATION

14.01 GENERAL

(revised 12-17-2018)

The following list is a basic outline of the road design plan development process. The sequence is not intended to be a rigid format that must be adhered to, but instead, a guide that is flexible enough to apply to all projects. Small projects may not require all the steps, whereas, large projects may require additional meetings, reviews, etc. to properly develop a complete plan/proposal package with input from all the appropriate disciplines. Project Managers should consider value added versus resources expended when omitting, revising, or adding steps to the process.

Numbers in parentheses after a heading refer to a corresponding or similar PPD (Preconstruction Process Documentation) Task Number and/or Milestone Number. For additional information, reference to the PPD Task Manual and individual task descriptions is encouraged.

14.02 DESIGN PACKAGE EVALUATIONS

(revised 2-26-2018)

The Design Package Evaluation (DPE) system has been retired and no longer exists. There is no replacement system at this time.

14.03 ESTIMATES

14.03.01 Definitions

(revised 12-17-2018)

AASHTOWare Project (AP) Preconstruction - AP Preconstruction is an AASHTO software system used for managing transportation programs and is a series of computer program modules. It is used to record and analyze data from the design, estimating, letting, award, and construction processes. MDOT has adopted the following modules at this time.

A. **Construction and Administration System (CAS) -** Is used by construction and utilizes Field Manager to track pay items and quantities in construction.

B. **Decision and Support System (DSS) -** Is used by the Specifications and Estimates Unit to analyze bid data and to determine average unit prices (bid-based prices) when generating detailed cost estimates.

Program Estimates - Cost estimates made prior to the assignment of a project for preliminary and final design.

Preliminary Cost Estimates - Cost estimates made at any time during plan development but prior to plan completion.

Engineer's Estimate - Cost estimate based on final quantities reviewed by the Specifications and Estimates Unit of the Design Division.

Pay Item - The name used to describe an item of work for a project.

Unit Price - The price estimated as the cost to complete one unit of a pay item.

Pay Item Number - A standard pay item number assigned to a pay item for use in AP Preconstruction and other automated systems.

PPD Task Manual - Preconstruction Process Documentation Manual, a.k.a. Project Management Development/Design Task Manual. This manual documents the MDOT preconstruction process pertaining to project development including working steps (tasks).

Method of Measurement - The method used to measure material or work used on a project. Measurement can be by unit, lump sum, or at times included in the measurement for other items.

14.03.02 Program Estimates

(revised 12-17-2018)

Original program estimates are usually made by Region/TSC personnel during the "Call-For-Projects" stage. These early estimates are broken down by major work items, such as; grading, pavement and shoulders, safety items, utilities, drainage, and so forth. Program estimates should be as complete and accurate as possible using such data as type of project, length, historical data, special features, etc. The program estimate is used by the Bureau of Transportation Planning to budget money for the project.

AP Preconstruction is available for use by Region System Managers and Region/TSC Design Engineers when preparing cost estimates. These program estimates are sent to Lansing with the Call-For-Projects submittals. When preparing these program estimates, only major pay item quantities would be estimated and inserted into the program under the proper code number. The resulting construction cost could then be adjusted to include miscellaneous unnamed pay items and for inflation. Use of AP Preconstruction would ensure that uniform and current unit prices would be used by all Region/TSCs for program cost estimates.

Program estimates should be reviewed by the Design Unit upon project assignment and during scope verification. This review should determine any obvious errors or omissions and/or if the estimate is reasonable. If the estimate is not reasonable, the Region/TSC or the author of the scope needs to obtain an approved cost increase or decrease, or re-scope the project. This needs to be completed before beginning the design.

14.03.03 Preliminary Estimates

(revised 12-17-2018)

Preliminary estimates are made periodically throughout the design of the project to update the estimated cost. Design revisions, changes in scope, and changes in project limits all can contribute to increases or decreases in the cost of the project. Changes in cost should be reviewed with the Region System Manager. If the change is sizable, a request to increase or decrease the programmed amount should be sent to the Bureau of Transportation Planning. Increases should be requested as early as possible to avoid a project delay. If the change to the original project budget varies more than ten percent, an approval to the Fiscal Year STIP may also be needed.

14.03.04 Engineer’s Preliminary Estimates

The Engineer's Estimate is the final cost estimate prepared by design before letting. The estimator uses the final quantities, plans and proposal material to estimate the unit prices and project costs. This is the official estimate used by the Department to determine if the low bid is reasonable.

14.04 DELETED

Section deleted.

14.05 PROJECT STUDY TEAM

A Project Study Team is normally formed for all New Routes/Increased Capacity projects and comprises representatives of a number of divisions from various bureaus within MDOT, as well as the FHWA. The purpose of the team is to develop improvement alternatives for evaluation based on environmental, social, community and regional planning, engineering, traffic operations, safety, construction and Right-of-Way cost criteria. The goal of the Study Team is to reach a consensus, based on the evaluation of alternatives, on a recommended course of action for MDOT management approval. The recommendation must be consistent with MDOT strategies and goals.

The Study Team Chairperson is the Project Manager who is responsible for assembling the Project Study Team and who is usually from the Project Development Section of the Design Division. The Road Design Representative on the Study Team will normally be a Design Engineer-Road. The assignment is made similar to that described in Section 14.06 (Project Assignment) of this chapter.

The Road Design Representative is assigned to a Project Study Team to provide practical design information during the Early Preliminary Engineering phase (EPE) when alternatives are developed and analyzed. The Road Design Representative on the Study Team will review all proposed alternatives and recommendations based on criteria of Design Standards and Guides, professional judgement, and construction procedures, and provide studies and cost estimates as may be required. As a Project Study Team member, the Road Design Representative fills an important role in the consensus building process. Such involvement and knowledge of a project's development during the EPE phase can be an invaluable tool since often the Design Engineer-Road is assigned the project once the Preliminary Engineering phase (PE) is initiated.

14.06 PROJECT ASSIGNMENT

(revised 2-26-2018)

MDOT projects that are ready to be designed are sent to the Region System Manager, who determines whether the project is to be designed by a Region/TSC design unit or by a consultant. The project is then assigned and authority transmitted through JobNet to the appropriate Design Unit.

The Design Unit should check the Design Division correspondence files for any pertinent documents that may impact the design of the project. Also, the Design Unit should check to see that all information in both JobNet and Phase Initiator is complete and correct on the electronic data screens for the project.

14.07 PROJECT NUMBERS

(revised 12-17-2018)

A project identification system is used to identify projects. A typical project identification would be: NH50022-05675PE.

Funding Identity: “NH” Identifies the funding category to which the project is being charged. See the Financial Systems Codes for a list of funds. (MDOT only, consultants contact your Project Manager)

Control Section: “50022" The first two digits identify the county (50-Macomb) and, in conjunction with the last three digits, define a specific section of trunkline, as shown in the Control Section Atlas-Report No. 42.

Job Number: “05675" A number assigned sequentially by JobNet. The digits in the number have no significance.

Phase: A phase designation identifies the stage of the project development process.

Additional information

1. A job number cannot be charged against until Phase Initiator indicates the ”PE” or “PE-S” phase has been authorized with a chargeable account number and the Phase shows as “Active” vs “Programmed” in JobNet.
2. Time spent developing ROW plans is charged against the project ”ROW” phase.
3. FHWA has agreed that the “PE” or “PE-S” phase can be charged against up to one month after the letting date (PE end date in JobNet).
4. Charges occurring after the Pre-Construction Meeting should be made against the “CON” phase.

The proper use of phases is outlined in the following table.

Phase	Phase Name	Description	Examples / Notes
EPE	Early Preliminary Engineering	Work related to environmental clearance and classification of the project. Or Work related to study type projects. Or Work related to the design survey of the project. Or Work related to the scoping of the project. Or Work related to the operation of a transportation system component. Or Work that does not readily fit other phase definitions.	Note: design survey work can also be included in the PE or PE-S Phase. Traffic Operations Center (TOC) operations or maintenance.
CON	Construction	Work related to the physical building of transportation system component.	N/A
ROW	Real Estate	Work related to the appraisal and acquisition of Right-of-Way necessary to construct a project, including planning and condemnation activities, and the relocation of displaced persons and personal property. Or Work related to the demolition of or preparation of property to construct the project.	N/A
PE	Road Preliminary Design	Work related to the construction design of the road (non-structure) portion of the project.	N/A
PE-S	Structure Preliminary Design	Work related to the construction design of the structure portion of the project.	Note: JobNet requires a structure number.
UTL	Utility – Reimbursable Relocations	Work related to the project's reimbursable utility relocations.	N/A

14.07.01 Work Type Codes and Descriptions

(revised 12-17-2018)

Each project is assigned a three digit work type code during the Region Call-for-Projects process. These work types exist in JobNet, and are provided here via Planisware for reference. They may change over time. The numbers correspond to the work descriptions listed below:

PRESERVATION

- **Traffic Operations**
  - 100 Raised Pavement Marking
  - 110 Signing Replacement
  - 111 Pavement Marking
  - 112 Traffic Signals
  - 113 Cantilevers/Trusses
  - 114 Sign Replacement
  - 264 Transit Operations
  - 687 Delineation
  - 688 Pedestrian Improvements
- **Safety**
  - 101 Relocate Roadside Obstacles
  - 102 Rumble Strips – Shoulder
  - 103 Intersection Geom. Imp. For Signals
  - 104 Add Turn Lanes for Traffic Volumes
  - 105 Vert/Horiz Alignment Revisions
  - 120 Intersection Revisions
  - 121 Lighting
  - 122 Median Barriers
  - 123 Guard Rails and Attenuators
  - 126 Obstacle Removal
  - 127 Culvert Extensions
  - 128 Safety Upgrading-Slope Flattening
  - 129 Widening for Accident Reduction
  - 615 Security or Surveillance System
  - 690 Centerline Rumble Strips
  - 691 Segment Geom. Imp. for Safety
  - 692 ADA Ramps
- **Railroads**
  - 124 RR Xing Imp & Safety Devices
  - 630 Grade Crossing
  - 633 Railroad Miscellaneous
  - 635 Railroad Track
  - 637 Rehabilitate Spurs

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- **Bridge Preservation**
  - 115 Superstructure Repair
  - 116 Substructure Repair
  - 117 Substructure Replacement
  - 130 Deck Replacement
  - 135 Widening-Maintain Same # of Lanes
  - 137 Superstructure Replacement
  - 139 Miscellaneous Rehabilitation
  - 152 Culvert Rehabilitation
  - 234 Miscellaneous Replace
  - 417 Overlay – Shallow
  - 420 Scour Protection
  - 424 Overlay – Deep
  - 434 HMA Overlay w/Waterproofing Mem.
  - 452 Culvert Replacement
  - 618 Bridge Barrier Railing Replace
  - 621 Superstructure Repair Steel
  - 622 Superstructure Repair Concrete
- **Road Restoration and Rehabilitation**
  - 140 Two Course HMA Resurfacing
  - 141 Bit Resurfacing and HMA Shoulders
  - 142 Bit Resurface-Mill and/or Pulverize
  - 143 Bit Resurface and Minor Widening
  - 144 Thin Concrete Overlay (<=4”)
  - 145 Concrete Overlay (> 4”)
  - 146 Bit Resurface and Drain Improvements
  - 147 Bit Resurface and Curb And Gutter
  - 148 Reconstruct Non-Freeway
  - 149 HMA Resurfacing (One Course)
  - 151 Shoulder Work
  - 153 Pumpstation Rehabilitation
  - 156 Unbonded Concrete Overlay
  - 157 Asphalt Pavement Repair
  - 158 Longitudinal and Transverse Joint Repairs
  - 159 Minor Rehabilitation
  - 165 Concrete Pavement Inlay
  - 166 Concrete Pavement Repair
  - 167 Crush & Shape & Asphalt Resurface
  - 168 Cold In-Place Recycle & HMA Resurf
  - 169 Conc Pavt Rubblize & HMA Resurf
  - 170 Major Rehabilitation
  - 199 General Miscellaneous
  - 250 Multi-Course HMA Overlay
  - 251 Multi-Crs HMA Over Composite Pavt
  - 684 Mill and two Course HMA Overlay
  - 685 Three Course Asphalt Resurfacing
  - 693 Maintaining Traffic
  - 695 Drainage Improvement
  - 696 Curb and Gutter

- **Reconstruction**
  - 160 Reconstruction
  - 162 Interchange Reconstruction Only
  - 163 Concrete Reconstruction
  - 164 Asphalt Reconstruction
- **Minor Widening**
  - 171 Left Turn Lane
  - 172 Right Turn Lane
  - 173 Additional Lanes – Up to ½ mile
  - 174 Passing Relief Lanes
- **Roadsides and Landscaping**
  - 183 Rest Area/Welcome Center Rehab
  - 185 Misc. Roadside
  - 186 Resurface Parking Area
  - 187 Weigh Station Modernization
  - 188 Landscaping Replacement
  - 189 Streetscaping
  - 191 Carpool Lots - Expansion
  - 192 Drainage Assessments
  - 198 Wetland Mitigation
  - 240 Landscaping - Improve
  - 241 Facility Expansion
  - 242 New Non-Motorized Path
  - 243 Parking Area Expansion
  - 244 Sound Barrier Rehabilitation
  - 245 Fence Upgrading
  - 246 New Carpool Lots
  - 247 Rest Area Repair/Rebuild
  - 248 Weigh Station Replace or Rehab

IMPROVE/EXPAND CAPACITY

- **Road**
  - 190 Non-Motorized Path Rehabilitation
  - 210 Add one or more Lanes over ½ mile
  - 212 Recon & Add Lanes over ½ mile
  - 213 Interchange Redesign and Upgrading
- **Roadsides and Landscaping**
  - 243 Parking Area Expansion
  - 244 Sound Barrier Rehabilitation
  - 245 Fence Upgrading
  - 246 New Carpool Lots
- **Bridge**
  - 221 Bridge Replacement
  - 230 Bridge Widen and Add Lanes
- **Railroads**
  - 636 New Spurs

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NEW ROUTES/STRUCTURES

- **Road**
  - 308 Wetland Mitigation for New Route
  - 310 New Road
  - 317 Landscaping New Facility
- **Relocation**
  - 320 New Road – Relocate Existing Route
  - 321 New Structure on Relocated Route
- **Bridge**
  - 311 New Structure on New Road
  - 340 New Interchange on Existing Route
  - 341 New Structure on Existing Route
- **Roadsides and Landscaping**
  - 312 New Sound Barrier – Type II
  - 313 New Rest Area
  - 314 New Welcome Center
  - 315 New Weigh Station
  - 316 New Sound Barrier – Type I
  - 331 Rest Area on New or Relocated Route
  - 332 Welcome Center
  - 333 Weigh Station
  - 335 Landscaping New Facility

PREVENTIVE MAINTENANCE AND MISCELLANEOUS

- **Road**
  - 186 Resurface Parking Area
  - 400 Multiple Course Chip Seal
  - 401 Cape Seal
  - 402 Fog Seal
  - 403 Diamond Grinding
  - 404 Partial Depth Conc Pavt Repair
  - 405 Overband Crack Fill
  - 406 Concrete Crack Sealing
  - 407 Ultra-Thin Bit Overlay (<0.75)
  - 408 Cold Millling & Overlay (<1.5)
  - 409 Hot In-Place Asphalt Recycling
  - 410 Single Course Micro-Surfacing
  - 411 Multiple Course Micro-Surfacing
  - 412 Concrete Joint & Surface Spall Repair
  - 413 Dowel Bar Retrofit
  - 414 Paver Placed Surface Seal
  - 415 Concrete Pavement Restoration
  - 416 New Treatment Tech – Conc Pavts
  - 440 Single Course Chip Seal
  - 441 Slurry Seal
  - 442 Skip Patching
  - 443 Bituminous Overlay (<1.5)
  - 444 Profile Milling
  - 450 Full Depth Concrete Pavement Repair
  - 451 Bituminous Shoulder Work
  - 453 Underdrain Outlet Repair & Cleaning
  - 454 Shoulder Slurry Seal
  - 455 Shoulder Chip Seal
  - 456 Bituminous Crack Treatment
  - 457 Concrete Joint Resealing
  - 459 New Treat Tech - Flex & Comp Pavts
  - 499 Scoping
  - 639 Real Estate Activities
  - 686 Cold Milling
  - 689 High Friction Surface
  - 694 Carpool Lots Preservation

- **Bridge**
  - 418 Overlay - Epoxy
  - 419 Deck Patching
  - 421 Miscellaneous Bridge CPM
  - 422 Painting Complete
  - 423 Pin & Hanger Replacement
  - 430 Joint Replacement
  - 431 Substructure Patching
  - 432 HMA Cap (No Membrane)
  - 433 Painting - Zone
  - 460 Superstructure Wash
  - 461 Vegetation Control
  - 462 Drain System Clean/Repair
  - 463 Paint Spot
  - 464 Joint Repair
  - 465 Concrete Surface Coating
  - 466 Crack Sealing
  - 467 Minor Concrete Patching
  - 468 Approach Pavt Relief Jts
  - 469 Slope Paving Repair
  - 470 Miscellaneous Bridge
  - 471 New Technologies
  - 472 Bridge Inspection
  - 474 Bridge Removal
  - 475 Special Needs
  - 476 Miscellaneous Bridge CSM
  - 479 Healer Sealer
  - 617 Deck Patching - Full Depth
  - 619 Bridge Barrier Railing Repair
  - 620 Thrie Beam Retrofit
  - 623 Bridge Approach
  - 624 Metal Mesh Panels
- **Rail**
  - 477 Railroad Oversight
  - 478 Relocation of Railroad Facilities
  - 634 Rail Structures

14.08 ACTIVATION OF "PE" / "PE-S" PHASE

(PPD Task Description 2560)
(revised 12-17-2018)

Once an assignment is made, the Project Manager must activate funding for that project prior to charging any costs to the project. This is done by accessing Phase Initiator and entering additional information and/or revising existing information previously entered into the system. Information that may be added/revised includes:

- Job Location
- Character of Work
- Type of Job
- City
- County
- Urban Area
- Type of Highway
- Type of Improvement
- Length
- Highway System

14.09 RISK BASED PROJECT INVOLVEMENT (RBPI)

(revised 11-22-2021)

The Federal Highway Administration (FHWA) Michigan Division uses a risk-based stewardship and oversight (RBSO) approach to determine how and when the FHWA is involved in programs and projects, while remaining consistent with statutes, regulations, Executive orders, and administrative and financial controls. RBSO integrates risk management into the FHWA performance planning process to identify agency-wide stewardship and oversight (S&O) initiatives. See the Michigan Division Risk Based Project Involvement Guidance document.

14.10 SCOPE VERIFICATION MEETING

(PPD Task Description 3130)
(PPD Milestone 312M)
(revised 12-17-2018)

Once a project is assigned, the Project Manager/Cost and Scheduling Engineer should request from the office that scoped the project, a copy of the scoping documents. These documents may include such items as a completed copy of the appropriate scoping forms and checklists, the project concept statement, pavement coring information, a cost estimate, a sketch of the proposed typical cross section(s), and a preliminary survey. The initial Planisware Network should also be available. The Project Manager will then gather the necessary old plans, utility information, traffic data, and other useful background information and develop a preliminary cost estimate and compare it to the programmed cost. When sufficient information is available, the Project Manager will schedule the Scope Verification Meeting.

If this preliminary estimate differs significantly from the programmed cost, the Project Manager should discuss increasing the programmed cost, changing the scope of work, and/or reducing the project limits at the Scope Verification Meeting. Consensus should be reached at, or as soon as possible after, this meeting to minimize lost design time and to avoid a possible delay of the project.

Prior to or at the Scope Verification Meeting the Project Manager should verify that the "Pavement Design and Selection Policy" has been followed as described in Section 6.01.06. Depending on the type of fix and estimated paving cost, a Life Cycle Cost Analysis (LCCA) may also be required. If the procedure has not been followed, the Project Manager should contact the Pavement Design Engineer or Region/TSC Soils Engineer to initiate adherence to the policy.

In order to ensure that everyone understands and agrees with the proposed scope of work, it is essential that all the disciplines and work centers that will be involved in the development of the project be invited to this meeting. This will minimize possible "scope creep" and reduce the number of redesigns by verifying and documenting the scope of work as early as possible in the design process. Recommended attendees include:

- Project Manager/Cost and Scheduling Engineer
- Unit Leader(s)
- Environmental - Project Planning Division (BTP)
- Geometrics Unit
- Construction Field Services Division
- FHWA (FHWA Oversight)
- System Manager
- Region/TSC
    - Design/Development Engineer
    - Operations Engineer
    - Soils/Materials
    - Utilities/Permits
    - Construction Engineer
    - Maintenance
    - Development Services Division (if applicable)
    - Survey (if Right-of-Way is to be acquired or as otherwise applicable)

The Project Manager will write and distribute the meeting minutes. Copies should be sent to the Region/TSC System Manager, the Environmental Section in the Bureau of Transportation Planning and all attendees to the meeting.

If this meeting results in a revised scope of work and/or an increase in the project cost, it is the responsibility of the office that originally scoped the project to revise the project scope and/or schedule and request reprogramming of the project.

NOTE: At this stage, the Project Manager should check to see if the project is required to be on the STIP (Statewide Transportation Improvement Plan). This may be done by accessing:

- JobNet
    - Job/CR Search (enter job number)
    - Approved Job
    - S/TIP

The S/TIP Indicator shows if the project is required to be on the STIP or TIP. The Phase tab in JobNet shows the S/TIP Cycle each phase is proposed for and the status. Project Managers needing clarification concerning the status of the STIP should contact the Region Planner or Statewide Planning Section of the Statewide Transportation Planning Division in the Bureau of Transportation Planning.

14.11 DESIGN EXCEPTIONS / DESIGN VARIANCES

(revised 3-23-2026)

After the scope verification meeting is held and the project scope has been agreed upon, the Project Manager should identify any Design Exceptions or Design Variances (DEs or DVs) that will be utilized in the design of the project (See Section 3.08.01E). Design Exceptions and Design Variances should be identified, and, ideally, completed during the scoping process using the Design Exception Form (DE26) or Design Variance Form (DV26). Consultation with the Geometrics Unit of the Design Division may be required to identify and develop justification for the exceptions or variances. Previously completed exceptions or variances should also be reviewed for accuracy at this time.

The Project Manager should request a folder be created for Design Exceptions or Design Variances in ProjectWise under the project number by e-mailing MDOT-ProjectWise@michigan.gov with a link to the project or by providing the TSC and the Job Number. Any consultant access to ProjectWise should also be requested at this time if it will be required. A DE folder and a DV folder will be created for each project. The folders will be located under “Supporting Documents” and “Design Exception-Design Variance”.

For each Design Exception or Design Variance submitted, the Project Manager should place a single .pdf file containing the Design Exception or Design Variance Form, a predictive Highway Safety Manual (HSM) Crash Analysis, and other supporting documents in the proper folder. The Design Exception or Design Variance Form should be flattened or printed to a .pdf so it is no longer fillable. However, the Project Manager should also save a copy of the fillable form for future revisions. Changing the "state" of the document to "next" will shift control of the DE process to the Design Exception Coordinator or Chief Structure Design Engineer for comments (or to the Region Associate Engineer, Development for a DV). The Project Manager should address the e-mail that appears after changing state, to the appropriate recipient while maintaining the E-ProjectWise address to indicate that a Design Exception or Design Variance has been submitted for review. A similar return e-mail indicates that control has shifted back to the Project Manager with comments provided in the original document. Revised sheets should be inserted into the original document while eliminating the sheets with comments (Do not create an additional document in the folder for each round of comments that occur).

Once all indicated comments have been addressed, signatures are added to the package. The Crash Analysis and Crash Analysis Approval Memo (if necessary) can be hand signed, stamped, or electronically signed. Final signatures (electronic) are then added with OneSpan.

Design Exceptions are approved and signed by either the Engineer of Road Design or the Chief Structure Design Engineer. Design Variances are approved and signed by the Region Associate Engineer, Development. Once final signatures are obtained, the package is placed back into ProjectWise and the state advanced to “Approved” to complete the process. Design Exception/Variance forms are available on the MDOT website.

For additional information see Sections 3.09.02C, 3.10.03, 3.11.02D and 3.11.03B.

14.12 REQUEST FOR SURVEY / MAPPING

(PPD Task Descriptions 3310, 3320, 3330, 3340, 3350 & 4510)
(revised 12-17-2018)

Once the scope is verified, the need for a ground survey and/or aerial photography and/or laser scanning for mapping should be determined. Requests for this work can be made by the Region System Manager, Project Manager/Cost and Scheduling Engineer, or the Design Unit Leader. Ideally, the need for, and the requirements of, survey and mapping on a project should be discussed and agreed upon at the Scope Verification Meeting.

If Right-of-Way (ROW) may be acquired for the project, an early control survey should be ordered immediately to enable Real Estate personnel to begin landowner contact and reduce the timeline through the critical path. This early control survey would consist of horizontal survey control being set throughout the project area, government corners being tied in to the coordinate system, and enough property corners being tied to develop approximate non-legal ROW and property lines throughout the project area.

The Survey/Mapping Action Request (Form 0226) should be used to initiate the work. If survey and/or mapping work was ordered and completed during the Call-for-Projects process or under an EPE phase, and additional information is required, a pick-up survey can be ordered using the above forms.

All survey requests should be directed to the Supervising Land Surveyor or Region Surveyor. The Region will decide whether to do the project themselves or request assistance from Lansing survey staff, either in the field or in hiring consultant surveyors. This should be done as soon as possible to allow for the survey and mapping to be completed in a timely manner that does not impact the project's critical path.

If a previous/existing consultant survey contract is still active, it may be possible to submit a revised scope of work to capture any additional information. During the original survey contract, if it is known additional information will be needed when design has furthered, additional information pick up should be included in the contract to reduce complications, keep information on the same datum, and create cohesion in data by utilizing the same team for data collection and compiling.

Also, when ordering survey or mapping work for complex projects, the requestor should consider all the disciplines involved and consolidate all of the survey needs prior to submitting a request. These disciplines may include such areas as bridges, hydraulics, utilities, electrical, railroads, signals, ADA, etc. This can save considerable time and effort by eliminating additional pick-up surveys and the resulting complications created when tying in multiple survey alignments and data.

Coordination of field survey data is necessary to support design. In order to ensure the necessary detail and accuracy for a set of plans, the Project Manager should discuss all requirements with the Supervising Land Surveyor or designated Survey Project Manager of Photogrammetry and Surveys. This will allow the most efficient methods to be used to obtain the field data.

Listed below are definitions for the different types of survey information that may be requested on the Survey/Mapping Action Request (Form 0226).

14.12.01 Road

(revised 12-17-2018)

Alignment: Typically, there are three different types of data described as 'Horizontal Alignments' that are used for MDOT design, any of which may or may not be considered a legal alignment. These three types of alignments are: Survey, As Constructed, and Construction.

Survey Alignment: Historically, a survey alignment was primarily used as a baseline for locating topographic features, cross-sections, etc., along a proposed route. This was an alignment provided to or created by survey crews to lay out a preliminary location and collect data relative to that route.

As-Constructed Alignment: This is frequently referred to as a "best fit" alignment, which represents the physical road location at a specific point in time. These alignments are typically computed using survey points collected along the actual roadway centerline (crack, crown, paint stripe, curb split, etc.).

Construction Alignment: An alignment developed for the purpose of constructing a roadway. The construction alignment is proposed by an engineer. Additional ROW needed for a project was frequently described from this alignment.

Legal vs. Non-legal

A **legal alignment** defines actual location of the Right-of-Way based on a survey alignment, as constructed alignment, and/or a construction alignment as referenced in property descriptions, conveyances, i.e. legal documents. It is considered a property controlling entity similar in standing to government section lines. A legal alignment is often used as a basic part of these descriptions. A survey to re-establish the location of the legal alignment is necessary when the purchase of additional ROW is required, or the designer wishes to know where the existing ROW is located to avoid acquiring additional ROW There may be several "legal" alignments on any particular project from which different parcels have been purchased over time. Considerable research and survey work may be required. The legal alignment and the physical centerline may not coincide. Generally, if property is purchased, the Department's past policy has been to describe the conveyance from the construction alignment, potentially creating yet another "legal" alignment. In order to minimize the creation of multiple legal alignments and hereby the confusion and added cost of future surveys, future **ROW acquisitions should be based on *previously established* legal alignments whenever possible.**

A **non-legal alignment** is used primarily to locate features for the purpose of design. It can be considered a line that provides direction and stationing for locating features, determining quantities, and staking out the project. A non-legal alignment is not intended to relate to the location of the Right-of-Way and is not used for property acquisition.

MDOT Alignment Standard

Alignments will be designated only as ***legal*** *or* ***non-legal*** by the surveyor/engineer. Differentiation and perpetuation of existing alignments will be done through annotation. Design alignment deliverables will be designated on CAD levels as

- Ali_Legal_Line_GS or
- Ali_NonLegal_Line for MDOT_01 workspace and
- Geom_Horiz_Legal_Wt0_Line_GS,
- Geom_Horiz_Legal_Wt1_Line_GS,
- Geom_Horiz_NonLegal_Wt0_Line_GS,
- Geom_Horiz_NonLegal_Wt1_Line_GS
- for MDOT_02 workspace in MicroStation for the plan alignment sheets.

Bench Marks: Points of known elevation. Bench marks are usually set along a project at a given interval to provide the construction crews elevations from which to work. May be an assumed (elev. = 300.000 ft), National Geodetic Vertical Datum (NGVD 1929) or North American Vertical Datum of 1988 (NAVD 1988, which is most current and recommended).

Drainage: Data specific to surface and underground storm drainage and related features. This usually includes a separate report describing any existing or potential problems, location and direction of flow of surface drainage, and underground storm systems.

Government Corners: Monuments representing the locations of the corners as originally set as part of the United States Public Land Survey System (USPLSS). These corners control the location of nearly all property boundaries. Preservation and perpetuation of these monuments is required by state law.

Hydraulic Survey: A cross section survey used to analyze the flood flow and capacity of a given stream which helps to determine the design parameters of a stream crossing structure. (The Engineer of Hydraulics should always be consulted whenever this type of survey data is required.

Photo Control: X, Y and Z coordinate data on target points specified by Photogrammetry for the purpose of controlling aerial mapping. This process is very similar to that used to control laser scan mapping.

Planimetric Mapping: The act of locating all topographic features (by coordinates) for the purpose of creating a map. This is analogous to station plus and offset information. Typically, when speaking of planimetrics, this does not include terrain data (elevation/cross section). In practice, this information is collected together with the terrain data to produce a three dimensional model of the surface.

Plat Maps: Legal maps that indicate the description, easements, layout and dimensions of a platted subdivision and its included lots. These documents are recorded and on file with the County Register of Deeds.

Property Owners: Owners of property adjacent to a roadway or bridge outside of the Department’s existing ROW limits.

Property Ties: Survey measurements that relate the location of existing property corners and or government corners to the alignment and horizontal coordinate system.

Property Ties: Survey measurements that relate the location of existing property corners and or government corners to the alignment and horizontal coordinate system.

Riparian Owners: Property owners adjacent to a lake, stream or river that may have some rights to the bottom lands of such a body of water or stream. Riparian ownership and contact information is usually required for the four quadrants around a bridge over water.

Terrain Mapping: The act of mapping the surface of the earth to determine the location and elevation of the ground features. This results in the creation of a Digital Terrain Model (DTM) and/or Triangulated Irregular Network (TIN) from which cross sections may be calculated. Usually collected at the same time as the planimetric data.

Utilities: Public and privately owned structures in place to carry electric, telephone, water, sanitary sewers, etc. Utility information would typically include ownership, location, rim and flow line elevations and pipe directions.

Other: Any other miscellaneous information.

14.12.02 Bridge

(revised 9-28-2026)

Alignment: Same as Road but should include exact stationing of the reference points (intersection of abutment and pier reference lines with the as constructed alignment.

Angle of Crossing of Substructure: The angle at which the reference lines of the structure cross the as constructed roadway alignment.

Bench Marks: Same as Road. Bench Marks should be left in the vicinity of the bridge structure on both sides of the crossing.

Bridge Seat Elevation: Elevations of the top of the abutment/pier that supports bearing pads/bridge beams.

Bridge Survey: A survey of a bridge structure. This survey often requires sketches in plan and elevation view, and diagrams to illustrate all critical dimensions, in addition to Microstation planimentric and terrain mapping.

Dimension of Existing Sub-structure Elements: Physical measurements of the abutments, piers, wingwalls, etc. such as width, length, face to face and height above natural ground, amount of cover and so on. Specific needs should be noted by the requestor.

Dimensions of Existing Superstructure Elements: Physical measurements of deck width, and length thickness, sidewalk and curb dimensions (face-face, width, height, etc.), bridge railing type and dimensions.

Property Ties: Same as road.

Riparian Owners: Same as road.

Top of Footing Elevation: Elevations of existing bridge footings. Usually requires probing and/or digging for location. Often difficult or impossible to find.

Topography: Typically describes planimetric and terrain features together. The planimetric detail should include the bridge deck as a feature. The terrain data should model the surface as though the deck did not exist. This should result in contours that accurately represent the surface of the ground.

Under clearance Elevation: Elevations of the bottom of the existing bridge beams. Normally taken over pavement edges and lane lines for grade separations. For design purposes, minimum vertical clearance must be maintained over the complete usable shoulder. See Section 3.16. For stream crossings the elevations would typically be taken over the intersection of the ground with the sub-structure units and over the highest low beam. The underclearance is then the difference between the elevation of the beams and the elevation of the appropriate feature below them. Any special locations should be noted in the request.

Utilities: See Road. Any utilities attached to the structure itself should be noted.

Water Surface Elevation: Elevation of the exact surface of the water on a given date, taken at intervals up and down stream to determine stream gradient. The date each measurement is made must be recorded.

Other Elevations: Any other elevations required that are not covered above.

14.13 PROJECT AREA CONTAMINATION SURVEY

(PPD Task Descriptions 2810 & 2820)
(revised 4-22-2019)

The following interim procedures have been developed for identifying potential contaminated sites, conducting the necessary testing and estimating the cost of remediation.

1. The Project Manager/Cost and Scheduling Engineer sends a project description and location and requests a list of potential contaminated sites to both the Environmental Assessment Unit (EAU) in the Development Services Division and the Region/TSC Resource Specialist (RRS).

2. The EAU and PCU (Project Coordination Unit of the Environmental, Development Services Division) coordinate with the Region/TSC Resource Specialist to conduct a Project Area Contamination Survey (PACS) by searching state or local records, interviewing state and local officials and citizens.

   The Region/TSC Resource Specialist performs a visual inspection of the project area. The EAU and RRS notify the Project Manager.

3. If no known or potential sites are found, The Project Area Contamination Survey process terminates at this point. (The Project Manager would delete PPD Task Description 2820 from the project Planisware network.)

4. If potential contamination sites do exist, the Project Manager adds the locations of the sites to the base plans and reviews the sites for conflicts with the proposed work. If the Project Manager determines the potential sites do not conflict with the proposed work, the Project Area Contamination Survey process terminates at this point. (The Project Manager would delete PPD Task Description 2820 from the project Planisware network.)

5. If potential contamination sites conflict with the proposed work, the Project Manager requests the Grading/Drainage & Consulting Contracting Unit (G/DCCU) in the Construction Field Services Division to prepare a scope of field work with a cost estimate for the Project Manager.

6. The Project Manager reviews and approves the scope and cost estimate.

7. The G/DCCU prepares the Health and Safety Plan, obtains clearance from Miss Dig, and assembles or coordinates with the Region/TSC all necessary resources and personnel.

8. The G/DCCU conducts/coordinates borings, monitors well installation and/or sample collection as necessary to complete the field work.

9. The G/DCCU notifies the Michigan Department of Environment, Great Lakes, and Energy (EGLE) of any contaminated or hazardous materials found during field work.

10. The G/DCCU submits collected samples to MDOT or contracted laboratory for analysis, receives the results from the laboratory, reviews and interprets them.

11. If the data is insufficient to draw complete conclusions, the G/DCCU repeats steps 4-10 for further testing.

12. Utilizing all U. S. EPA and EGLE guidance and policies, the G/DCCU develops and submits a report to the Project Manager and the Environmental Assessment Unit containing the location, nature, extent and volume of any contamination found and recommendations for dealing with it. Recommendations will include any permits or special procedures and/or provisions that are required and pay items with an estimate of construction costs relating to any contamination present.
13. The Project Manager incorporates the information in the plan/proposal package.

14.14 REVIEW / REVISE PLANISWARE NETWORK

Once the scope of work has been agreed upon, the original Planisware network submitted by the Project Initiator should be reviewed. At this time, the network may be revised to better represent the actual tasks and corresponding durations required during the design of the project. Durations of tasks should not be altered without first consulting the work center involved. Any change in the plan completion date, ROW certification date or the letting date should also be included in any change request submitted for scope of work or cost.

14.15 CHANGE REQUEST (REVIEW OF PROJECT SCOPE, COST AND SCHEDULE)

(revised 2-26-2018)

Once the scope has been verified, any changes in cost, limits, work, schedule or funding should be submitted to the appropriate System Manager or Statewide Transportation Planning Division. This change request is done through JobNet.

14.16 REQUEST FOR UTILITY INFORMATION

(PPD Task Description 3610)
(PPD Milestone 311M)
(revised 12-17-2018)

This process outlines the responsibilities and procedures for gathering utility information early in a project's design phase. Gathering utility information typically occurs after the project scope verification has been completed. For this procedure, utility is defined as any type of private, public, municipal, or county drain commission facility that is within or near the limits of the proposed construction project.

Capital preventive maintenance and pavement marking projects are examples of projects that do not require plan distribution to utilities. The project must not include any guardrail work or any work beyond the outside edge of the shoulder, or require any excavation, trenching, boring, etc., into the aggregate base or subbase material. The Project Manager evaluates each project and use discretion on whether plans need to be distributed for utility coordination.

Subsurface Utility Engineering (SUE) projects that use a consultant to provide the underground utility information may not need to follow this entire procedure. The Project Manager may need to coordinate this request for utility information with the SUE vendor.

Procedure

Project Manager

1. Contact the TSC Utility Coordinator to request Letter Requesting Utility Information at Base Plan Stage, (Form 2480). Provide the following information:

    - Project Location
    - Scope of Work
    - Control Section(s)
    - Job Number(s)
    - Proposed Plan Completion Date
    - Consultant Information

    Note: When project information exceeds the allowed space on Form 2480 an additional document is supplied by the Project Manager detailing this information. The applicable field(s) on Form 2480 state "see attached sheet" when this occurs.

2. Receive the Cover Letter and all Form 2480 letters within 7 working days from the TSC Utility Coordinator.

3. Review and sign Form 2480 letters

4. Send Form 2480 letters and plans to the utilities with courtesy copies to TSC Utility Coordinator.

   Note: Old plans, Right-of-Way maps, or MDOT Construction Base Plans are acceptable for sending to the utilities. The plans must provide the project's location and limits of work. Vicinity maps may be included for general information, but are not used as the sole project plans as they provide inadequate information for the utilities to plot their facilities. This includes log jobs that may affect a utility.

5. Receive returned Form 2480 and plans from the TSC Utility Coordinator.

   Note: The TSC Utility Coordinator will follow-up with non-responsive utilities and provide a status to the Project Manager.

6. Plot all utility facilities on the Preliminary Plans.

14.17 FAA OBSTRUCTION EVALUATION

(revised 12-17-2018)

Federal regulation (14 CFR Part 77.9) requires notification with the FAA (Federal Aviation Administration) when construction alteration, or activity is planned in a zone that may impact aircraft flight operations. This may include changes in grades, structure elevations, lighting, towers, crane heights, etc.

Notification must be filed for any of the following conditions:

- Any construction or alteration exceeding 200 ft. above ground level.
- Any construction or alteration:
    - Within 20,000 ft. of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 ft.
    - Within 10,000 ft. of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 ft.
    - Within 5,000 ft. of a public use heliport which exceeds a 25:1 surface.
- Any highway, railroad or other traverse way whose prescribed adjusted height would exceed the above noted standards.
- When requested by the FAA.
- Any construction or alteration located on a public use airport or heliport regardless of height or location.

The notice can be filed either by mail or electronically on the FAA Obstruction Evaluation / Airspace Analysis website.

The website features a “Notice Criteria Tool” to assist in determining if a project location is in a zone of influence requiring notification. If the results produced by the tool are inconsistent with known vicinity location information, they should be verified by requesting assistance from MDOT's Office of Aeronautics, Planning and Development Section.

The Project Manager should determine as soon as possible if a notification is required. If a notification is required, it should be filed prior to FPC to allow the FAA to make a determination early enough to accommodate any conflicts. Allow 45 days from the time of submittal for FAA review.

Questions regarding the filing requirement or procedure should be directed to the Aeronautics Division, Planning and Development Section. Notices that require special airspace study may take up to 120 days.

14.18 PAVEMENT DESIGN

(revised 3-26-2012)

After the scope verification meeting, the Project Manager should determine the estimated pavement costs of the project. Depending on the type of work and estimated cost, a Life Cycle Cost Analysis (LCCA) may be required. This along with the actual pavement design will be done by either the Region/TSC Pavement Design Engineer or the Operations Unit of the Construction Field Services Division – Pavement Operations. Those done by the Operations Unit must be submitted for approval to the Engineering Operations Committee (EOC). See Section 6.01.06.

14.19 REQUEST FOR PAVEMENT CORES / SOIL BORINGS

(PPD Task Description 3110 & 3510)
(revised 12-17-2018)

Most projects will require pavement core information, especially those involving pavement removal, rubblizing, crushing and shaping and/or cold milling. This information is useful not only in verifying the type of fix but also in assisting the Contractor in developing their bid prices. Pavement cores should be requested as soon as possible, but no later than the Scope Verification Meeting if they have not been completed prior in an EPE phase. The Project Manager should check with the Region/TSC involved to find out if cores were taken during the Call-for-Projects process.

When requesting pavement cores the Project Manager should include the following:

- Set of plans
- Description of what information is needed
- Desired location
- A target date when the information is needed

14.20 RECEIPT OF SURVEY / MAPPING DATA

(PPD Task Description 3310, 3320, 3330, 3340, 3350 & 4510)
(revised 12-17-2018)

When the survey or mapping work is submitted, the Supervising Land Surveyor or Region Surveyor forwards the data, notes, maps, etc. to the requestor in electronic format unless requested otherwise. This could be the initial survey ordered during the Call-for-Projects process or a pick-up survey with specific information not identified in the initial survey.

Photogrammetric and laser scan will be sent directly to ProjectWise. A transmittal memo with the map file names to be used on the project is sent to the requestor as notification the mapping has been completed.

14.21 BRIDGE REVIEW

Although the procedures discussed under Bridge Review should, ideally, occur during the scoping and Call-for-Projects process, the coordination described below should still be done during the initial stages of the design phase until the development of the Bridge Program is totally integrated into the Call-for-Projects process. This may sometimes eliminate any oversights during the programming of projects or due to scheduling changes of ongoing projects.

14.21.01 Review by Bridge Design

(revised 12-17-2018)

Whenever there are structures within the limits of a project, regardless of the scope of work, Bridge Design should be notified. The notification should be in the form of a memo to the Bridge Management Engineer initiating a review of those structures to determine if any design work is presently ongoing, being planned, or might be considered at each structure. The Bridge Management Engineer will contact Operations Field Services Division to determine if periodic inspections have revealed the need for structure repair or upgrading. This ensures any future construction is coordinated and possibly consolidated thereby reducing PE and CE costs as well as minimizing the number of disruptions to traffic.

The following information should be relayed to the Bridge Management Unit:

- Control Section
- Job Number
- Route Number
- Location-Project Limits
- Proposed Scope of Work
- All Structures within the project limits
    a. Names of crossroad/stream crossed by structure
    b. Structure/bridge number
- Project Manager/Cost and Scheduling Engineer
- Proposed Plan Completion Date
- Proposed Letting Date

After the review is completed, the Bridge Management Engineer will inform the Project Manager in writing of any recommended work on each structure.

14.21.02 Historic Bridges

The following structures have been classified as historic bridges. Prior to initiating any design work on one of these structures, the Project Manager should contact the Project Planning Division in the Bureau of Transportation Planning. Any design restrictions should be identified as early in the design phase as possible.

BRIDGES	CROSSING	ROUTE
02041-B01	Sand River	M-28
05031-B01	Intermediate River	M-88
07012-B02	Sturgeon River	US-41
09032-B01	E. Channel-Saginaw River	M-13/M-84
10032-R01	Ann Arbor RR	US-31
11021-B02	St. Joseph River	US-12
11053-B01	St. Joseph River	M-63
15012-B01	Island Lake Outlet	US-31
16081-B03	Cheboygan River	US-23
17032-B02	Power Canal (Ashmun St.)	I-75 BS
17034-B01	St. Mary River & Portage Ave. W.	I-75
17062-B01	E. Br. Tahquemenon River	M-28
20012-B01	Au Sable River	I-75 BL
22023-B01	Sturgeon River	US-2
22031-B01	Menominee River	US-141
24011-B01	Bear Creek	US-31/M-68
26011-B03	Cedar Creek	M-18
31012-B01	Portage Lake	US-41 & Soo RR
33021-B01	Sycamore Creek	M-36
33032-R01	GTW RR & Red Cedar River	I-96 BL
34081-R01	Mid. Michigan RR	M-44/M-91
35012-B02	Au Sable River	M-65
36022-B01	Iron River	US-2
36023-B01	Paint River	M-69
41042-B01	Plaster Creek	M-21
41081-B01	Grand River	M-45 (Fulton St.)
42012-B02	Fanny Hooe Creek	US-41
42021-B03	Eagle River	M-26 (Ped. Only)
45041-B01	Lake Leelanau Narrows	M-204
46032-B02	Silver Creek	M-156

49023-B01	Cut River	US-2
50051-B01	Clinton River	M-3SB
51011-B01	Manistee River	US-31
51021-B03	Pine River	M-55
55011-B01	Menominee River	US-41
58151-R03	Conrail RR & W. Raison River	I-75
58151-S11	Dunbar Road	I-75
58152-S06	Sigler Road	I-75
60031-B01	Thunder Bay River	M-32 Spur
64012-B01	Pentwater River	US-31
66013-B12	Ontonagon River	M-64
66023-B01	Middle Branch Ontonagon River	M-28
70041-B02	Grand River	M-45
71073-B02	Ocqueoc River	US-23
75022-B01	Manistique River	US-2/M-94
77111-B04	St. Clair River	I-94/Blue Water Bridge
78021-B01	St. Joseph River	US-12(Pedestrian)
78061-B01	St. Joseph River	M-86
78061-B03	Prairie River	M-86
81063-S04	Wiard Road(Sbd)	US-12
81063-S05	Ford Exit Drive(Sbd)	US-12
82022-S33	I-94	US-12 (Michigan)
82022-S34	I-94	US-12 (Michigan)
82023-S22	I-94 Ramp	M-10 SB
82023-S23	I-94 Ramp to M-10	I-94 EB
82023-S24	I-94	M-10 SB
82023-S25	M-10 SB & I-94 WB	I-94 EB Ramp to M-10
82023-S26	M-10 NB & I-94 EB	I-94 WB Ramp to M-10
82023-S27	I-94	M-10
82023-S28	I-94 Ramp from M-10	I-94 WB
82023-S29	I-94 Ramp from M-10	M-10 NB
82071-B04	Rouge River	Old US-25 (Fort Street)
86000-B01	Straits of Mackinac	I-75

14.21.03 Bridge Loading and Under Clearance Review

It is essential that the Department maintain accurate and detailed records and control of the added deadload on bridges and of the under clearance at underpasses. Occasionally these considerations will mean that deck surfacing material must be removed before a resurfacing can be undertaken or that surfacing under a bridge must be removed so that a new surface can be maintained at or near the existing elevation. On some H-15 bridges, 2" of surfacing may reduce the operating load capacity by 10,000 lbs.

After scope verification, a memo should be sent to the Bridge Management Unit listing structures within the limits of the project, proposed treatments, proposed plan completion and letting dates requesting recommendations. The Bridge Management Unit will contact the Operations Field Services Division to determine if periodic maintenance inspections have disclosed the need for remedial measures. Detailed recommendations will then be sent to the Project Manager.

14.21.04 Special Structures/Footing Design

On occasion there may be situations where the scope of work includes disciplines beyond the expertise of the Project Manager and/or the unit assigned the project. Frequently, items such as sound walls, retaining walls, unique culverts and footings are assigned a bridge unit for design assistance. In these instances the Project Manager should request assistance from the Special Assignment Structures Unit in Bridge Design. The request should be by memo with copies to the Supervising Engineer-Bridge, and Engineer of Bridge Design. These requests should be made as soon as the need is known to allow the bridge unit(s) as much lead time as possible to accommodate the project’s schedule while meeting their own schedules.

14.22 RAILROAD COORDINATION

(PPD Task Description 3650)
(revised 11-22-2021)

Contact by the Department with the railroad company is required any time a railroad crossing is within a highway project Construction Influence Area (CIA). Coordination may also be required if queuing is expected to extend beyond the CIA and impact crossings. Contact and negotiations with the railroad company are made by the MDOT Office of Rail, Rail Infrastructure Section. See Section 12.11 for more information and procedures.

14.23 REQUEST FOR TRAFFIC VOLUMES

(PPD Task Description 2120)
(revised 9-22-2025)

Existing traffic volumes (ADT, DHV) for Construction on Existing Road project types should be requested from the Data Collection Section in the Bureau of Transportation Planning. Volumes from the latest available year should be included in the plans (Title Sheet).

Increased Capacity/New Routes (New Construction or Reconstruction project types) require projected traffic volumes, usually 20 years in advance of the projected year of construction. Ordinarily these volumes have already been determined during the Project Development stage (see Section 14.05). However, if a significant period of time has elapsed, these volumes should be revised. Revisions are requested from the Project Planning Section in the Bureau of Transportation Planning. This request should be made as soon as the need becomes evident. (Traffic Analysis Request (TAR) Form 1730)

If the amount of traffic data is large (i.e. entrance & exit ramps at several interchanges), it may be desirable to show the information on a separate plan sheet.

14.24 REQUEST FOR CRASH ANALYIS AND SAFETY REVIEW

(PPD Task Description 3560)
(revised 1-27-2025)

All projects shall have a crash analysis conducted by the TSC or Region Traffic and Safety Engineer, unless it is determined by the TSC or Region Traffic and Safety Engineer that the project work type does not provide an opportunity to make roadway safety improvements (i.e., Wetland Mitigation, Crack Sealing) and a memo to the project file stating that determination is provided.

The analysis may have already been completed as part of the Region/TSC's Call for Projects process, in which case an additional analysis may not be necessary. However, analyses older than 3 years should be updated by requesting another one. The analysis will identify any unusual occurrences or above expected number of crashes and will advise the Design Unit of any recommended safety countermeasures to address the situation and/or systemic improvements to incorporate within the project limits. The Project Manager should review the plans to verify these measures have indeed been incorporated into the plans prior to the FPC Meeting.

Road Safety Audits (RSA) are warranted based on the conditions defined in the Road Safety Audit (RSA) Guidance document. An RSA is a formal safety performance examination of an existing or future road or bridge project by an independent, multi-disciplinary RSA team. RSAs should be scheduled during the scoping process and are highly recommended to be scheduled prior to the Scope Verification meeting and include consideration for all users of the roadway to help achieve strategic safety goals. RSAs contribute to road safety by providing a fresh, unbiased assessment of the area or intersection to identify potential safety issues and solutions. The Project Manager (Project Owner) submits Form 3767 to request the RSA and follows the process as laid out in the Road Safety Audit Guidance to meet this requirement. RSAs are not applicable for design exceptions.

14.25 REQUEST FOR SPECIAL SOILS INVESTIGATIONS AND/OR DESIGNS

(PPD Task Description 3510)
(revised 12-17-2018)

Although the Region/TSC Soils and Materials Engineer is responsible for supplying soil borings, pavement cores and limits and quantities for removal of unstable materials (peat, muck, etc.), to the Design Unit, other types of soil analysis may also be necessary. Any soil information, analysis and design regarding the following should be requested from the Geotechnical Services Unit of the Construction Field Services Division.

- Sewers and culverts greater than 5'-0"
- Box culverts greater than 4'-0" x 4'-0"
- Retaining walls
- Sound walls (except Metro Region)
- Light Towers (except Metro Region)
- Mechanically stabilized earth (MSE) walls
- Reinforced soil slopes
- Pipe and culvert trenchless installations

In order to request any of the above, the Project Manager should send a memo and electronic access to the plan set with the following minimum information:

- Plan of site (location map)
- Alignment with stationing
- Benchmarks as close to the location as possible
- A detailed description of the requested information
- Plan completion date and a date when the information is needed.
- Proposed method of controlling water (during culvert construction) - diversion channel, temporary dam, pump across road, etc.

14.26 DISTRIBUTION OF PRELIMINARY PLANS TO UTILITIES AND UTILITY COORDINATION MEETING

(PPD Task Description 3660)
(PPD Milestone 361M)
(revised 7-25-2022)

Preliminary plan distribution to utilities must be completed whether or not utility conflicts have been identified. It is important to provide preliminary plans because it allows the utilities an opportunity to review the proposed project, to ensure facilities are plotted accurately, and provides notification to relocate facilities in conflict.

Distribution of preliminary plans, and the Utility Coordination Meeting if necessary, typically occurs after The Plan Review Meeting and before the Final Project Coordination (FPC) Meeting. The TSC Utility Coordinator and the Project Manager will work together to determine if a particular project warrants scheduling a Utility Coordination Meeting. Some projects may not require a Utility Coordination Meeting while others may require several meetings. Those invited usually include:

- TSC Utility Coordinator
- Project Manager/Cost and Scheduling Engineer
- Private/Public utilities
- Municipalities
- Municipal Utility Design Staff/Consultant
- Real Estate Services Section
- Road Commissions
- Design Team key members
- Design Consultant representatives
- MDOT construction team members

The preferred method for preliminary plan distribution is to send separate letters to public/private and municipal utilities that address the following:

- The Letter to Public/Private Utilities at Preliminary Plan Stage, (Form 2481) includes the following:
    - References Public Act (PA) 368 of 1925 entitled Highway Obstructions and Encroachments; Use of Highway by Public Utilities
    - Gives legal notification to relocate
    - Authorizes preliminary engineering for reimbursable relocations
- The Letter to Municipal Utilities at Preliminary Plan Stage, (Form 2482) is used because MDOT may be responsible for the relocation costs associated with municipal utility relocations within their corporate limits. This may require MDOT to complete the following:
    - Perform the relocation design
    - Include relocation work in the project plans
    - Formalize an agreement

If Forms 2481 and 2482 are not sent to the utilities, the Utility Coordination Meeting Invitation letter must cite PA 368, authorize preliminary engineering, provide relocation reimbursement information, and be accompanied by preliminary plans.

Procedure

Project Manager/Cost and Scheduling Engineer

1. Send preliminary plans to the TSC Utility Coordinator for distribution to utilities.
2. Complete a preliminary assessment of utility issues and conflicts with the TSC Utility Coordinator and Design Team. Ensure all utilities appear on the preliminary plans. Approximate location, size, and type of utility should be indicated. All utilities carrying dangerous, hazardous, or critical materials should be flagged on all plan sheets where the utility is shown. Refer to the Road Sample Plans.

   Note: It may be beneficial to have a conflict list and special plans with cross section details for use as presentation tools to the utilities.
3. Distribute preliminary plans to all potentially impacted utilities with either a Utility Coordination Meeting invitation or Forms 2481 and/or 2482.
4. Prior to a Utility Coordination Meeting, municipalities, if affected, should evaluate and comment on the preliminary plan and review the extent of the work and decide who will develop plans for utility alterations, if necessary (Department, Department's consultant, municipality, or municipality's consultant).

14.27 VALUE ENGINEERING

(PPD Task Description 3375)
(revised 10-27-2025)

14.27A Definitions

Value Engineering (VE) - A systematic process of review and analysis of a project, during the concept and design phases, by a multi-disciplined team of persons not involved in the project, that is conducted to provide recommendations for:

1. Providing the needed functions safely, reliably, efficiently, and at the lowest overall cost;
2. Improving the value and quality of the project; and
3. Reducing the time to complete the project.

Applicable VE Project - A portion of highway that is proposed for construction, reconstruction, or improvement as described in the preliminary design report or applicable environmental clearance document. A project may consist of several job numbers/contracts or phases over several years.

Estimated Total Cost of a Project - The estimated cost of the project includes the cost of all phases of a project including environmental, design, Right-of-Way, utilities and estimated construction cost based on final design.

Road Projects VE Study Cost Threshold - The federal regulations on VE studies are in 23 CFR Section 627. MDOT's policy requires VE studies on all federal-aid road projects that have a total project cost of $50 million or greater. The total project cost is the sum of the costs for all phases of the project. If any part of the environmental clearance document is to be let for construction, it must have a VE study even if the cost of the construction work is less than $50 Million. When it is determined that it may be beneficial for a unique and/or complex project, VE studies may also be considered for federal-aid projects that are below the required project cost threshold, or for projects that are 100% state-funded.

Bridge Project VE Study Cost Threshold - A project is considered a bridge project if the majority of the cost/work is related to bridge work. The federal regulations on VE studies are in 23 CFR Section 627. MDOT's policy requires VE studies on all federal-aid bridge projects that have a total project cost of $40 million or greater. The total project cost is the sum of the costs for all phases of the project. If any part of the environmental clearance document is to be let for construction, it must have a VE study even if the cost of the construction work is less than $40 Million. When it is determined that it may be beneficial for a unique and/or complex project, VE studies may also be considered for federal-aid projects that are below the required project cost threshold, or for projects that are 100% state-funded.

VE Re-Study - If a project has a change to the scope of work between the final design and the letting, then FHWA will require an updated VE analysis.

VE Proposal/ Recommendation - The ideas resulting from a VE study that provide the project's functional requirements at less cost or improved value or service. VE proposal recommendations may reduce, increase, or have no cost impacts but still provide improved value or service; and must have documented decisions and implementation. Design Suggestions are provided for additional consideration to enhance the quality of a project that could be incorporated into the project's design to improve its overall functionality or aesthetics. VE proposals/recommendations are reviewed and approved before being implemented, while design suggestions may be discussed and implemented more informally.

Value Engineering Change Proposal (VECP) - A frequently used special provision that is placed in all construction contracts except Construction Manager General Contractor (CMGC) and Design Build (DB) projects. It encourages the contractor to propose changes in contract work that will accomplish the project's functional requirements at less cost, reduced time, or improve value or service at little or no increase in cost. The net savings of each proposal is shared with the contractor at a stated rate (50-50). MDOT's procedures for Construction VECP's are contained in Section 104 in the current edition of the Construction Manual.

MDOT State VE Coordinator - Office of Major Project's (OMP) Innovative Contracting Unit (ICU) staff person responsible to assure all VE studies are completed per the Federal Regulations. The State VE Coordinator works with the Design Project Manager (MDOT PM) and other design personnel to schedule, complete, follow up and document VE Studies and decisions. The State VE Coordinator determines if the study can be done by MDOT personnel or by a Consultant. To hire a Consultant, they solicit and establish the contract per current vendor selection procedures. At the year end, they prepare the FHWA Annual Report documenting VE studies and activities. They also determine if a recommendation may be warranted as a best practice and provide information statewide.

VE Facilitator - A qualified facilitator experienced in performing and leading VE studies. MDOT personnel who facilitate VE studies must be experienced in VE studies and have additional facilitation and process reengineering training. VE studies done by outside consultant firms must have a VE facilitator with sufficient VE training, education and experience to be recognized by SAVE International as meeting the requirements for certification.

VE Team - The group with diverse expertise suited to the scope and complexity of a project to participate in the VE study. At a minimum, design, construction, and maintenance will be represented on the team. In the event of specialized projects, individuals with specific expertise necessary to perform a proficient VE study should be included in the team makeup. The VE Team must also include member(s) experienced in estimating construction costs and cost-benefit analysis. All members should have completed a Module 1 VE training seminar or have prior VE experience. The composition of the expertise should reflect the complexity of the project design to be studied. At least two members of the team should be experienced in the high-cost areas of the project. Anyone directly involved in the design of the project should not be a team member but is expected to participate as an information source.

14.27B Federal Regulation

Title 23 CFR 627 under the authority of 23 USC Chapter 1, Section 106(e) requires a VE study be conducted before the advertisement/letting of all Federal Aid projects with an estimated total project cost of $50 million or greater for a road project, or $40 million or greater for a bridge project. See the previous section for definitions of “project” and VE study requirements. The VE study might encompass a longer corridor of similar work, but only the projects for which there are design plans or sufficient scoping information available will receive VE credit

DB projects used to expedite the completion of a project are exempt from VE requirement. However, a VE study may be conducted prior to advertising the Request for Proposals (RFP) of the DB contract if requested by the Region or Leadership.

CMGC projects used to provide contractor input during the design phase of a project require a VE analysis to be completed and approved recommendations incorporated into the project plans prior to requesting a final construction price proposal from the CMGC contractor. A VE analysis is not required prior to the preparation and release of the RFP for the CMGC pre-construction services contract.

14.27C Procedures

1. **Identification of Potential VE Studies.** The State VE Coordinator prepares a tentative list of potential VE studies per fiscal year while MDOT PMs determine projects meeting the aforementioned VE requirements and request a VE study during the early plan development process.

   The VE study is commonly performed between concept and 30% plan completion. Holding the VE study early allows the recommendations to be considered without disruption to the design process.

2. **Funding**. The MDOT PM will confirm or obtain sufficient funding in the PE phase for the VE study.

3. **Scheduling VE Study.** The MDOT PM and State VE Coordinator determine the VE Team. Team members should not be directly involved in the project design.

   Based on the project’s scope, the State VE Coordinator will choose one of the following methods for conducting the VE study:

   a. A Consultant is hired to perform all parts of the VE study. Two to three MDOT/FHWA personnel may be invited to join the VE Team.

   b. MDOT performs all parts of the VE study, usually facilitated by personnel from Performance Excellence Division.

   c. A Consultant is hired to provide a VE Facilitator/Trainer and MDOT/FHWA will provide the VE Team.

4. **Information Needed for VE Study.** The MDOT PM(s) and/or designers gather current project information, adds it to the VE folder and informs the State VE Coordinator. The VE Facilitator distributes the information to the VE Team prior to the first day of the VE study. This information can include but is not limited to the following:

   - Existing Aerials
   - Project Photographs
   - As-Built Plans, Base Plans
   - Project Area Map
   - Environmental Clearance Document or Issues
   - Right-of-Way Plans or Concerns
   - Agreements
   - Utility Plans or Encroachment Issues
   - Detour/Staging Concepts/Restrictions
   - Traffic Data
   - Crash Data/Safety Report
   - Context Sensitive Design Issues
   - Constructability Issues
   - Current Cost Estimate (Excel or PQS format)
   - Scoping Reports/Scope Verification Meeting Minutes
   - Design Exceptions/Variances
   - Construction/Letting Schedule
   - Structure Appraisal and Inventory
   - Bridge Safety Inspection Report
   - Bridge Structure Studies
   - Geotechnical Soils Reports and Foundation Reports
   - Hydrology/Hydraulic Information
   - Drainage Report or Issues
   - Maintenance Records

   In addition, the MDOT PM/Designer should be prepared to discuss with the VE Team information on functionality (what is main purpose of project), constraints, needs, and/or any requirements that the VE Team should know about.

5. **The VE Study.** The VE study consists of the following phases:

    a. **Information Phase:** The MDOT PM/Designers presents project background information and is available for questions. The VE Team determines the needs, requirements, and constraints of the owners/users/stakeholders, as well as the design criteria. The VE Team develops a cost model, breaks the project down into functions, and performs functional analysis.

    b. **Speculation Phase:** Brainstorming takes place within the VE Team to generate ideas to add value to the project without changing the function.

    c. **Evaluation Phase:** Best ideas from the Speculation Phase are selected for consideration based on the best blend of performance, cost and schedule.

    d. **Development Phase:** Best ideas are developed into VE proposals and design recommendations through sketches, cost estimates, and schedules. Both initial and life-cycle costs will be examined.

    e. **Decision Phase:** The Decision Team decides if the VE Proposals should be Accepted, Accepted for Further Study (AFS) or Rejected. The final decisions are documented by the VE facilitator in the final VE Report. If a VE recommendation has a potential savings of more than $1.0 million, the Region Engineer must also be included on the Decision Team.

6. **The VE Study Report**. The VE Facilitator/VE Team prepares and provides electronically a final report. A typical report includes the following: executive summary, participant list, research sources, project history (including project criteria, commitments, and constraints), existing design, performance criteria, basic functions, life cycle cost estimate, proposal descriptions and cost calculations, implementation plan and documentation of MDOT's decisions regarding the recommendations.

    The State VE Coordinator saves the final report in ProjectWise and provides a copy to the FHWA.

    Recommendations Accepted for Further Study. The MDOT PMs will report the outcome of unresolved recommendations that were labeled as "AFS" to the State VE Coordinator for the annual report.

7. **Annual Reporting**

    a. **MDOT Annual Report.** The State VE Coordinator prepares an annual report on the VE recommendations received during the previous year. The report includes certain cost and savings data (recommendations, recommended cost savings, VE study cost, etc.). It is provided to MDOT Management and staff involved in scoping new projects to encourage alternate solutions that provide cost savings or maximized benefits at little or no increase in cost.

    b. **FHWA Annual Report.** The State VE Coordinator submits an annual report to the FHWA Division Office each year for national compilation and distribution. The report includes the number and cost of VE's and VECP's held and the value of recommendations made (both accepted and rejected).

14.28 REQUEST FOR PRELIMINARY MAINTAINING TRAFFIC

(PPD Task Description 3390, 3540 & 3550)
(revised 1-23-2023)

Once the design has proceeded to a point where the proposed scope of work has been defined (typicals with existing and proposed dimensions, plan sheets with existing and proposed curb lines, etc.), the Project Manager should request a preliminary maintaining traffic scheme from the Region/TSC Traffic and Safety representative. This may include such items as:

- a detour route with any required work to accommodate the proposed traffic, including non-motorized users. See the Work Zone Safety and Mobility Manual for more information
- identification of local special events that may influence traffic during construction or that may be substantial enough to require scheduling the project around the activity
- the use of temporary traffic signals
- the use of temporary cross-overs or a runaround
- preliminary maintaining traffic special provision
- temporary and or permanent pavement markings
- construction staging plans/typicals

It is at this stage when critical construction staging issues may be identified that may significantly influence the proposed scope of work and the corresponding project cost. Situations such as a proposed reconstructed section not wide enough to maintain traffic that has no available detour route or a structure on a detour route with load restrictions often are not identified until this stage. It is essential that a preliminary maintaining traffic scheme be included for review at The Plan Review Meeting.

14.29 PRELIMINARY GEOMETRIC REVIEW FOR NEW CONSTRUCTION, RECONSTRUCTION, OR CONSTRUCTION ON EXISTING ROAD PROJECT TYPES

(PPD Task Description 3560)
(revised 9-22-2025)

During preliminary design it is necessary to have a review by the Geometrics Section of the Design Division. For further discussions on these classifications see Sections 3.08, 3.10 and 3.11. This review will evaluate such areas as:

- sight distance
- design speeds
- curve and interchange placement
- turning radii
- exit and entrance ramps
- driveways
- turn lanes
- roadside safety
- intersection design

Once the design elements have been identified and included in the plans, a memo with a set of plans (or appropriate plan sheets) should be sent to the Supervisor of the Geometrics Unit requesting a review and recommendations by a specified date. This should be done when base plans are available to allow any revisions/additions to be incorporated into the plans prior to The Plan Review. The memo should indicate the project type (see Section 3.08.01B for combined work types).

Non-Freeway Construction on Existing Road project types (see Section 3.09) may be coordinated during plan development on an informal basis.

Regardless of the type of work, all outstanding geometric issues should be resolved prior to submitting for The Plan Review.

14.30 PRELIMINARY CONSTRUCTABILITY REVIEW

(PPD Task Description 3565)
(revised 12-17-2018)

Constructability is taken into account during the scoping and early plan development process (and in conjunction with the Early Project Scoping Constructability Checklist Form 1961). After the Job Concept Statement has been created in JobNet, the Project Manager/Concept Author should consult with the Region/TSC Delivery Engineer concerning items such as Coordinating with other Agencies, Permits, Staging, Maintaining Traffic, Site Investigation, and Right-of-Way. Much of the work under this task should occur before the Scope Verification Meeting. On small projects this task may consist of only the transmittal of base plans to the Resident/Delivery Engineer for comment. On large projects with complex staging, one or more meetings with the Resident/Delivery Engineer and Region/TSC Traffic and Safety Engineer may be required throughout this task. In both instances the review and incorporation of any comments must occur prior to Preliminary Plan Development.

14.31 ENVIRONMENTAL REVIEW AND CLEARANCE

(revised 12-17-2018)

Environmental review and clearance is a two-step process: Environmental Classification (PPD Task 3150) and Environmental Certification (PPD Task 3155).

14.31.01 Environmental Classification

(PPD Task 3150)
(revised 3-23-2026)

Environmental Classification is required by the National Environmental Policy Act (NEPA). All projects must be reviewed for potential environmental impacts and classified according to the significance of those impacts. Class I Actions are those projects with significant environmental impacts and require the preparation of an Environmental Impact Statement (EIS). Class II Actions have minor or no environmental impacts and require Categorical Exclusion (CE) documentation on the Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator). Class III Actions are projects where the significance of the impacts is not known and require the preparation of an Environmental Assessment (EA).

Most projects are classified as CEs. However, environmental review is still required to identify non-significant environmental impacts, and establish measures to mitigate those impacts. Measures to mitigate can include avoidance, design changes, protective measures, or replacement. Establishing mitigation measures can be complex and require coordination with state, federal and local resource agencies. Often, mitigation measures can be developed through collaboration between the Project Manager (PM)/Cost and Scheduling Engineer and MDOT Environmental Staff.

The Environmental Clearance Coordinator (ECC) will contact the PM about one year prior to the Base Plan Date (BPD), or upon notification of project programming (JobNet) for projects of short development duration. The ECC will request information about the scope and location of the project. This information can include the extent of grading and filling, Right-of-Way requirements, detour information, etc., and is critical in assessing project environmental impacts. The project description, location, and other pertinent project information are put on the Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator). MDOT Environmental Staff may contact the PM for more details about the project in order to assess impacts.

Once impacts are assessed, collaboration occurs between the PM and MDOT Environmental Staff, to develop mitigation measures. The goal of collaboration is to develop measures that both allow the project to accomplish its transportation goal and minimize impacts to the environment. Once impacts are identified and mitigation measures established the project can be classified as a CE. The PM will be notified and the Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator) and supporting documentation will be stored in ProjectWise under the Project Job Number. Classification is also recorded in JobNet. Classification is scheduled to occur on or before the completion of Base Plan Review (PPD Task 3380).

14.31.01A Preliminary Design Activity

Prior to completions of the NEPA review process, preliminary engineering and other activities and analyses must not materially affect the objective consideration of alternatives in the NEPA review process. FHWA defines Preliminary Design as activities that define the general project location and design concepts. It includes, but is not limited to, preliminary engineering and other activities and analyses, such as environmental assessments, topographic surveys, metes and bounds surveys, geotechnical investigations, hydrologic analysis, hydraulic analysis, utility engineering, traffic studies, financial plans, revenue estimate, hazardous materials assessments, general estimates of the types and quantities of materials, and other work needed to establish parameters for the final design.

If the information required for classification requires engineering work or environmental coordination extending beyond the BPD, the PM must receive approval from the ECC to continue work limited to the following tasks:

Task	PPD Tasks	Task Extension	Approval
Preliminary Plan Preparation	3500 Series	Note 1	Note 3
Utilities/Railroad	3600 Series	Note 1	Note 3
Mitigation/Permits	3700 Series	Note 1	Note 3
Prepare/Review Final Traffic Signal Operations	3825	Note 1	Note 3
Early ROW Work	4100 Series	Note 1	Note 3
ROW Technical Work	4150 Series	Note 1	Note 3
ROW Appraisal Work	4350 Series	Note 1	Note 3
Safety and Mobility Peer Team Review	3800	Note 2	Note 4
Conduct Final Geometrics and Roadside Safety Reviews	3810	Note 2	Note 4
Geotechnical Design Review - Structures	3815	Note 2	Note 4
Prepare/Review Final Traffic Signal Design Plan	3821	Note 2	Note 4
Complete Permanent Pavement Marking Plan	3822	Note 2	Note 4
Complete Non-Freeway Signing Plan	3823	Note 2	Note 4
Prepare/Review Final Traffic Signal Operations	3824	Note 2	Note 4
Complete the Maintaining Traffic Plan	3830	Note 2	Note 4
Develop Final Plans and Specification	3840	Note 2	Note 4
Develop Structure Final Plans and Specifications	3850	Note 2	Note 4
Final Constructability Review	3860	Note 2	Note 4
Project Plan Quality Assurance Review	3865	Note 2	Note 4

1. Up to Plan Review
2. Up to Plan Completion
3. ECC notification of approval by Bureau of Development Environmental Manager
4. ECC notification of approval by FHWA and Bureau of Development Environmental Manager

The Bureau of Development Environmental Manager will report to FHWA each quarter of the fiscal year the number of projects that have allowed any of the tasks noted above to be performed before the environmental classification.

Final design or Right-of-Way acquisition cannot proceed prior to classification. FHWA defines final design as any design activities following preliminary design and expressly includes the preparation of final construction plans and detailed specifications for the performance of construction work.

14.31.01B Mitigation Requirements

Between base plans and quality assurance review, environmental mitigation measures are to be fully developed and detailed in the plan package.

Development of the materials necessary to convey the environmental mitigation measures within the Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator) will include but not be limited to:

- Project specific Plan Notes
- Notice to Bidders
- Unique Special Provisions

Design staff must take into account that individual pay items needing modification to meet the requirements of environmental mitigation measures require the inclusion of an appropriate unique or frequently used Special Provision to ensure proper construction.

The Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator) filled out by the ECC will have highlighted mitigation measures in bold text to signify that those measures are to be transmitted directly to the TSC Construction Engineer for the project.

Design staff will prepare a Special Design Consideration Memo to be transmitted to the Construction Engineer for their use at the Pre-Construction meeting. The memo should highlight the specific environmental mitigation measures in the plans and proposal and include construction specific instructions related to environmental mitigation highlighted with bold text in the Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator).

14.31.01C Special Design Considerations Memo

Preparation of the Special Design Considerations Memo (SDCM) if applicable to the project will be started in a draft form by the PM and in coordination with design personnel once the PM is in receipt of the Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator) from the ECC. This draft will include the bolded items from the Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator) and any other design issues that may need special consideration to include but not be limited to:

- Environmental mitigation and restrictions.
- Property Owner Agreements from negotiations involving the purchase of Right-of-Way.
- Unique design features that must not be modified in construction.

The DRAFT SDCM should be submitted with The Plan Review Meeting material submittal for review.

A final SDCM should be prepared and submitted with the FPC package and defined on the Design Plan Submittal Form (0303 – Comments Section) and noted on the Milestone Checklist – Supporting Documents Section – Environmental Classification/Certification Row. This final copy should be reviewed by the ECC and the Construction Engineer to resolve any potential conflicts with constructability.

Transmittal of the SDCM from the PM to the TSC Construction Engineer will occur between the FPC Meeting and the Pre-Construction Meeting. A potential reason to wait for final submittal of the SDCM would be to include any items of note that should be brought to the attention of the Construction staff and the Contractor due to plan revisions, addenda, and contractor inquiries that occurred during that time frame.

It will be the responsibility of the Project Manager and the ECC to ensure that all mitigation measures whether or not highlighted in bold on the Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator) are incorporated into the project plans and proposal.

The Construction Engineer will be responsible for ensuring that the contractor is made aware of all environmental mitigation measures and the consequences of not meeting them.

The environmental section of the Pre-Con Boilerplate has been written to ensure this Memo is read at that meeting.

14.31.02 Environmental Certification

(PPD Task 3155)
(revised 3-23-2026)

Environmental Certification is the final step in the Environmental Review and Clearance Process. This task takes place during Project Plan Quality Assurance Review (PPD Task 3865). During Certification, plans and other documents are reviewed to ensure that all areas of concern are avoided, all mitigation measures are in place, and all commitments adhered to. This review is conducted by the ECC and documented on the Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator).

If all mitigation measures are in place and all commitments adhered to, the project will be certified. The PM will be notified and Environmental Classification/Certification (Supplied by Environmental Clearance Coordinator) and supporting documentation will be stored in ProjectWise under the Project Job Number. Certification is also recorded in JobNet.

14.32 MDOT ENVIRONMENTAL PERMITS

(revised 4-22-2019)

Permits from the Michigan Department of Environment, Great Lakes, and Energy (EGLE), the Michigan Department of Natural Resources (DNR) and/or the Army Corps of Engineers are required for projects that involve work in wetlands, inland lakes, streams, drains, flood plains, critical sand dune areas along the shores of the Great Lakes and navigable rivers/harbors. A current summary of the most frequently needed environmental permits is listed below:

Michigan Act 451, Natural Resources and Environmental Protection Act of 1994

- Part 31: Water Resource Protection (including NPDES and Flood plain Authority)
- Part 91: Soil Erosion and Sediment Control
- Part 301: Inland Lakes and Streams
- Part 303: Wetland Protection
- Part 365: Endangered Species Protection

Federal Section 404: Clean Water Act of 1972

Federal Section 10: River and Harbor Act of 1899

The Environmental Section in the Project Planning Division determines which regulations apply to a specific project and can help make recommendations for the project to better address the applicable policies. To make such determinations, project scope, location and a set of plans are required. The review may also involve field inspections or wetland delineation. The Environmental Section is also responsible for submitting the appropriate paperwork to the regulatory agencies for permits.

14.32.01 Clearance

(revised 4-22-2019)

The scope of work statement on project authorizations must be accurate and complete to ensure the appropriate concerns can be determined in a timely manner. Along with the analysis of other environmental impacts, the clearance process includes determining when permits are required for a project. This may involve discussions between the Design/Development Engineer and the Environmental Section and possibly a field review. Plans are often required in the environmental clearance process. It is important that when plans are requested by the Environmental Section, they are submitted as soon as possible or the clearance or permitting process could be delayed. Projects with substantial impacts may require a preliminary review with the EGLE.

14.32.02 Oversight

(revised 2-17-2015)

Once a project with environmental impacts receives a clearance, a letter is sent to the Design/Development Engineer identifying the contact people (environmental) for necessary coordination. Projects involving wetlands, flood plains, inland lakes and streams are entered into a database according to plan completion date. A project status record is maintained by the Environmental Services Section by entering permit request and review information. Therefore, any changes in scheduling or scope of work should be communicated to the Environmental Section so that project clearances and permit requirements may be monitored.

14.32.03 Application

(revised 4-22-2019)

Project Managers of projects needing EGLE permit applications will receive a list of required information from the Environmental Services Section. Submitting incomplete application information will result in additional time before the permit application can be filed with the regulatory agency. Listed below is the required information for EGLE permit applications:

All projects must include the following.

- Project location map indicating approximate locations of each regulated activity. This must have road names legible on an 8.5" x 11" size (Example: a USGS quad map enlarged with culvert extensions at county drains circled.).
- County, township, range, and section numbers of regulated activities.
- Estimated project letting and construction start date.
- Electronic half-sized plan set (11" x 17") and a legible electronic set of 8.5" x 11" plan sheets and cross sections of regulated activities.
- Information on soil erosion and sedimentation controls planned in conjunction with regulated activities.
- Information on any temporary structures or measures to be used in the regulated area during construction.

For culverts at regulated streams and drains, plans should include the following:

- Plan view of the culvert and road.
- Cross section view of the culvert and road. For projects that have similar treatments for all culvert work, a typical cross section that applies may be used. Projects requiring an Army Corps of Engineer Permit require a separate cross section for each culvert including elevations.
- Dimensions of pipe/culvert openings.
- Earth excavation (in cubic yards) needed to complete the crossing structure project.
- Volume of riprap (in cubic yards) needed to complete the crossing structure project.
- List of names and addresses of riparian owners on the four quadrants of the watercourse if work requires public notice by the EGLE. (Examples of work requiring public notice are culvert extensions that total more than 24'-0" or a replacement of a culvert of a diameter 66" or greater).

- For culvert replacements or new culverts, the bottom section of page 2 of the EGLE application must be completed. Information to be provided includes elevations of the invert, low steel, high water and road grades at the structure and the low point of approach.

14.32.04 Duration

(revised 4-22-2019)

It normally takes 60 to 90 days for the EGLE to complete the permit process. This may vary depending on federal involvement and public notice requirements. If a project becomes urgent, such as emergency scour protection, culvert failure or channel stabilization, the EGLE can issue permits on an expedited schedule. Projects with large impacts (such as new bridges or interchanges) are classified by the EGLE as red files and may require a longer processing period due to coordination with the Environmental Protection Agency and other federal agencies. Projects involving the Army Corps of Engineers also require a longer processing period. For EGLE red files and Army Corps of Engineers permit applications allow four to six months for permit processing. The Army Corps of Engineers often requires a higher degree of specificity in its applications compared to the EGLE and may request additional information depending on the project type.

14.32.05 Issued Permits

(revised 4-22-2019)

Permits should be incorporated into the proposal package so that any special requirements are included. Any changes in the project after permitting should be relayed to the permit coordinator in case a permit revision is required. The permit coordinator should also be notified if a project is shelved or the Critical Path indicates the construction scheduling extends beyond the effective date of the permit so that a permit extension can be requested.

For additional information on EGLE Permits for Sewer and Water Main Plans see Sections 9.04.03 and 9.04.07.

14.33 PRELIMINARY ROW SUBMITTAL

(PPD Task Description 3361)
(PPD Milestone 331M)
(revised 12-17-2018)

Preliminary Right-of-Way (ROW) plans are developed for use by the Development Services Division to: conduct title searches and preliminary appraisals, assign parcel numbers, and prepare the ownership sheet. Preliminary ROW plans should be submitted at base plan submittal. An estimated number of parcels affected must be entered in the Planisware network to establish the task duration.

The Project Manager initiates the review process by including the Preliminary ROW plans for Base Plan Review in the ProjectWise workflow.

Additional information on Preliminary ROW plans and plan requirements can be found in Sections 5.16, 5.17 and 5.18.

14.34 DELETED

Section deleted.

14.35 FINAL ROW SUBMITTAL

(PPD Task Description 3581)
(PPD Milestone 361M)
(revised 12-17-2018)

The scheduled Final ROW date is one of the most important deadlines that must be met. Final ROW is submitted at the Preliminary Plan submittal stage. The signed Final ROW Plans and the Design Plan Submittal (Form 0303) give the Development Services Division the authorization to initiate acquisition activities. The design plans must have enough detail and review to have reached a point where the designer is reasonably assured that the ROW being requested will not be changed except for minor design revisions to accommodate the actual acquisition.

NOTE: On large projects, it may be desirable to have an informal plan review with representatives from the Project Development and Control Section of the Development Services Division, the Region Real Estate Agent and the Design ROW Engineer in Quality Assurance prior to the formal ROW submittal. This may help avoid future revisions and ensure that the Development Services Division is receiving all the information it needs.

Additional information on final ROW plans including plan content requirements can be found in Sections 5.16, 5.19 and 5.20.

14.36 THE PLAN REVIEW

(PPD Task Description 3590)
(PPD Milestone 352M)
(revised 12-17-2018)

Most projects being designed by the Region/TSC or its Consultants require a Plan Review meeting. Refer to the table, QA/QC Process by Template on the Plan Development Services intranet website to verify the need for a Plan Review Meeting. The meeting and corresponding field review should be conducted by Quality Assurance. Under unusual circumstances such as expedited project schedules or when a Quality Assurance Engineer is unavailable, a Region/TSC Design Engineer or Region System Manager may arrange to facilitate The Plan Review meeting.

Section 14.36.01 identifies the information that should be provided in the Preliminary Plan file at a minimum if required. The Plan File must be developed consistently with Section 1.02 and the current version of the Road Sample Plans.

14.36.01 Requirements

(revised 12-17-2018)

The Plan Review material will be submitted in the following 3 files:

1. Supporting Documents File
    - See the project Milestone Checklist and Form 0303 Design Plan Submittal.
2. Proposal File
    - See the project Milestone Checklist and Form 0303 Design Plan Submittal.
3. Plan File
    - See Road Sample Plans and Chapter 1.
4. RID
    - Place required RID files according to the Design Submittal Requirements in the RID Preliminary folder.

14.36.02 Procedure

(revised 12-17-2018)

1. When the Project Manager or Consultant determines the plans meet the requirements for The Plan Review, the project Milestone Checklist is completed to verify that supporting documents, proposal materials and plans are ready to submit. The materials are entered into ProjectWise using the file naming conventions outlined in Section 1.03.02.

2. The Project Manager fills out a Design Plan Submittal (Form 0303) and initiates the Certification Acceptance form. Include E mail addresses for invitees outside of MDOT. Include dates that key personnel and conference rooms are available. They should be at least 3 weeks (preferably 4-5 weeks) from the submittal date.

3. The Project Manager will verify that ProjectWise (folder 3) is current with the following format;

- 3 – Plan Review
    - Design Submittal Form and Minutes
    - RID Preliminary

If the format is not correct contact the ProjectWise administrator to apply the proper template.

4. When the project is ready for final review, Form 0303 is placed in the ProjectWise subfolder "Design Submittal Form and Minutes" using the file name *Job Number_0303_DPS_Prelim.pdf* and the state is advanced to "Request for Meeting" to initiate submittal to Quality Assurance for review. The ProjectWise state on the three files containing plans, proposal material and supporting documents in the "Plan Review" folder are also advanced once to "Submitted for Review".

5. The plans will be reviewed by Quality Assurance for completeness and a meeting date scheduled 4-5 weeks from the time of submittal. Instances where projects require a compressed schedule or scheduling without plans should be kept to a minimum. The 4-5 week period is needed to assure all participants are given ample time to review the plans prior to the meeting. This is essential to making The Plan Review as useful and productive as possible.

6. Plans and other material are made accessible in ProjectWise by the Project Manager. Quality Assurance distributes the same to non-ProjectWise users in an alternate deliverable and usable format. The reviewers include the following:

    - Operations Field Services Division
    - Region System Manager
    - TSC Manager
    - Region/TSC Resident/Delivery Engineer
    - TSC Development Engineer
    - Region/TSC Operations Engineer
    - Region/TSC Soils/Materials Engineer
    - Region/TSC Traffic and Safety Engineer
    - Region/TSC Maintenance Engineer
    - Region/TSC Utilities/Permits Engineer
    - Region/TSC Real Estate Agent
    - Region Resource Specialist
    - Region Bridge Engineer (Bridge Jobs Only)
    - Region Bridge Inspection Engineer (Bridge Jobs Only)
    - Environmental Services Section
    - FHWA Oversight
    - Design Utilities Section
    - Railroad Coordination Unit – Office of Rail (if applicable)
    - Geometrics Section- Design
    - Utilities/Permits Development Services Division
    - MDOT-RIDSupport
    - City or Village (if applicable)
    - County Drain Commissioner (if applicable)
    - County Road Commission
    - Department of Management and Budget (MIR Program)
    - Others identified by the Project Manager

During the review process, reviewers can deposit comments in to the Review Comments subfolder in ProjectWise. Prior to the meeting, the Project Manager incorporates all comments received into the plan set for discussion at the meeting.

7. After The Plan Review Meeting is held, either the Quality Assurance Engineer or Region/TSC Design Engineer must resolve any undecided or controversial issues and inform the individuals involved of the outcome (approval/rejection) of their proposal prior to the distribution of the meeting minutes. The meeting minutes and an electronic set of plans with Plan Review comments will be given to the Design Unit, and should remain in the project files until the project is closed out.

14.37 REVIEW OF PROJECT SCOPE, COST AND SCHEDULE

(revised 11-26-2018)

After The Plan Review has been completed, the Project Manager should review the project scope, cost (preliminary engineering and construction) and schedule. Any significant changes to the scope, cost and/or schedule should be submitted to the appropriate System Manager or Statewide Transportation Planning Division. See Section 14.15 (Change Request/Review of Project Scope, Cost and Schedule). Project Managers can access the JobNet home screen for more information on the S/TIP User Guides and the MPO/RTF Actions Page for more information on changes that trigger a Federal amendment.

NOTE: If the project was required to be, but not, on the approved STIP at the time of the Scope Verification Meeting (see Section 14.10), the Project Manager should again check to see if the project is on the STIP by following the instructions given in that section.

If the project is not on the STIP, the Project Manager must immediately notify Statewide Planning Section of the Statewide Transportation Planning Division in the Bureau of Transportation Planning. The approval process for the STIP involves many independent entities and cannot be expedited. Therefore, it is imperative that the Project Manager take action at this time to avoid possible delays in advertising the project.

14.38 ROW REVISIONS

(revised 12-17-2018)

ROW revisions occur only after final ROW is submitted, not between preliminary and final ROW submittals. Revisions should be processed whenever changes in proposed ROW occur or when changes in the design plans could affect the appraisal of and/or negotiations for a ROW parcel(s). ROW revisions are processed by submitting a completed Design Plan Submittal (Form 0303) to the Design ROW Engineer in Quality Assurance with the standard size reproducible(s) of the revised sheets and one print of each sheet with the revision circled in red. The Design Plan Submittal (Form 0303) should include a description of each revision. The Design ROW Engineer will review the plans and submit the ROW revision to the Development Services Division.

Revisions, unless originated by the Development Services Division, are strongly discouraged within six months of the project letting date. If a revision is necessary within six months of the letting, consult with the Project Development and Control Section of the Development Services Division, or the Design ROW Engineer to determine the best method for processing the revision.

Additional information on ROW revisions can be found in Section 5.21.

14.39 UTILITY STATUS REPORT CERTIFICATION

(PPD Task Description 3660)
(revised 12-17-2018)

All projects require a utility certification prior to the contract award. The utility certification is comprised of the completion and inclusion of the Utilities Status Report (Form 2286), and the Notice to Bidders – Utility Coordination document if necessary, in the final plan/proposal package distributed for review at the Final Project Coordination (FPC) Meeting and later submitted to the Specifications and Estimates Unit for processing prior to advertisement.

Form 2286 informs project bidders and the awarded contractor of utility impacts and/or coordination requirements that can be expected. Utility impacts will be described using the following four categories as indicated on Form 2286:

- Relocation work identified
- Utility to relocate prior to start date
- Notice to Bidders - Utility Coordination
- Work included in contract

A Notice to Bidders - Utility Coordination document must be used when one of the following conditions applies:

- There is contract work which will need to be coordinated with a utility's work. The document describes in detail the coordination effort necessary.
- There may be utility facilities that could affect normal contractor operations and/or scheduling. The document includes additional information that may be useful to the contractor.

Procedure

Project Manager

1. Request preliminary Form 2286 and Notice to Bidders - Utility Coordination from the TSC Utility Coordinator in preparation for the Plan Review Meeting mailing.

   Note: If no utility involvement in the project, the TSC Utility Coordinator may provide the final Form 2286 and Notice to Bidders - Utility Coordination.

2. Request final Form 2286 and Notice to Bidders - Utility Coordination after the Plan Completion Date in preparation for final plan turn-in .

14.40 EGLE PERMITS FOR SEWER AND WATER MAINS

(PPD Task Description 3680)
(revised 4-22-2019)

Plans that include additions or changes to water mains, sanitary sewers or combination storm and sanitary sewers require a Michigan Department of Environment, Great Lakes, and Energy (EGLE) permit. The Project Manager should contact the Design Engineer-Municipal Utilities as early as possible in the scope verification/plan development process when water mains or sanitary sewers are involved. The Municipal Utilities Unit will complete the required plan sheets and specifications, seal the plans (Licensed Professional Engineer) and make the distribution to any municipalities involved. The municipalities will request the permit from the EGLE and return an approved copy to MDOT. If possible, a copy of the permit should be included in the proposal. For additional information see Section 9.04.07.

14.41 PARTICIPATION AGREEMENTS

(PPD Task Description 3630)

14.41.01 General

(revised 2-17-2018)

Any questions with respect to the necessity of an agreement, cost participation, cost splits, or negotiation of terms in an agreement should be coordinated with the Utility Coordination, Permits and Agreements Section - Development Services Division. Agreements for State trunkline highway projects are prepared by the Utility Coordination, Permits and Agreements Section - Development Services Division in the following categories:

- Memos of Understanding (for activities performed by local agencies-PE, CE, ROW acquisition, etc.
- Trunkline Transportation Alternatives Program projects
- Statutory-Act 51 Participation
- Extra Width Construction and Resurfacing
- Non-trunkline Work
- Municipal Utility (betterment or relocation)
- Turnback
- Parking
- Maintenance and Operation (bike path, sound walls, pedestrian bridges, etc.)
- Michigan Institutional Roads
- Joint Storm Sewers
- Detour Route Improvements
- Local Agency Permit Work within Trunkline Right-of-Way
- Lighting on non-freeway projects

The Utility Coordination, Permits and Agreements Section - Development Services Division is responsible for the negotiation of terms and preparation of agreements. Contact should be made as early as possible in the plan development process to allow adequate time for the proper coordination to process an agreement.

Any correspondence with a local unit of government that involves participation, whether statutory or special, should be originated by or cleared through the Utility Coordination, Permits and Agreements Section - Development Services Division. Particular care should be used when citing cost estimates and federal participation since the agreement cost estimate figures may include higher contingency percentage and lower federal-aid participation ratios.

Information on work to be included in a contract at 100% local expense should be submitted to the Utility Coordination, Permits and Agreements Section - Development Services Division upon request for the additional work from the local agency.

Requests for agreements should be submitted to the Governmental Trunkline Engineer by e-mailing MDOT-TLAgreements@michigan.gov

Requests for agreements should be submitted prior to scheduling an FPC Meeting. The following information should be submitted for an agreement preparation:

- Project Agreement Checklist (Form 2047) - with any special conditions included in the project.
- Engineer's Estimate-with proper agency splits (proposal level in AP Preconstruction).

Plans should include the following:

1. Corporate limits and itemized quantity splits to be participated in by the city for Act 51 work.
2. Itemized quantity splits for any 100% local work (work not participated in with MDOT funds).

Other agreements such as, non-contract traffic signal (Operational Services), Right-of-Way (Development Services Division) and general road and bridge maintenance (Maintenance Services) are processed by other areas within MDOT.

14.41.02 Estimates

(revised 12-17-2018)

The estimate provided to the Utility Coordination, Permits and Agreements Section - Development Services Division for agreement purposes should NOT include contingencies since a contingency factor will be added to the construction cost for agreement purposes. The estimate should be refined to such a degree that it will be within 25% of the final engineer's estimate. Anything in excess of 25% should be called to the attention of the Utility Coordination, Permits and Agreements Section - Development Services Division. The estimate must be split along corporate limits for projects with city participation. Any modifications to the scope should be incorporated in a revised or amended agreement.

Upon receipt of the request for involvement, the Utility Coordination, Permits and Agreements Section - Development Services Division will contact the Design Unit to request any additional information required and will coordinate the agreement processing procedure.

14.41.03 Act 51 Participation

(revised 7-28-2025)

Act 51 Public Acts of 1951, as amended (1982), as amended by Public Act 459 of 2016, provides that cities having a population of 25,000 or more will participate with the Department in the cost of opening, widening and improving, including construction and reconstruction, of State trunkline highways within said cities not within limited access trunkline Right-of-Way. Cities required to participate, based on the 2020 census, are:

OVER 50,000 12.5% Participation		
Ann Arbor	Kalamazoo	St. Clair Shores
Battle Creek	Kentwood	Southfield
Dearborn	Lansing	Sterling Heights
Dearborn Heights	Livonia	Taylor
Detroit	Novi	Troy
Farmington Hills	Pontiac	Warren
Flint	Rochester Hills	Westland
Grand Rapids	Royal Oak	Wyoming
40,000 to 50,000 11.25% Participation		
East Lansing	Midland	Roseville
Lincoln Park	Portage	Saginaw
25,000 to 40,000 8.75% Participation		
Allen Park	Inkster	Port Huron
Bay City	Jackson	Romulus
Burton	Kentwood	Southgate
Eastpointe	Madison Heights	Walker
Garden City	Muskegon	Wyandotte
Hamtramck	Norton Shores	N/A
Holland	Oak Park	N/A

In order to facilitate the administration of Act 51, participating and non-participating items have been compiled. Refer to the Utility Coordination, Permits, and Agreements Unit for a determination of participation requirements for situations not covered in this section.

14.41.03A Participation Items

The following is a partial classification of those items of work which require participation.

1. Preliminary and construction engineering and inspection, including surveys, design, plans and specifications, contracting, legal, and all related costs.
2. Acquisition of property for right-of-way including consequential and abuttal damages, if any, interest on awards and court costs, legal, appraisal, financing, and all related costs.
3. All items necessary for the construction, reconstruction, and improvement of state trunkline roadways, including:

a. The removal of existing roadbed and structures.

b. The removal and replacement of existing sidewalks and the construction of new sidewalk ramps.

c. The construction of new curb and gutter and the removal and replacement of existing curb and gutter when required in connection with a resurfacing project or traffic operational improvement project or to maintain curb height.

d. The removal, replacement, and modification of existing publicly-owned street lighting facilities and utilities required in connection with a highway improvement.

e. The installation of new culverts, drainage facilities, sewers, catch basins, guardrail, right-of-way fencing, and sound barriers.

f. The extension or modification, as a betterment, of existing culverts, drainage facilities, guardrail, and Right-of-Way fencing.

g. The construction of flood control, flood prevention, and earthwork protective structures.

h. The construction of bicycle and other non-motorized paths.

i. Landscaping.

j. All costs of maintaining traffic and detours required for a project including rehabilitation of roads and streets used as detours and material haul routes and all signing, electrical devices, and markings required for such.

k. The trunkline portion of the cost of the construction of railroad grade separations.

l. The trunkline portion of the cost of the construction of railroad grade crossings and the installation of warning devices when performed for the construction of a new or relocated roadway.

m. The trunkline portion of the cost of joint storm sewers.

n. The removal of fixed objects such as trees and stumps for safety purposes.

o. The installation of traffic attenuators.

p. The removal, recycling, and replacement of surface materials having a length of one city block or 500 feet, whichever is less.

q. The grooving or mechanical texturizing of the roadway surface for any length to increase friction.

4. Participation is required in the construction of new bridges and grade separations and the reconstruction or modification of such structures for the purposes of increasing vehicular or pedestrian capacity; strengthening, widening, or replacing piers and abutments; replacing the deck when such deck replacement is of one span or more in length; and other major modifications. All items necessary for the construction, reconstruction, and improvement of state trunkline structures, including:

    a. Replacement or widening of a bridge deck for at least one continuous span, including deck improvements for drainage, safety, or the existing road alignment.

        i. The bridge deck does not have to be full width but requires at least one continuous span.

        ii. The deck resurfacing or overlay must be a minimum of ¾-inch thick.

    b. Trunkline approach work as required as part of a bridge project.

    c. All preparatory work necessary for superstructure construction including hand chipping for the deck, hydrodemolishing, and removal of existing pavement patches and joints.

    d. Joint replacement as part of a deck overlay or deck replacement.

    e. Pedestrian screening.

    f. Any widening or replacement of piers, headwalls, and abutments necessary for superstructure construction.

    g. Structural steel replacement as part of a deck replacement project.

    h. The installation, extension, or betterment of guardrail protecting the bridge structure.

    i. The removal and replacement of sidewalks.

    j. All maintaining traffic items related to the participating items of the bridge project (i.e. pavement markings and barricades used for traffic control).

    k. All necessary landscaping required for this construction, widening or major modifications to these bridges.

    l. Mobilization and miscellaneous items related to participating items of the bridge projects involving construction or major modifications.

5. Any resurfacing or reconstruction operation which changes the roadway surface type or consists of special surface treatment to improve traffic operations provided:

    a. Any resurfacing material placed on a roadway must be at least 1 ½-inches thick and have a continuous length of one city block or 500 feet, whichever is less, unless performed in conjunction with an improvement, in which case the length limitation will not apply.

    b. Any surfacing of shoulders, other than seal coating, which consists of materials of higher quality than standard gravel shoulders, or the replacement of earth shoulders with standard gravel shoulders.

    c. The placing of at least 3-inches of new aggregate on prepared gravel or stone surfaces to substantially increase the thickness of the surfacing material beyond that originally built.

14.41.03B Non-Participation Items

Maintenance work is excluded from statutory participation. The following is a partial classification of state trunkline roadway items of work which do not require participation.

1. Replacing aggregate in a thickness of less than 3 inches on an existing gravel or stone surface where the original material has been lost.
2. Reconditioning of HMA surfaces of any length by scarifying and remixing in place or resurfacing without scarifying when the new material added increases the existing HMA surface 1½-inches or less.
3. Seal coating, patching, and repairing of roadway surfaces.
4. Cleaning of drainage structures and ditches.
5. Application of dust control layers, sprinkling, and flushing.
6. Brushing and tree trimming if not associated with a roadway improvement.
7. The installation of traffic signs, delineators, or pavement markings, other than those required for the maintaining of traffic during construction.
8. Ordinary repair or replacement in kind of guardrail and right-of-way fence.
9. Installation of freeway lighting for traffic safety.
10. Replacement of pavement joints, unless performed in conjunction with a project to prepare the roadway for resurfacing.
11. The trunkline share of traffic signals unless specifically included as a part of the agreement with the participating city or village.
12. The installation of railroad crossing warning devices at existing railroad grade crossings.
13. The reconstruction or replacement of railroad crossing materials, including maintaining traffic, detours, and minor roadway approach work to accommodate the work at the crossing.
14. Snow and ice removal.
15. Cleaning of road and street surfaces.
16. Outdoor advertising sign removals.

17. County drain assessments.
18. All work programmed as Capital Preventive Maintenance (CPM).
19. Upgrading of existing sidewalk ramps or construction of new sidewalk ramps to comply with federal requirements under the Americans with Disabilities Act (ADA), ONLY when required ADA compliance is a direct result of CPM work.

The following is a partial classification of state trunkline structure items of work which do not require participation.

1. Pin and hanger replacement.
2. Cleaning and coating existing structural steel.
3. Any patching or sealing work done on the substructure.
4. Rocker bearing realignment.
5. Removal and replacement of joints not part of a deck overlay.
6. Resurfacing of the trunkline approach with a length less than 500 feet or one city block and not related to participating bridge construction.
7. Resurfacing of the deck that is less than one continuous span.
8. Routine maintenance which includes ordinary repair, painting, cleaning and snow and ice removal for the bridge deck and structure.
9. Furnishing and fabricating structural steel additions and replacement for existing structures as a result of accidents.
10. The construction of temporary supports.

14.41.04 Deleted

Section Deleted

14.41.05 Extra Width Construction or Resurfacing

(revised 12-17-2018)

Act 51 is specific as to the width of pavement for which the Department is responsible. An agreement is necessary whenever the proposed work covers a width greater than the Department can justify.

In any city or village, the width of a State trunkline highway will be the width required to serve expected future traffic needs for a 20 year period, as determined by a Department transportation survey. This width, except as noted below, will not be less than (1)the currently accepted standards for a 4-lane highway, (2)such width as may be built on the same trunkline route immediately beyond and adjacent to either legal boundary of the city or village, or (3)on trunklines eligible for federal highway funds, such width as may be prescribed by the federal government, whichever is greater. The Department and the governing body of a city or village by mutual agreement may determine that the width of a State trunkline highway will be less than the width prescribed above. If any city or village desires to widen a State trunkline highway for local purposes beyond the width prescribed above, the entire cost of the extra width must be borne by the city or village.

Resurfacing of any width greater than 47'-3" (64'-0" if parking is prohibited and marking is for 5 lane operation) or of any lane or bay on which parking is permitted should be reviewed with the Utility Coordination, Permits and Agreements Section - Development Services Division.

The Department will pay the costs for any construction on a trunkline highway where parking is permitted when the width is 47'-3" or less. If the resurfacing of the parking lanes is done at project cost, an agreement will be written that states that the Department may use the additional width for trunkline purposes, when and if, necessary.

The Utility Coordination, Permits and Agreements Section - Development Services Division should be notified if there is a possibility of extra width construction or resurfacing. If so, it will conduct negotiations, make a final determination, and prepare an agreement if necessary.

14.41.06 100% Betterment for Local Party (non-trunkline work)

(revised 7-28-2025)

A local party, whether governmental or private, may request betterments (generally with 100% municipal participation) to their local facilities, to be constructed in conjunction with a state trunkline project. Any such work requires a participation agreement. Regardless of the Division contacted, the Utility Coordination, Permits and Agreements Section - Development Services Division should be notified so that negotiations on the cost agreement can be started.

Betterments may be either improvement of utilities or any construction not required because of the trunkline project. Generally, this includes any construction beyond the spring points of the intersection on the local legs or the trunkline right-of-way lines extended (whichever is smaller), other than the minimum work to transition either in width or grade back to the existing road.

14.41.07 Municipal Utilities

(revised 12-17-2018)

General relocation of municipally owned utilities within their corporate limits is done at project expense, except for water main relocation (See Section 9.02.01B). If the relocation is part of the Department's contract, no agreement is necessary; however, local notification is secured through the procedure outlined in Chapter 9 "Utilities." If the relocation is to be done by the owner, or if the utility is located outside the corporate limits of the owner, an agreement is required. The Utility Coordination, Permits and Agreements Section - Development Services Division and the Municipal Utilities Unit will make the determination. For more information see Section 9.02.

14.41.08 Bicycle Paths

(revised 12-17-2018)

An agreement is necessary with the local government agency for the construction of independent bike paths within the limits of that agency. The Department will construct the path, including the initial signing, provided that the governmental agency agrees to certain conditions, principally a willingness to assume all maintenance responsibility. The agreement should be requested from the Utility Coordination, Permits and Agreements Section - Development Services Division at the beginning of the design phase. No agreement is required for shoulders designated as bike paths other than for reasons listed in other categories of agreements. For more information see Section 12.12.

14.41.09 Turnbacks

Turnback work will require an agreement. Cities with a population over 25,000 participate by statute. Special items or betterments are treated the same as regular trunkline work. Under some circumstances an agreement will be obtained only to outline the procedure for design, construction and transferring jurisdiction. Care in meeting these provisions must be exercised in the design process. Any work done in advance of or in anticipation of turnback may require an agreement to protect the Department's interest. The Turn Back Law also contains provisions for making a lump sum payment to the local agency in lieu of a rehabilitation project. For more information see Section 12.03.

14.41.10 Parking

(revised 12-17-2018)

The Project Manager should notify the Traffic and Safety Unit of the possibility that a parking restriction agreement is required. The Traffic and Safety Unit will investigate the situation and formally request an agreement, if required. Any section of roadway being widened within the corporate limits of a city or village should be referred to and reviewed by the Traffic and Safety Unit. Resurfacing of any roadway in any city or village where parking is not prohibited should be reviewed.

14.41.11 Special Maintenance and Operational Obligations

(revised 12-17-2018)

When special conditions for either maintenance or operational obligations exist (sidewalks, bike paths, sound walls, pedestrian bridges, etc.), contact the Utility Coordination, Permits and Agreements Section - Development Services Division, as these must be covered by an agreement.

14.41.12 Michigan Institutional Roads (MIR Program)

(revised 12-17-2018)

Work done with MIR funds does not require an agreement since these are budgeted MDOT funds. Work is confined to roads open to the public. Institutions may request work on private roads, parking lots, or other items of benefit to them such as drainage or lighting. These items are not eligible for MIR funds and must be funded with a special account number. An agreement must be secured with the Department of Management and Budget by the Utility Coordination, Permits and Agreements Section - Development Services Division.

14.42 SPECIAL USE PERMITS

(revised 3-16-2015)

Special Use Permits (SUPs) are issued by local governmental agencies. Currently, except in a few instances, the Contractor is responsible for obtaining Special Use Permits. However, on occasion, construction delays can be caused if certain SUPs are required. Therefore, the Project Manager needs to address SUPs during the plan development process.

All SUPs are not required to be obtained during the design phase, only those that have the potential to delay construction. To determine which SUPs could impact construction schedules, the Project Manager should list any possible SUPs on the title sheet prior to submittal for The Plan Review. These can be discussed separately at The Plan Review and a determination made as to which, if any, are required to be obtained prior to advertising. The minutes from The Plan Review will indicate any SUPs that are required. The Project Manager will coordinate the work with the appropriate individual(s) to obtain the SUPs prior to the distribution of the plan/proposal package for the FPC Meeting. Any required SUPs should be included in the plan/proposal package submitted to the Specifications and Estimates Unit.

A partial list of Special Use Permits is given below:

- Mining (wetland)
- Night work
- Noise
- Tree cutting/replacement
- Burning
- Water system connections
- Public utility
- Concrete plants of crushers
- Pavement breakers
- County drain
- Dust control
- Storm sewer connection
- City/Township ordinance
- Other

14.43 SPECIAL DRAINAGE DESIGNS

(revised 4-26-2021)

Specialized units within the Department assist in the preparation of plans and specifications for various highway drainage structures including mechanical systems for pump houses, tunnel storm sewers, inverted siphons, special manholes, junction chambers, slab culverts, box culverts, precast three-sided culverts, precast arch culverts, head walls, and circular culvert extensions. All requests for such work should be directed to the Bureau of Bridges & Structures, Structure Design Section, Special Structures Unit, as well as Utilities, Drainage, and Roadside Section of the Design Division. Requests for design assistance must be made as soon as possible after the scope verification meeting.

14.44 COUNTY DRAIN REVIEW

(revised 5-28-2024)

When it becomes evident a county drain will be affected by a project, the Project Manager should contact ***both*** the Region/TSC Drainage Coordinator and MDOT Drainage Coordinator (Hydraulic Unit – Environmental Services Section) as soon as possible. The Project Manager is also responsible for sending a copy of the plans (required by law under the Drain Code) at milestone reviews (Plan Review and Final Project Coordination (FPC)) to the County Drain Commissioner, Water Resources Commissioner, or Drainage Board, per Section 2.5.5 in the MDOT Drainage Manual.

MDOT drainage coordination responsibilities are described in the MDOT Drainage Manual, Chapter 2 Legal Policy and Procedure, Appendix 2-D, Attachment B.

14.45 MAINTAINING TRAFFIC AND CONSTRUCTION STAGING

(PPD Task Descriptions 3820 & 3830)
(revised 12-17-2018)

After The Plan Review Meeting has been held and the plans revised accordingly, the Project Manager should request the final maintaining traffic scheme from the Region/TSC Traffic and Safety representative. This should include the following applicable items:

- Maintaining traffic special provision
- All pay items and quantities
- Temporary and/or permanent signing
- Temporary and/or permanent signals (this may have to be coordinated with the Operations Field Services Division)
- A copy of any agreement(s) authorizing MDOT use of a detour route
- Maintaining traffic plans and staging typicals/plans

The above request can be initiated by sending a memorandum and an up-to-date set of plans to the Region/TSC Traffic and Safety representative. On large projects with separate staging typicals and/or plan sheets or unique/complex projects, a meeting with the Project Manager, Resident/Delivery Engineer, Traffic and Safety representative(s) and Utilities and Permit representative(s) may be beneficial to guarantee the plans, proposal and maintaining traffic special provision are compatible.

14.46 FINAL GEOMETRIC AND SAFETY REVIEW

(PPD Task Description 3810)
(revised 12-17-2018)

After The Plan Review Meeting has been held and the comments are incorporated into the plans the Project Manager should transmit a set of plans to the Geometrics Unit of the Design Division for review. On large projects this may include several transmittals, discussions, meetings, etc. periodically during development of the final plan/proposal package. It is essential to have geometric and safety items reviewed and approved prior to the FPC Meeting to avoid delays and last second revisions. Items to review may include:

- Sight distances
- Design speeds
- Curve and interchange location
- Turning radii
- Exit and entrance ramps
- Driveways
- Turn lanes
- Storage and transition lengths
- Superelevation
- Roadside safety
- Intersection layout

This review is only to allow the Geometrics Unit to verify that all previous recommendations have been incorporated in the plans.

14.47 RIGHT-OF-WAY MONUMENTING

(revised 12-17-2018)

Monumentation of trunkline Right-of-Way has presently been discontinued due to both a lack of funding and shortage of personnel. Permanently monumented Rights-of-Way benefit the Department both as physical evidence of the location of trunkline and property boundaries as well as reducing the costs of future surveys, adjacent surveys and other boundary control issues. Therefore, it is still to be included in construction plans as defined by the situations below.

Right-of-Way monumenting and documentation must be done by a Professional Surveyor licensed to practice in the State of Michigan.

14.47.01 New Construction

On new construction, ROW monumentation should be placed along the ROW at every deflection, Curve PC and PT, intersections with section lines, plat boundaries, and crossings with municipal Rights-of-Way. The monument locations should be coordinated with the project control and shown on the construction and ROW plans labeled with their Station and Coordinate values. The actual numbering of monuments should be coordinated with the Lansing Design Survey Unit. The scope of services for such a contract should be prepared by the Lansing Survey consultant management staff or the Regional Surveyor (if not included in the construction contract). Funding must be identified for any such work.

14.47.02 Improvements Requiring ROW Acquisition

On existing facilities requiring ROW, monuments should be placed so as to define the boundary of any newly acquired parcel (total or partial take). Those extending through platted areas should monument any new plat corner locations. These locations should be coordinated with the project control and shown on the construction and ROW plans labeled with their Station and Coordinate values. The actual numbering of monuments should be coordinated with the Lansing Design Survey Unit. The scope of services for such a contract should be prepared by the Lansing Survey consultant management staff or the Regional Surveyor (if not included in the construction contract). Funding must be identified for any such work.

14.47.03 Improvements Not Requiring ROW Acquisition

Existing Rights-of-Way typically have sufficient evidence or occupation (i.e.: fences, existing monumentation, etc.) to indicate the location of the boundary. Monumentation in these situations is not recommended. Any dispute involving the location of any ROW boundary should be resolved by formal survey on a case by case basis.

14.47.04 Coordination

Currently, MDOT rarely provides funding for monumentation. Project Managers for projects requiring ROW acquisition should contact the Lansing Design Survey Unit for direction in what, if any, monumentation information should be included in the plans.

14.48 REQUEST FOR TURF ESTABLISHMENT RECOMMENDATIONS

(revised 12-17-2018)

Once the limits of earthwork are known and the construction schedule has been determined, the Project Manager should include the Region Soils Engineer and the Statewide NPDES Resource Specialist in all electronic plan submittals throughout the duration of the project to confirm the correct Soil Erosion Sedimentation Control (SESC) Measures have been properly implemented and finalized before the FPC Meeting. The Project Manager will contact Region/TSC construction staff or the Roadside Development Unit for turf establishment recommendations.

14.49 DELETED

Section deleted.

14.50 FINAL CONSTRUCTABILITY REVIEW

(PPD Task Description 3860)
(revised 12-17-2018)

Once the revisions from The Plan Review Meeting have been incorporated into the plans, Final Plans begin. After the final maintaining traffic special provision has been received, and staging typicals and/or plan sheets have been completed, this information plus any unique special provisions should be sent to the Resident/Delivery Engineer for review. Discussions concerning a Construction Critical Path Network, if applicable, should also occur at this stage. In conjunction with the Constructability Review Checklist (Form 1960) for the Project Development/Design Phase, the work in this task must be addressed prior to the distribution of the final plan/proposal package for the FPC Meeting.

The final constructability review applies to all projects. On small projects this task may consist of only the transmittal of plans to the Resident or Delivery Engineer for comment. On large projects with complex staging, one or more meetings with the Resident/Delivery Engineer and Region/TSC Traffic and Safety Engineer may be required throughout this task. For projects in templates that do not require an FPC Meeting, the Final Constructability Review must be completed prior to Plan Completion.

14.51 INCENTIVE AND LIQUIDATED DAMAGES CLAUSES

(revised 12-17-2018)

There are two inducements to completing work by the prescribed completion date or time. These are in addition to the normal schedule of Liquidated Damages included in Section 108.10 of the current Standard Specifications for Construction. Both are listed below.

- Incentive payments - used primarily on critical projects where traffic inconvenience and delays are to be held to a minimum. The amounts are based on estimates of items such as traffic safety, traffic maintenance, and road user delay costs.
- Liquidated Damages for Other Department Costs - based on increased user costs and/or additional cost incurred by MDOT; such as increased maintenance costs or costs due to the type of designs for temporary roads.

14.51.01 Guidelines

(revised 3-16-2015)

Guidelines for the development and use of Incentive or Liquidated Damages Clauses are as follows:

- Projects that are to be on an expedited schedule should be identified during the “Call for Projects” process and in the Project Concept Statement.
- Justification material such as hourly counts, user cost data and construction costs should be available prior to The Plan Review Meeting so a traffic control plan can be presented and reviewed at the meeting.
- When Incentive clauses or special expedited schedules are used, adequate Department staff must be available to maintain proper inspection and to assure a quality product.
- Projects should be straight forward and not require several different types of construction procedures or typical sections.

14.51.02 Applications

(revised 7-22-2013)

Incentive Clauses would be appropriate where the following conditions exist:

- A substantial savings in user costs can be realized by shortening the time of the traffic restrictions or completing the project ahead of schedule.
- Total additional user costs should be at least in the neighborhood of 5% of the project cost. $5000 per day should be considered as the daily minimum incentive for major projects. For smaller interim elements of a project, a lesser value may be used.
- The time of the traffic restriction should be long enough to allow the construction schedule to be compressed at least an additional 15 days, based on a completion date using an expedited schedule.
- Where capacity will be reduced below an acceptable level of service and no detour route is available.
- Where a detour route must be used and the detour has an unacceptable level of service.

Liquidated Damages for Other Department Costs would be appropriate where the following conditions exist:

- Where additional costs would be incurred by MDOT in the form of maintenance costs on temporary roads, costs of over-designing temporary roads, maintaining traffic costs, etc. and where substantial additional user costs would be incurred or could be justified. An example would be a road being maintained on a detour or a temporary road through the construction area. The level of service would not be reduced but maintaining this situation beyond a specified date (winter shutdown) would create additional costs for MDOT. The amount of the Liquidated Damages should be substantive enough to cause the contractor to follow the schedule and to do the work as required otherwise the contractor may choose to pay the Liquidated Damages payment.
- Where the substantial user costs could be justified but the construction time is too short to allow a meaningful incentive period before the established completion date. An example would be to assess Liquidated Damages to assure the daily lane closures will not extend into the rush hour.

14.51.03 Procedure

(revised 7-22-2013)

As soon as the Project Managers are aware that Incentive or Liquidated Damages Clauses will be included in a project, they should request an analysis. Since the analysis often requires considerable data from different work centers, it is essential to give as much lead time as possible. The Project Manager should supply, as a minimum, the following information:

- All available traffic counts (24 hour)
- The number of lane closures, if applicable
- Detour routes - distance and estimated travel times

Once the analysis is completed, reviewed, and approved the information is forwarded to the Project Manager and is incorporated into the progress clause.

The maximum cost (usually 5% of the total contract) must be included in the construction cost of the project and remain within the approved programmed amount.

14.52 REVIEW OF PROJECT SCOPE, COST AND SCHEDULE

(revised 12-17-2018)

Once the plans and proposal are completed and quantities have been entered into AP Preconstruction, the Project Manager should compare the estimate with the programmed cost. If a revision to the cost (or schedule) is required, a change request through JobNet should be submitted immediately. This will ensure a decision concerning cost is reached prior to the FPC Meeting. If the cost increase is denied a revised scope, change in limits, etc. needed to reduce the cost to within the programmed amount can be incorporated into the plan/proposal package prior to distribution of the material for the FPC Meeting. It is essential that the AP Preconstruction estimate, when submitted to the Specifications and Estimates Section, be within the JobNet programmed budget allowable limits. This eliminates any delays in advertising due to funding.

14.53 DELETED

Section deleted.

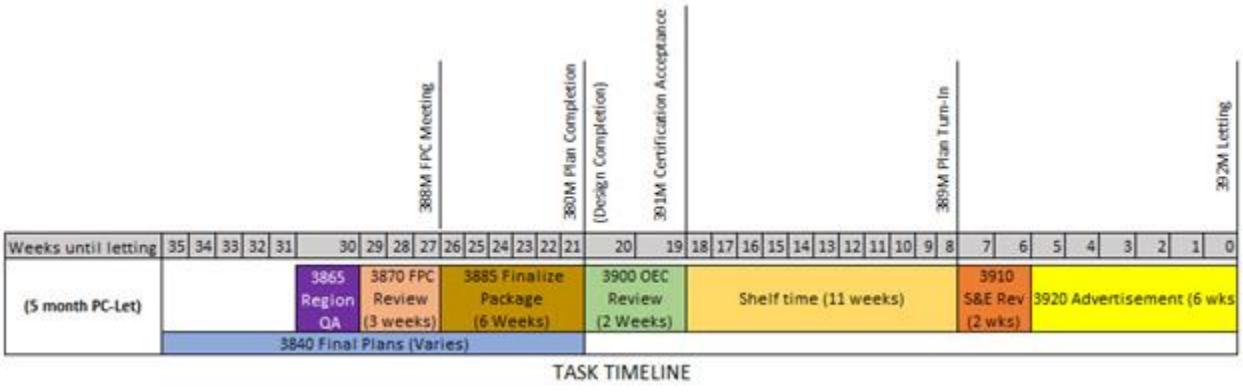
14.54 FINAL PROJECT COORDINATION (FPC)

(PPD Task Description 3870)
(PPD Milestone 387M)
(revised 12-17-2018)

The Final Project Coordination indicates 90-95% completion of the plans, proposal and supporting documents herein after referred to as the FPC package. The FPC Meeting takes place 6-8 weeks prior to Plan Completion. See task timeline below.

PPD Task	Duration	Weeks Prior to Letting
3840 Final Plans	Varies	36 (Varies)
3865 Region QA	1 week	31
3870 FPC Review	3 weeks	30
388M FPC Review Meeting	1 day	27
3885 Finalize Package	6 weeks	27
380M Plan Completion	(Milestone)	21
3900 OEC / 391M Certification Acceptance	2 weeks	21
389M Plan Turn-In	(Milestone)	8
3910 Final Project Package 910 S&E Review	2 weeks	6
3920 * Advertisement	6 weeks	6

* The Supervisor of the Specifications and Estimates Unit will determine which projects are candidates for letting with 3 or 4 week advertisements. Projects proposed for 3 week advertisements must have the approval of the Engineer of Design (except for Capital Preventive Maintenance, Non-Freeway Resurfacing Program and Pavement Marking projects).



TASK TIMELINE

Note: This is a general timeline. See Planisware for project specific network.

Often, multiple projects and/or project elements are designed across multiple groups (i.e. bridge, road, signals, municipal utilities, etc.) At this stage, design is essentially complete for all collective pieces. This milestone allows designers and stakeholders to coordinate, collaborate, and finalize the details of the project(s) as a whole. Exceptions/clarifications to the FPC package are:

- Miscellaneous quantities may be preliminary
- Detail grade sheets may not be complete
- Progress Clause may be draft
- Permits may not be finalized
- Unique Special Provisions have been submitted but may not be approved
- Cost Summary may have some estimated items

14.54.01 Requirements

(revised 12-17-2018)

The FPC Package material must include applicable items from the Milestone Checklist. If the submitted material is missing enough of the listed essential items, the System Manager will direct the Project Manager to cancel the meeting and reschedule when the material is more complete and/or available.

Every effort should be made to submit the project for FPC with Environmental Certification, ROW Certification, and approved design exceptions or variances, as well as any draft/approved Unique Special Provisions.

The FPC material will be submitted in the following files:

1. Supporting Documents
2. Proposal
3. Plans
4. RID

Place required RID files according to the Design Submittal Requirements in the folder 5-Final Project Coordination RID. The materials are entered into ProjectWise using the file naming conventions outlined in Section 1.03.02. MDOT-RID Support will review the ProjectWise RID FPC folder and provide comments prior to the FPC Meeting. The Design Team will address the comments in the RID FPC folder and place the files for letting in the RID Documents folder located in folder 6-Letting Plans and Proposal> RID Documents. MDOT-RID Support will then confirm that all comments have been addressed and the RID files are ready for letting.

14.54.02 Procedure

(revised 12-17-2018)

1. When the Project Manager or Consultant determines the plans meet the requirements for the Final Project Coordination, the Milestone Checklist is updated to verify the supporting documents, proposal materials and plans are ready to submit. The materials are entered into ProjectWise using the file naming conventions outlined in Section 1.03.02.
2. The Project Manager updates the Design Plan Submittal (Form 0303) and CA form.
3. The Project Manager will verify that ProjectWise (folder 5) is current with the following format:

   - 5 – Final Project Coordination
     - Design Submittal Form
     - RID

   If the format is not correct contact the ProjectWise administrator to apply the proper template.
4. When the project is ready for FPC review, a PDF copy of Form 0303 is placed in the ProjectWise subfolder “Design Submittal Form” and the state is advanced to “Ready for System Manager Review”.
5. The System Manager will verify that the package is sufficient to hold a productive FPC review meeting and items from the Milestone Checklist are included. The System Manager advances the state to “Meeting Scheduled and Ready for Review”. The Project Manager schedules the FPC meeting with a calendar appointment, 3 weeks from the time of submittal, with the date, time and location of the meeting with a link to the FPC package. See Section 14.54.03 for recommended review invitees. See chapter 1.3 of the Development Guide for further guidance on creating the review meeting appointment.
6. The Project Manager advances the state on Form 0303 and the three files in folder 5 (plans, proposal and supporting documents) to “Review in Progress”.
7. The Project Manager will conduct the FPC Meeting. During the meeting the Project Manager will document responses to the review comments within the electronic files. The purpose of this meeting is to discuss and resolve all final conflicts, contradictions, omissions, etc. If participants at the meeting are unable to resolve a conflict, the Project Manager should report the conflict to his/her supervisor for resolution.
8. Following the meeting, the design team will respond to the review comments that were not documented during the meeting and change the state from “Design Team Response” to “Completed”.

14.54.03 Attendees

(revised 12-17-2018)

See “Review meeting contacts list.xls” in Supporting Documents Milestone Forms list for the reviewers to be included for the Final Project Coordination. The following should attend the FPC Meeting:

- Project Manager/Cost and Scheduling Engineer
- Design Engineer(s)
- Construction Engineer(s)
- Operations Engineer
- Traffic & Safety Engineer
- Utilities/Permits Engineer
- TSC Maintenance Coordinator
- Region Quality Assurance Engineer
- Quality Assurance
- Geometrics Unit
- Environmental Clearance Coordinator
- Construction Field Services Division

Others (if applicable):

- FHWA Oversight
- Consultant Coordinator
- Consultant
- Electrical Unit/Lighting Unit
- Municipal Utilities Unit
- Hydraulics/Hydrology Unit
- Roadside Development Unit
- Signals (Operation Field Services Division)
- Signs
- Pavement Marking
- Region Real Estate
- Railroad Coordination Unit
- City or Village
- County Drain Commissioner
- County Road Commission
- MDOT Geotechnical Services Unit (if project includes bridge foundation work)
- MDOT Bridge Structural Fabrication Unit (if project includes bridge fabrication work)

Ensure the Specifications & Estimates Unit receives notification of the FPC review. An estimator will review the estimate, adjust any unit costs and return it to the Project Manager prior to the FPC Meeting so that any funding problems can be discussed at the FPC Meeting.

14.55 CONTRACT SELECTION TEAM (DBE PROGRAM)

Each fiscal year the State Transportation Commission adopts a percentage goal for Disadvantaged Business Enterprise (DBE) participation on selected federally funded projects (all projects with any federal funding are eligible). The Contract Selection Team was established to set the DBE percentage on each MDOT construction project in order to meet or exceed the MDOT goal.

The DBE program attempts to aid DBE contractors in gaining the necessary skills to compete in their chosen field.

The Contract Selection Team may establish varying DBE levels of participation in order to achieve MDOT's annual goal. However, due to location, type of work, or cost, some projects are not appropriate candidates for DBE participation.

The Project Manager should contact the Contract Selection Committee with any questions concerning established percentages.

14.56 PACKAGING OR CONSOLIDATING PROJECTS

(revised 12-17-2018)

Occasionally it may be advantageous to combine two or more projects into one contract. The benefits may include lower bid prices, improved maintaining traffic coordination, eliminating possible conflicts with more than one contractor working in the same area and reduction and/or simplification of required documentation during construction of the project. Projects that are scheduled for the same letting and are located in the same area should be considered for consolidating or packaging under one contract.

Consolidation is the combining of projects into one contract under one job number. Packaging is combining of projects into one contract but with separate job numbers for each project.

When consolidating, projects must have the same construction funding. Federal-aid projects must be on the same federal route and section. If projects are consolidated under one job number, usually the number associated with the largest project is the remaining number.

Projects programmed with different types of construction funding or that are not in the same federal section, although not eligible for consolidation, can be packaged into one contract. The projects have to retain separate job numbers but are advertised, bid, and let under one contract. Construction personnel have to maintain separate records for each project. The shared Contract ID is developed from the predominate Control Section with in the lowest job number of those being packaged together. This will also apply to the Progress Clause and MOT Special Provision where the Contract ID is also listed. Other locations, separate job numbers will be listed.

Projects with DBE (Disadvantaged Business Enterprises) requirements cannot be consolidated or packaged without prior approval from the Contract Selection Committee (DBE).

14.57 PLAN COMPLETION & DESIGN PLAN SUBMITAL – CERTIFICATION ACCEPTANCE

(PPD Milestone 380M)
(PPD Milestone 391M)
(PPD Milestone 389M)
(revised 3-24-2025)

The Plan Completion date indicates 100% completion of the plans, proposal and supporting documents.

As part of the stewardship agreement with the FHWA, MDOT developed a procedure involving a system of checks/reviews to verify all requirements of the agreement are met. The Department also made the decision to use the majority of the process (completion of the Design Plan Submittal-Certification Acceptance (DPS-CA Form) on all projects (Federal and/or State funded), including those classified with FHWA Oversight (Risk Based Project Involvement (RBPI)). The verification is accomplished by completing the Certification Acceptance portion of the DPS-CA form. The form includes reviews (with confirmation utilizing dynamic Reviewed stamps) by several divisions and sections within MDOT. Once the DPS-CA form is completed with all applicable stamps, and stored in the ProjectWise Supporting Documents folder, it is submitted to the Specifications and Estimates Unit at final turn-in. The required stamps are listed below:

- Bridge Design Unit (as applicable)
- Project Manager Licensed in the State of Michigan
- Quality Assurance Engineer
- Specifications and Estimates Engineer
- Utility Coordination and Permits (as applicable)
- Governmental Coordination and Engineering
- Office of Rail (as applicable)
- Force Account Work (as applicable)
- Geometric Design Engineer (pending CA form type and as applicable)
- Traffic Signs and Delineation (as applicable)
- Freeway Lighting (as applicable)
- Pavement Markings (as applicable)
- Traffic Signals (as applicable)
- Region/TSC Traffic and Safety
- Construction Engineer

MICHIGAN DESIGN MANUAL
ROAD DESIGN

The following documentation must be completed and stored in the applicable ProjectWise location prior to the final turn-in submittal to the Specifications and Estimate Unit **as it pertains to the project**.

- Environmental Classification/Certification Special Design Considerations Memo
- Milestone Checklist
- Form 0334 – Exception to the Plan Review/FPC Meeting Process
- AASHTOWare Project Preconstruction Documents as noted on the Milestone Checklist
- Form 0268 – Project Cost Estimating Checklist
- Mitigation measures required in the environmental document (EIS, FONSI)
- Permits
- Environmental Classification/Certification
- ROW Certification
- PACS Report
- Proprietary Item Documentation
- Copies of Scope Verification and The Plan Review Meeting minutes.
- Design Exceptions / Variances
- Waiver-Planting Wildflower Expenditures
- Checklists for Supplemental Specifications, Notice to Bidders, and Special Provisions
- Constructability Review Checklist(s) (Form 1961 or Form 1960)
- Build America Buy America (BABA) Documentation
- Buy America Documentation
- Innovative Contracting Work Plans
- Warranties or Waivers for Warranties from applicable authorizing groups
- Pavement Selection Review Committee Approval Letter
- Contract Time Determination (CTD) and/or Critical Path Method Documentation
- Crash Analysis and Safety Review
- Value Engineering Results
- Interstate Access Change Request (IACR) Documentation
- 20 Yr Capacity Analysis
- ITS Conformance Document (Form 2560)
- Incentive/Disincentive Project Documentation
- Guardrail Worksheets
- Exception Risk Analysis (Form 2912)
- Exception Risk Analysis – Special Provisions (Form 2908)
- Transportation Management Plan (TMP)
- Special Approval Documentation (i.e. Cold milling concrete pavement email or scope change approval email)
- Progress Clause
- MOT Special Provision
- Traffic Typicals and Work Zone Device Special Details
- Frequently Used Special Provisions (FUSPs)
- Notice to Bidders (standard or unique)
- Project Coordination Clause (describes adjacent project(s) that could conflict with the project)
- Railroad Coordination Clause
- Utility Coordination Clause
- Supplemental Specifications
- Log of Plans

- Notice to Bidder Contact Information Sheet
- Approved Unique Special Provisions
- Stamped Completed Certification Acceptance File
- Digitally Signed / Completed Project Signature Sheet
- Completed/Packaged Plan Set
- Completed/Packaged Proposal

On FHWA Oversight projects, in addition to the Certification Acceptance Form being **complete,** the corresponding signed Risk Based Project Involvement Stewardship & Oversight Plan (RBPI S&O) form must also be obtained from FHWA, completed/signed, and placed in the ProjectWise Supporting Documents folder prior to submitting the final plan/proposal files to the Specifications and Estimates Unit.

Note: The applicable FHWA Area Engineer will supply the RBPI Stewardship & Oversight Plan form on applicable projects with FHWA Oversight.

14.57.01 Procedure

(revised 12-26-2023)

1. Following the Final Project Coordination (FPC) Meeting, the design team will incorporate the accepted review comments and complete the final plans and proposal package.
2. When plans are 100% complete (Plan Completion – PPD Milestone 380M) the packaged plan and proposal files are placed in folder 6 – Letting Plans and Proposal in ProjectWise. The design team advances the file state to “PM Review in Progress”. The Project Manager is responsible for verifying all the agreed-upon revisions are incorporated into the plans.
3. The reviewers from the Omission and Errors Check (OEC) Review (PPD Task 3900) and those required to stamp the Certification Acceptance (CA) Form are notified with the file state change to “CA Sign Off” in ProjectWise. The OEC reviewers are responsible for verifying that their concerns have been resolved with the final plans. Certification Acceptance reviewers will stamp the CA form with the Licensed Project Manager stamping the CA form last (PPD Milestone 391M).
4. The Project Manager advances the completed files state to “Initiate Final Project Review” to submit the completed final turn-in plans to Specifications and Estimates (PPD Milestone 389M).
5. The Project Manager will also submit the Supporting Documents by selecting all files in that folder and changing state to “e-Prop – Initial Final Project Review – Supporting Documents” (PPD Milestone 389M).

14.58 APPROVAL OF SPECIAL PROVSIONS

(revised 1-23-2023)

In order to clarify terminology surrounding this subject, the following definitions are provided:

1. Standard Specifications - The book of specifications approved for general application and repetitive use.
2. Supplemental Specifications - Detailed specifications that add to or supersede the Standard Specifications.
3. Special Provisions - Revisions or additions to the Standard and Supplemental Specifications applicable to an individual project.
4. Frequently Used Special Provisions - An approved special provision with stable requirements applicable to a number of projects used on a regular basis.
5. Addendum - a change, addition and/or deletion to the contract documents occurring after a project is advertised but before the letting date.

Occasionally, information in the plan/proposal package may differ or conflict. To help in resolving such conflicts, the following order of preference has been established per the Standard Specifications for Construction:

1. All proposal material except those listed in subsections 104.06B through 104.06F
2. Special Provisions
3. Supplemental Specifications
4. Project Plans and Drawings
5. Standard Plans
6. Standard Specifications

All unique special provisions that are part of the proposal must have the approval of the Design Division prior to contract printing and advertising. When a project is submitted to the Specifications and Estimates Unit for advertisement with unapproved unique special provisions, the Project Manager must complete Form 2908 Special Provision - Exception Risk Analysis, including approval by the appropriate Region Engineer. Although minimal use is encouraged, this form does allow for exceptions for multiple unique special provisions. These do not include the Frequently Used Special Provisions, which are reviewed and approved before they are placed on the FUSP list. The Project Manager should submit any unique special provisions for approval as soon as possible during project design, but no later than 30 working days (6 weeks) prior to the plan completion date. The special provision(s) must be placed in folder “Special Provisions – Unique” under “Letting Plans and Proposal” (folder 6) and state advanced to begin the review and approval process. Special provisions must be submitted in MSWord format following the guidelines outlined in Chapter 11. Consultant-written Special Provisions must also be submitted for approval by the MDOT Project Manager following the same process as internal designs. Drafts of these should be available for review and discussion at The Plan Review meeting.

Project Managers are encouraged to use previously approved Special Provisions whenever possible. To review an index of available approved Special Provisions, see the Previously Approved Special Provisions page on the MDOT Web site. If any changes are made to the approved document, it must be saved with another filename. When submitting a revised (previously approved) Special Provision, the redline and strikeout features under MSWord (track changes) should be used to delineate the changes made to the original document. This will substantially expedite the approval process.

For additional information regarding Special Provisions including a sample format see Chapter 11 (Specifications and Estimates) of the Road Design Manual.

14.59 SHELF PROJECTS

(revised 12-17-2018)

Projects with completed plan/proposal packages that do not have funding or approval for advertising and letting should not be submitted to the Specifications and Estimates Unit for processing. The Project Manager should verify all the contents of the plan/proposal package necessary for submission to the Specifications and Estimates Unit are included and correct. Once completed, the Project Manager should inform the Region System Manager of the completion of a “shelf project.” The Region System Manager will verify the project is indeed a “shelf project.” The Project Manager should periodically inquire about the status of the project.

Prior to submitting a “shelf project” to the Specifications and Estimates Unit for processing, the Project Manager must review the plan/proposal package and determine the amount and extent of revisions required to update the package. If a project has been on the shelf a significant amount of time the Project Manager should consider holding another FPC Meeting.

14.60 SUBMISSION OF COMPLETED PLANS

14.60.01 General

(revised 11-22-2021)

The final plan/proposal package should be submitted to the Specifications and Estimates Unit on or before the date listed in the calendar year's schedule of Letting and Board Dates. This date should not be confused with "Plan Completion Date." Plan completion date occurs after the FPC Meeting and is the date when 100% of the plans are completed. See Section 14.54 for task timelines. A copy of the letting schedule is located on the Plan Development SharePoint site.

The Supervisor of the Specifications and Estimates Unit will determine which projects are candidates for letting with 3 or 4 week advertisements. Projects proposed for 3 week advertisements must have the approval of the Engineer of Design (except for Capital Preventive Maintenance, Non-Freeway Resurfacing Program and Pavement Marking projects). Projects proposed for a 6 week advertisement require notification with the Supervisor of the Specifications and Estimates Unit, and must be submitted one week prior to normal turn in. All other projects will utilize a 5 week advertisement period.

Once a project is submitted to the Specifications and Estimates Unit the Project Manager can check ProjectWise for the status of a project.

Upon receipt of the plan/proposal package for processing, the Specifications and Estimates Unit may ask to review the project with the Design Unit in order to gain an insight into the type of work involved to determine if any additional special provisions and/or supplemental specifications are required.

14.60.02 Requirements

(revised 3-23-2026)

Advertisement cannot occur until all projects within a contract have funding obligation. Funding obligation requests cannot occur without the following:

- All change requests in JobNet are approved
- Environmental Certification or Classification in JobNet is up to date
- ROW Certification or Conditional Certification is approved
- S/TIP CON phase is approved – if a JobNet change request increases the project budget significantly, a previously approved S/TIP phase may become pending, and will need to be approved again before obligation can occur
- FHWA has signed off on the CA Form, if necessary

Expedited or other projects requiring special attention should be brought to the attention of the Supervisor of the Specifications and Estimates Unit prior to submittal. This includes projects without all the material described above.

All plan/proposal package and final supporting document submittals should include at least the following, in addition to the plans:

1. Title Sheet
2. Signed / Completed Project Signature Sheet
3. Milestone Checklist
4. Proposal level cost summary (AP Preconstruction)
5. Unique special provisions (approved for project use) including maintaining traffic
6. Frequently used supplemental specifications and special provisions (package and checklist)
7. Required permits
8. Utility Relocation Status Report (Form 2286)
9. Utility Charge Estimate (Form 0223) - for bridge projects
10. ROW Certification for Advertising (Form 0725I or Form 0725N)
11. Coordination clauses
12. Signed / Completed Certification Acceptance File
13. Notices to Bidder
14. Progress schedule with any incentive/disincentive clauses
15. Project Cost Estimating Checklist (Form 0268)
16. Exception with a memorandum signed by the Region Engineer acknowledging the risks and a completed Exception Risk Analysis (Form 2912).
17. Signed / Completed RBPI (Risked Based Project Involvement) Stewardship & Oversight Action Plan form (if applicable)

The Project Manager must get approval from the Supervisor of the Specifications and Estimates Unit prior to submitting a final package without ***ALL*** of the above items.

14.60.03 Exceptions

(revised 5-28-2024)

There are some exceptions to the above minimum requirements for submittal of plan/proposal packages to the Specifications and Estimates Section. Exceptions are permitted in the following areas:

1. Permits
2. ROW Certification on non-federally funded projects
3. Trunkline agreements with local agencies
4. Unique Special Provisions (not desirable and must have supporting signed/approved Special Provision Exception Risk Analysis Form 2908, also see Section 14.58)

In order to submit a package to the Specifications and Estimates unit with an allowable exception for items 1-3 above, the following steps must be followed:

- Perform a risk analysis for each appropriate exception.
- Invite appropriate experts for each exception to the FPC Meeting.
- Send the Exception Risk Analysis (Form 2912) along with the other required documents to the FPC participants (two weeks prior to the meeting).
- If the participants at the FPC meeting agree with your request for an exception, have them initial the Exception Risk Analysis (Form 2912).
- If the participants disagree with the need for an exception, they must attach written comments to the Exception Risk Analysis (Form 2912).
- The Exception Risk Analysis (Form 2912) along with any comments should be forwarded to the Region Engineer for their signature. The form is placed in the Supporting Documents folder in ProjectWise when the plan/proposal package is submitted to the Specifications and Estimates unit.
- If the exception is a permit, include a Notice to Bidders that a permit is required, the projected date of permit approval and identify any restrictive conditions. Once the project is advertised, the Project Manager will monitor the permit approval process and submit the approved permit through the addendum process (see Section 14.63). If the permit has not been approved and received by the Project Manager at least one week prior to the letting, they must contact the Supervisor of Specifications and Estimates to determine if the project needs to be postponed or withdrawn from the letting (see Section 14.64).

Specifications and Estimates will not submit the package for advertisement without an approved exception.

14.60.04 QA/QC Review

(revised 12-17-2018)

It is the responsibility of the Project Manager to perform a QA/QC review of the entire plan/proposal package prior to submittal to the Specifications and Estimates Unit. As a minimum, in addition to those items listed under Section 14.60.02, the following items ***must*** be correct:

- Quantities and pay items on plan sheets must match those in AP Preconstruction.
- All Unique Special Provisions with a pay item must have a matching pay item in the plans and in AP Preconstruction.
- All 7000 numbers in AP Preconstruction must have a Unique Special Provision in the proposal with matching units.
- Any Frequently Used Special Provision with a pay item must have a matching pay item in the plans and in AP Preconstruction.
- All Frequently Used Special Provisions and Specifications included in the package are the latest version.
- AP Preconstruction files must be complete and correct.
- All references to standard plans and special details are the latest version.

14.60.05 AASHTOWare Project (AP) Preconstruction Files

(revised 5-28-2024)

Listed below are some directions/reminders concerning AP Preconstruction files:

- Project should be identified as J.N. with A (######A)
- Proposal Contract ID should be “C.S.-J.N.”, with no extra spaces or characters, job number does not have an “A” or any other suffix (i.e., 54321-123456)
- If more than one job is packaged together, the Contract ID number is based on the predominate C.S. in the lowest numerical job number of those being packaged together.
- County number is filled in
- Spec year is correct, both at proposal and project level
- Section and Line number have been run
- Primary Region has been filled in
- Section List indicate “Road Work” or “Bridge Work”
- Long description entered using standard wording
- Number of plan sheets filled in
- Contract type is filled in
- All Pre-established prices have been marked

- Funding distribution adds to 100%
- Each Lump Sum item adds to a combined total of 1.00
- Administrative unit has been filled in
- Beginning and Ending termini have been filled in
- CE dollar amount is correct
- Control group changed to ”DS” in the Project and Proposal level
- The unit bid requirement code (on Items tab) is fixed, NOT LOCKED, for all dollar items
- Project start date and completion date filled in
- The supplemental description for all 7000 items is the same as the pay item in the Special Provision.

Listed below are some common oversights of plan/proposal packages submitted to the Specifications and Estimates Unit:

- Copies of Special Details not included in the plans.
- Undefined pay items. Every pay item used on the project must be covered by the Standard Specifications for Construction, Special Provision or Supplemental Specification.
- Identical pay items in both the road and bridge sections. These should be revised to appear in only one section. This eliminates the possibility of a Contractor bidding differently on the same pay item.
- Packaging of projects. Packages with road, bridge, utilities, signals, signing, etc. should be packaged prior to submittal to the Specifications and Estimates Unit.
- Project cost, including CE, not within the limits of JobNet CON phase programmed budget.
- Construction completion date exceeding a permit’s expiration date.
- Missing or incorrect Mobilization maximum amount.
- Funding for Incentive/Disincentive clause not programmed or quantity not properly entered in AP Preconstruction.

14.61 PRE-LETTING BRIEFING/PRE-BID MEETING

(revised 5-28-2024)

Pre-Bid Meetings are held for Contractors on complex or unique projects. These meetings are usually recommended by the Project Manager, Unit Leader or Engineer of Design, although others may propose the meeting be scheduled. Responsibility for arranging the meeting rests with the Project Manager. The Project Manager is also responsible for notifying the appropriate MDOT representatives (Construction, Utility- Permits, Traffic and Safety, Contracts, etc.) as well as outside agencies (cities, villages, counties, etc.) of the time and place. The Contracts Division will advertise the briefing.

The briefing consists of a presentation of the project by a spokesman of the Department before interested Contractors. The briefing is opened to questions after the presentation. Minutes should be recorded and distributed to the attendees.

14.61.01 Procedure

1. The Project Manager determines the need for a Pre-Bid Meeting. Projects with one or more of the following should be considered for a Pre-Bid Meeting:

    - A major project with programmed cost of $20 million or more.
    - A high impact project with a complex progress schedule.
    - A project with an expedited schedule, incentive/disincentive or increased liquidated damages.
    - Project with complex traffic control and staging requirements.
    - Project with extensive, new or unusual special provisions.
    - Project in an environmentally sensitive areas (i.e. superfund site).
    - Other projects which are unique, complex or experimental in nature.

    Also, a determination as to whether the Pre-Bid Meeting is mandatory must be made at this time. Mandatory Pre-Bid Meetings should be rarely used.

2. Project Manager requests approval for Pre-Bid Meeting from Supervisor of the Specifications and Estimates Unit prior to advertisement of project, who reviews the request with Engineer of Design and notifies Project Manager and Contract Services Division (approvals only) of decision.
3. Project Manager arranges time and location of meeting. Pre-Bid Meetings should be scheduled a minimum of three weeks prior to letting to allow incorporation of any necessary changes by addendum. When selecting a location, consideration should be given as to whether the potential bidders may need/wish to visit the construction site.
4. Project Manager prepares and submits a Special Provision for approval and inclusion in the proposal. This should be submitted with the plan/proposal package.
5. Project Manager identifies attendees (from MDOT) and notifies each of time and location of meeting.
6. Project Manager conducts meeting including preparation of agenda, distributing material to attendees, and taking notes at the meeting. For meetings which require attendance, a list of bidders in attendance must be submitted to the Contract Services Division. Contractors must complete and sign the registration form to certify attendance.
7. Project Manager submits any changes (if required) to the Specifications and Estimates Unit for issuance of addendum.

14.62 CONTRACTOR INQUIRIES

(revised 3-29-2021)

During the advertising period, Contractors may contact the Department for clarification of plan/proposal material. Each proposal has a Notice to Bidders that specifies all inquiries be made by E-mail through the MDOT e-Proposal system. This is to ensure that all Contractors are given the same information (responses/answers) and, therefore, an equal opportunity to bid the project. An MDOT e-Proposal Resource will post all contractor inquiries within the NTB Inquiry folder in folder 6, (Letting Plans and Proposal). The MDOT PM (Project Manager) will then post the response to the Inquiry within the same document when the correct response is determined.

The MDOT Project Manager/Cost and Scheduling Engineer will evaluate each inquiry and determine if it will have a significant impact on the bids and if an addendum is required. These inquiries may identify errors or oversights in the bidding document. If an addendum is required, the MDOT PM will submit the necessary information to the Specifications and Estimates Unit for review and distribution. The following information is intended to give some direction in dealing with Contractor Inquiries.

If the answer is only a clarification of proposal or plan material that will not give the Contractor an unfair advantage in bidding the project, the MDOT PM can simply provide the answer via the NTB Inquiry e-Proposal System. If possible, to provide clarity and improve effective bid prices, the PM should cite the page or page range for the NTB Response. It is good practice for the PM to utilize their team within their TSC and/or Region to help determine responses and level of detail to any appropriate inquiries.

If the answer will give the Contractor an unfair advantage in bidding the project, the item is reviewed with the Supervisor of the Specifications and Estimates Unit to determine if an addendum should be issued.

If an addendum is required, the MDOT PM must take the necessary steps to ensure one is issued.

If it is too late to issue an addendum, the item should be bid as proposed. If the error or omission is significant enough, the project may have to be postponed or withdrawn from letting. See Section 14.64. Although undesirable, an alternate Letting may be necessary if the changes are too great from the original bid submittal.

Although all inquiries are supposed to be made a minimum of one week prior to the letting date (as stated in the proposal), they can still occur during the last week of advertising. Occasionally, these require a late addendum. The decision to submit a late addendum during the week of the letting should be discussed with and approved by the Supervisor of the Specifications and Estimates Unit.

Addenda are sent to prime Contractors only. If a Subcontractor makes an inquiry that results in an addendum, the addendum is sent only to the prime Contractor. MDOT is not responsible for notifying Subcontractors or suppliers.

Contractors may ask for additional information not contained in the plans such as exact locations of miscellaneous quantities on the note sheet or approval to substitute materials. These are examples of information the MDOT PM should **not** provide. Answers should be concise and only clarify, not expand the content of the plan/proposal material. If the question only warrants a yes or no response, briefly state how the inquiry item was or was not determined appropriate for the project in question.

Please use the following standard language when responding to inquiries **NOT** made through the e-Proposal system:

"This inquiry was not made through the MDOT e-Proposal System. Please submit your inquiry using the e-Proposal System by using the link provided within the corresponding proposal page."

In addition, when responding to Contractor Inquiries within ProjectWise, please use the following standard language and format for responses to the scenarios described:

1. Response WITH an Answer - Notifies Contractor that an answer to their inquiry has been provided
    - *Answer supplied to submitted inquiry including page range where possible.*
2. Response WITH an Addendum - Notifies Contractor that an addendum will be coming and gives them preliminary information as to what areas of the package it may alter
    - *"The above inquiry was received and reviewed by the MDOT Project Manager. It has been determined that an addendum will be necessary to address the requested information. An addendum will be issued to edit the following areas of the plan and proposal package:"*
        - *Plans*
        - *Proposal*
        - *RID*
        - *Etc.*
3. Response WITHOUT an Addendum where an answer will not be issued - Please note - this option is to be utilized sparingly. Whenever possible, the PM and responding team should try to provide a reason as to why the inquiry will not be responded to or supply additional details to help promote better bid prices. In circumstances where more information cannot be supplied, the following response can be issued.
    - *"The above inquiry was received and reviewed by the MDOT Project Manager. A more detailed response to this inquiry will not be issued. Please review the plan and proposal package or RID documents for further information or resubmit your inquiry with more specific detail applicable to the contract."*

14.63 ADDENDA

(revised 5-28-2024)

Changes to the contract (plans, specifications and special provisions) are sometimes necessary when they affect the way a Contractor bids a project. Notification to Contractors is sent out by the Contract Services Division in the form of an addendum (an amendment to the contract documents as advertised). Changes most often originate by Contractor Inquiry. Addenda are issued at the request of the Project Manager/Cost and Scheduling Engineer, after a project is advertised but before the letting. Once the plans and proposal have been sent to the Contract Services Division, for advertising, the plan/proposal package cannot be changed except by addendum.

The Project Manager should determine if changes are necessary by determining the effect on the way the work will be bid. The Project Manager should consult with the Supervisor of the Specifications and Estimates Unit to determine the impacts as necessary. If there is no effect on the bidding, an addendum may not be necessary. This type of change can be handled by a plan revision after the project is let and prior to construction.

If an addendum is needed, it is initiated by supplying the required information to the Specifications and Estimates Unit. Detailed instructions and templates for submitting an addendum request can be found in ProjectWise or on the Plan Development website.

Typically there are three types of changes made to the contract documents by an addendum. Pay item, proposal, and plan changes require the following information:

1. **If Pay Items are Affected:**

The proposal line number, pay item number, pay item description, and quantity and units as specified in the Schedule of Items in the proposal.

2. **If the Proposal is Affected:**

The proposal page number(s) of the document affected along with supplying any additional or replacement page(s).

3. **If Plan Sheets are Affected:**

The sheet number(s) of the plan set(s) affected along with the change to the plan sheet(s) if not supplying additional or replacement plan sheet(s).

The FHWA must give prior approval for applicable addenda involving FHWA oversight projects before they can be published. The Project Manager is responsible for obtaining FHWA approval. E-mail approval from the FHWA Area Engineer is sufficient documentation.

Addenda submitted within four days of the letting require the approval of the Specifications and Estimates Supervisor. The decision to submit a late addendum during the week of the letting should be discussed with and approved by the Supervisor of the Specifications and Estimates Unit.

Project Managers should make every attempt to minimize the number of addenda requests, especially those within four days of the letting date. Addenda must NOT be used as a process for completing the design of a project after advertisement.

14.64 POSTPONEMENT, WITHDRAWL, OR REJECTION FROM LETTING

(revised 5-28-2024)

The Project Manager will work with the Supervisor of Specifications and Estimates on any project that requires the following action:

1. Postponement from Letting

Takes place prior to the letting and is usually a delay to the next available letting. The Contractor retains the plans and proposal, and an addendum will be issued.

A copy of the postponement memo signed by the Director of the Bureau of Development will be sent to the Director of the Bureau of Finance and Administration for appropriate action.

The Project Manager will make the required changes and submit an addendum request to the Specifications and Estimates Unit.

2. Withdrawal from Letting

Takes place prior to the letting and is usually a delay of more than one letting. The original plans and proposal material will be retained in ProjectWise and AP Preconstruction for historic records.

A copy of the withdrawal memo signed by the Director of the Bureau of Development will be sent to the Director of the Bureau of Finance and Administration for appropriate action.

The Project Manager has the responsibility to pursue whatever contract changes are necessary and resubmit the project back to the Specifications and Estimates Unit for re-advertising. See Section 14.64 Subsection 7 titled “Resubmission of a Withdrawn or Rejected Project”.

3. Rejection from Letting

Takes place after letting and Executive Bid Review. The original plans and proposal material will be retained in ProjectWise and AP Preconstruction for historic records.

A copy of the rejection memo signed by the Director of the Bureau of Development will be sent to the Director of the Bureau of Finance and Administration for appropriate action.

The Project Manager has the responsibility to pursue whatever contract changes are necessary and resubmit the project back to the Specifications and Estimates Unit for re-advertising. See Section 14.64 Subsection 7 titled “Resubmission of a Withdrawn or Rejected Project”.

4. Bid Rejection Less Than 10% Over the Engineer's Estimate

a) The Project Manager contacts the Design Division's Supervisor of Specifications and Estimates with concerns that the bids received are not reflective of previous projects with similar scope and type of work or that the project cannot be built as advertised.

b) The Supervisor of Specifications and Estimates and the Project Manager review the proposal package to document why the bids are not acceptable. The Project Manager, in cooperation with the System/Template Manager and Region Engineer, recommends that bids be rejected to the Director of the Bureau of Development.

c) If the decision is made to reject all bids, a rejection memo is sent to the Director of the Bureau of Finance and Administration from the Director of the Bureau of Development requesting rejection of all bids with an explanation why the bids should be rejected.

5. Bid Rejection More Than 10% Over the Engineer's Estimate

a) Design Division's Specifications and Estimates Unit reviews the bid tabulation with the Project Manager to determine what items caused the bid amounts to exceed the Engineer's Estimate.

b) The Specifications and Estimates Unit and the Project Manager review the proposal package to see if the bid amount is reasonable. The Project Manager, in cooperation with the System/Template Manager and Region Engineer, recommends that bids be rejected or accepted to the Director of the Bureau of Development.

c) If bids are rejected, a rejection memo is sent to the Bureau of Finance and Administration from the Director of the Bureau of Development requesting rejection of all bids.

d) If bids are accepted, a "justification memo" is sent to the Bureau of Finance and Administration from the Director of the Bureau of Development with reasons why the bids should be considered reasonable and be awarded to the low bidder.

e) If the low bid is $500,000 or greater, the justification memo is placed on the next available State Transportation Commission agenda for informational purposes and placed on the next available State Administrative Board agenda for approval.

6. Single Bid Rejection less than 10% over the Engineer's Estimate

a) If the single bid is not acceptable, the Project Manager contacts the Design Division's Specifications and Estimates Supervisor with concerns that the low bid received is not reflective of previous projects with similar scope and type of work or that the project cannot be built as advertised.

b) The Specifications and Estimates Supervisor and the Project Manager review the proposal package to document why the single bid is not acceptable. The Project Manager, in cooperation with the System/Template Manager and Region Engineer, recommends the bid be rejected to the Director of the Bureau of Development.

c) If the decision is made to reject the bid, a rejection memo is sent to the Director of the Bureau of Finance and Administration from the Director of the Bureau of Development requesting rejection of the bid with an explanation why the single bid should be rejected.

d) If the single bid is deemed acceptable, the Bureau of Finance and Administration will process the bid in the normal manner. This includes the extra step of reporting the single bid contract to the State Transportation Commission agenda for approval.

7. Resubmission of a Withdrawn or Rejected Project

a) Once the withdrawal or rejection memo has been signed, a new ProjectWise folder is created with a "-2" extension (e.g. 123456-2), and an email notification is sent to the Project Manager.

b) The Project Manager must email MDOT-DesignEstimates to request the creation of a new proposal file in AP Preconstruction with a "-2" extension (e.g. 63172-123456-2).

c) The Project Manager will revise the letting date in JobNet and make updates to the plans, proposal, AP Preconstruction and applicable supporting documents prior to resubmitting the project to the Specifications and Estimates Unit.

14.65 REFERENCE INFORMATION DOCUMENTS

(revised 12-17-2018)

The Reference Information Document (RID) process provides availability of electronic data files through the e-Proposal website. RID files are non-contractual items for contractor use prior to bidding on construction projects. They include design files, survey deliverable files, miscellaneous files and the RID Index.xlxs.

Milestone reviews by MDOT-RIDSupport are intended to be on the same timeline as other reviews mentioned in the previous sections. RID files will be submitted to the Specifications and Estimates Unit and MDOT-RIDSupport for review prior to final turn in. The files are subsequently published at the same time as the Proposal and Plans. Any changes made to the RID files after this time, due to an addendum, will be the responsibility of the Project Manager. Each published 'set' released after the original publication includes a revised RID Index.xlxs using the Project Changes tab that includes only the changed files and a brief explanation of the changes made to the files.

See the Design Submittal Requirements in the MDOT Development Guide for more information.

14.66 TABULATION OF BIDS

(revised 5-28-2013)

Approximately one week after the letting, bid tabulations with the Engineer's Estimate, the low bid Contractor and the other prime Contractor's bids are posted to the MDOT website. Some projects require an additional review and may take longer. The Tabulation of Bids can also be accessed through the Bid Letting System on the Plan Development website by selecting the appropriate letting date and letting item number.

14.67 PRE-CONSTRUCTION MEETING

(revised 12-17-2018)

A pre-construction meeting is usually held with the low-bid contractor, subcontractors, and MDOT representatives after the letting and award of a project. Participants usually include (when applicable):

- Contractor
- Subcontractor(s)
- Resident/Delivery Engineer
- Project Manager/Cost and Scheduling Engineer/Designer/Consultant
- Soils Engineer
- Traffic Engineer
- Utility/Permits Engineer
- Region/TSC Materials Engineer
- Utility Companies
- Counties and/or Municipalities
- Railroad Companies
- FHWA Area Engineer

The agenda may include:

- Introduction of attendees
- Recording of Minutes & Attendance record
- Project description
- Designation of Supervisors
- Proposal (including any addenda)
- Subcontractors
- Real Estate
- Utilities and Railroads
- Affected Municipalities and or Counties
    - Haul routes and hours
    - Special use permits
    - local ordinances
- Testing Order

- Soils/Materials
- Traffic
- Progress Schedule
- Safety Program/Issues
- Work Orders and Contract Modifications
- Labor Compliance
- OJT/EEO/DBE Requirements
- Miscellaneous
- Erosion Control
- Environmental Mitigation Requirements Review and/or Special Design Considerations Memo
- NPDES NOC and BMP Measures

The Project Manager should be invited to all pre-construction meetings. However, due to the limited time to schedule and hold the meeting, advanced notification may be short. Also, the Project Manager may want to contact the Resident/Delivery Engineer prior to the meeting to discuss the need for their participation. In some instances attendance at the pre-construction meeting is not required on the simplest, most straightforward projects.

Minutes at this meeting are recorded by a Region/TSC representative and copies are distributed to the Engineer of Construction Field Services Division, Region Engineer, TSC Manager, and all participants.

14.68 DESIGN ERRORS PROCESS

(revised 6-28-2021)

The following process was developed in compliance with State Transportation Commission (STC) policy. It outlines the identification, responsibilities, and resolution of design errors.

If the TSC Construction Engineer identifies a potential design issue, and the construction contract value/correction cost combination meets the criteria below, or the impact of the issue is significant to the project, further investigation will be needed.

Construction Contract Value	Correction Cost
≤ $3 million	≥ $30,000
$3 million to $10 million	≥ 1% of Construction Contract Value
> $10 million	≥ $100,000

The TSC Construction Engineer will coordinate and work collaboratively with the Design Project Manager/Project Designer (Engineer of Record, EOR) and the TSC Manager to evaluate the issue. Considerations to include among others, are the information available during development, the process documentation, and any assumptions made. The TSC Manager will determine if the issue is a design error. A design error must be reported if the project, or a portion of the project, cannot be practically built as designed due to omissions or errors.

Additional consideration and dialogue will be conducted to determine if there are associated premium costs as defined in the Construction Manual. Documentation of the evaluation, assessment, and determination must be retained in the construction files.

The TSC Manager is required to communicate all design errors exceeding the previously defined impact or cost thresholds, to the Associate Region Engineer - Development, Quality Assurance Engineer, the Engineer of Design, and Chief Structure Design Engineer (for bridge projects) for reporting. Information provided shall include: Region, Contract ID, Job Number, Consultant (if applicable), Issue Description, Impact to Construction (cost and time), Issue Resolution (how resolved), and any suggestions on how this could have been addressed during design. This information will also include lessons learned and possible process change considerations to be shared as needed. The Quality Assurance Engineer will assemble and retain this information for quarterly reporting to the Statewide Design Alignment Team (SDAT).

14.69 DESIGN PROJECT RECORD

(revised 12-17-2018)

As soon as a project has been assigned, the Project Manager should begin to compile a Design Project Record. This is done by maintaining a chronological record of any events affecting plan development which:

1. Affect the cost of design or construction of the project
2. Change the scheduled dates (plan completion, ROW or letting).
3. Deviate from standard design practices via Design Exceptions, Design Variances, or Performance Based Practical Design decisions.

14.70 PLAN REVISIONS

(revised 10-28-2024)

Occasionally plans must be revised after a contract is let and, in extreme instances, after construction has begun. Changes issued by design teams are documented on a Revision of Plans (Form 0291) and/or a Pay Item Changes spreadsheet (if applicable). No other documentation is required.

Develop a concise and accurate description of the plan revision modifications and work involved on the Revisions of Plans (Form 0291). The following are guidelines for preparing a plan revision:

- Include revised plan sheets with the Form 0291 when necessary to communicate the revisions. When revised plan sheets include changes to dimensions or quantities, cross out the corrected values (leaving them legible) and place the new values above or adjacent to the previous (crossed out) values.
- Plan revisions involving FHWA Oversight projects must be reviewed and approved by the FHWA Area Engineer prior to distribution.
- Place exact quantities in the corresponding Pay Item Changes spreadsheet (as noted in Section 14.70.01). Estimate quantities accurately if exact quantities cannot be determined until after the work is completed.
- Do not revise the Project Quantity Sheet (PQS) or AASHTOWare Project. Quantity changes will be corrected with a Contract Modification submitted by the project office.
- If most of the plan sheets are affected, the complete set should be reissued following the procedure in Section 14.70.01.
- If the RID files need to be changed, submit the revised files consistent with the Design Submittal Requirements outlined in the MDOT Development Guide.

14.70.01 Procedure

(revised 10-28-2024)

Follow this general procedure when preparing and distributing plan revisions:

1. Send an email (including the ProjectWise Project folder link) to MDOT-ProjectWise@michigan.gov requesting a “Plan Revisions” folder be created in ProjectWise under the “7 - As-Builts and Revisions” folder. The responding folder creation email will contain a ProjectWise link to the “Plan Revisions“ folder. This folder will contain a document set that links to a Pay Item Changes spreadsheet for tracking any quantity changes associated with the plan revision to be submitted with the Form 0291.
2. Revise the affected plan sheet(s) if required.
3. Complete the Revision of Plans (Form 0291) and Pay Item Changes spreadsheet if needed.
4. Discuss the proposed changes with the FHWA Area Engineer if the project has FHWA Oversight.
5. Create a combined PDF of the completed Revision of Plans (Form 0291) with any revised plan sheets, matching the existing replacement sheet size. Name the combined file PLANREV_X1.pdf and the Pay Item Changes spreadsheet as PLANREV_X1.xlsx (or subsequent numerical naming if necessary). Note that the ”X” in the aforementioned filenames are to be replaced with a letter prefix for the section issuing the revision (R-Road, B-Bridge, U-Utilities). Save the files in the "Plan Revisions” folder.
6. Provide an email link to all affected MDOT Staff notifying them that a plan revision is available. Potential affected Staff include:
    - TSC Construction Engineer
    - Bridge Design/Management Units
    - Road Design/Management Units
    - Structural Fabrication Unit
    - Utility Coordination, Permits, & Agreements
    - Railroad Coordination Unit
7. Provide electronic copies to all affected non-MDOT stakeholders notifying them that a plan revision is attached. Potential affected stakeholders include:
    - FHWA (for RBPI projects)
    - Consultants
    - Cities/Counties
    - County Drain Commissions
    - Utilities
    - Fabricators

14.71 CONTRACT MODIFICATIONS

(revised 10-28-2024)

Contract modifications are the formal process by which revisions to the contract are officially authorized, approved and incorporated into the construction contract. Contract modifications are processed for any revisions to the contract that alters the nature, scope, cost and/or schedule of the project.

For specific details regarding the Construction Contract Modification Process refer to 103.02 Contract Revisions of the MDOT Construction Wiki website.

14.72 POST-CONSTRUCTION REVIEW MEETING

(revised 10-28-2024)

The purpose of a post-construction review is to provide feedback to design staff and other stakeholders to improve the quality and cost effectiveness of future projects. These meetings are initiated by Construction and held for selected projects per construction season.

It is essential for the Design Project Manager (PM)/Cost and Scheduling Engineer to take a proactive stance on all projects, keep lines of communication open with construction, and become familiar with any field implemented changes being made to projects during construction activities that differ from design. It is essential to understand why these changes were made and if they warrant a new perspective in design on certain fixes, or if it was a circumstantial instance. This enables the Design PM to become more informed and be better prepared to engage in productive discussions during the post-construction review meetings, as well as prepare better plans for future similar projects, and maintain quality records with a higher level of accuracy for future corridor improvement plans.

The Design PM should attend and coordinate invitations to internal designers and external design consultants who participated in the design process.

Upon completion of the post-construction meeting, the meeting minutes will be deposited into ProjectWise and an email notification will be sent to the project stakeholders letting them know that the minutes have been compiled, completed and ready for viewing.

For more specific details regarding Post-Construction Review Meetings criteria and agenda items, refer to http://mdotwiki.state.mi.us/construction/index.php/Plans,_Proposal,_Input,_Review_and_Evaluation#Post-Construction_Reviews of the MDOT Construction Wiki website.

14.73 MARKED FINAL PLANS

(revised 9-21-2009)

As-Built Plans, also referred to as As-Constructed Final Plans (ACFP), or Marked Final Plans, are original awarded project plan sheets that have been updated to show changes, corrections and comments made during construction.

After construction is complete, the Resident/Delivery Engineer's office is responsible for creating and placing marked As-Built Plans in ProjectWise.

14.73.01 Mark-Up Standards

(revised 12-17-2018)

Use the following guidelines to capture the As-Built changes and corrections made to the As-Let Plans:

Horizontal Control: Changes in alignment, bearings, PC's, PI's, PT's, curve data, government corner witnesses, witnesses to alignment monuments, Right-of-Way monuments and boxes, and Right-of-Way fence should be shown on plan sheets.

Vertical Control: Changes in vertical curves, benchmarks, grade changes, structure grade changes, and changes in elevation and/or percent grade of ditch flow line should be shown on profile and plan sheets where applicable.

Drainage and Topography: Changes in location, elevation, length and size of culverts, sewers, edge drain, manholes, and catch basins should be shown on plan and profile sheets. This information should include stationing, offset from centerline, flow line elevation, types, sizes, lengths, end section types/materials, and quantities. Other topography changes including guardrail, slopes, drives (location, surface material type (HMA/Agg/Conc), and width) utility changes such as water main, lighting, etc. should also be shown.

Earthwork and Surfacing: It is not necessary to show minor changes in earthwork, sub-base or surfacing on plan and profile sheets if such changes are broken by balances on the quantity sheets. When borrow is contractor-furnished, actual earthwork balances are not important. Use the same station to station breakdown as was used for plan quantities. Undercuts also do not need to be shown as most reconstruction projects require a new soils investigation.

When capturing As-Built mark-ups, adhere to the following As-Built Mark-Up Standards:

- Mark-ups can be made in either CAD or by hand
- Use black ink only to mark-up plans
- Mark-ups must be clear and legible
- Hand comments must appear opaque (solid)
- Do not obliterate As-Let plan data – only line out or place an "x" through item
- Final output must be PDF format in PLANHALF size of 11" x 17"
- Plan sheets with As-Built mark-ups are to be saved individually outside of the original plan set

14.73.02 File Standards and Requirements

(revised 3-16-2015)

Once the As-Built mark-ups are complete and formatted properly, use the following requirements to ensure the As-Builts plans are ready for submission.

Review Mark-ups for Legibility: Ensure the As-Built Plan sheets being submitted meet the data capture and mark-up requirements as outline in Section 14.73.01.

File Requirements: As-Built Plans must be in PDF format. They must also be sized and scaled to the PLANHALF size of 11" x 17".

As-Built File Naming Standards: In order to ensure consistency and proper search results, specific naming conventions must be maintained for all As-Built sheets.

- File names must follow the naming conventions used in the Letting Plan or Proposal, including capitalization.
- The page number given to the sheet must be the page it represents in the PDF As-Let plan set and NOT the page in the project drawing plan set.
- As-Built plans sheets that are PDF pages 1-9 should be named as "01, 02, 03"… in order to keep them in proper page sequence in the folder.
- Corrected PDF plan sheets must be saved and named individually.
- Consecutive As-Built sheets can be saved in a single pdf file and named according to the following format: "Road_09-22.pdf", "Bridge_09-22.pdf". Use this format only when the As-Builts contain corrected sheets that are in sequence.

The following list provides examples of the standard naming conventions for As-Builts.

- Proposal_15.pdf
- Road_01.pdf
- Bridge_22-46.pdf
- Road1_07.pdf
- Bridge1_22.pdf

14.73.03 As-Built Turn In Process

(revised 12-17-2018)

After ensuring the As-Builts meet the required criteria, they are ready to be submitted. Submit the As-Built Plans using ProjectWise by:

- Contacting your local ProjectWise administrator for As-Built folder set-up
- Adding As-Built plan sheets to the As-Built folder for the designated job number
- Filling out and submitting Form 250

Detailed instructions can be found in the ProjectWise Reference documents for As-Builts under the Standards and Submittal Instructions folder at:

pwname://MDOTProjectWise/Documents/Reference Documents/As-Builts/~ Standards and Submittal Instructions

14.73.04 Design Division Review and Approval Process

(revised 9-21-2009)

Upon receiving the submitted As-Built plan information, the As-Built Administrator reviews the As-Builts to determine if they are ready to be turned to Final status or if they need further correction.

When the As-Builts are approved, an electronic notification is sent to the submitter acknowledging the As-Builts are approved and marked to Final status. No further action is required by the submitter.

If the administrator rejects the submitted As-Builts, an electronic notification is sent to the submitter indicating the items that need to be re-addressed before the plans can be approved. Once the items have been re-addressed the submitter can re-submit the As-Builts for approval.

14.74 DOCUMENT RETENTION

(revised 9-21-2009)

Once a project has been completed and closed-out, document retention for the project is necessary.

14.74.01 Permanent Records

(revised 12-17-2018)

Permanent, or indefinite, paper files and electronic documents, are to be stored in ProjectWise. (Permanent paper files must be scanned and saved in the PDF format prior to storing in ProjectWise.) Such documentation includes:

- PDF plan sheets with “As-Built” changes and/or corrections
- Contract plans or proposal
- Agreement file
- Permit file

The following items should also be included in the permanent records as well:

- Drainage calculations
- Environmental Impact Statement
- Environmental Assessment
- Engineering Report
- Correspondence (only correspondence concerning design decisions on the project)
- Survey data (benchmark, government corner tie information only)
- Design exceptions / variances
- Design project records
- Guardrail Designs

All other information, paper or electronically stored in ProjectWise, including review sets and calculations not described above, should be discarded. This specifically includes the Plan Review plans, FPC plans, design data, line and grade plans, office check plans, drainage approval plans, municipal approval plans and Health Department plans, etc.

APPENDIX D – LIST OF ACRONYMS

Acronym	Description
ADT	Average Daily Traffic
BOH	Bureau of Highways
BTP	Bureau of Transportation Planning
CA	Certification Acceptance
CE	Construction Engineering
CFR	Code of Federal Register
COR	Construction Office Review
CPM	Critical Path Method (Network)
DBE	Disadvantaged Business Enterprise
DHV	Design Hourly Volume
DTM	Digital Terrain Model
EAU	Environmental Assessment Unit
EEO	Equal Employment Opportunity
EIS	Environmental Impact Statement
EOC	Engineering Operations Committee
EPA	Environmental Protection Agency
EPE	Early Preliminary Engineering
FHWA	Federal Highway Administration
FOIA	Freedom of Information Act
FONSI	Finding of No Significant Impacts
FUSP	Frequently Used Special Provisions
FUSS	Frequently Used Supplemental Specifications
G/DCCU	Grading/Drainage Consulting Contracting Unit
GRCU	Governmental and Railroad Coordination Unit
I/D	Incentive/Disincentive
LCCA	Life Cycle Cost Analysis
LSUM	Lump Sum
EGLE	Michigan Department of Environment, Great Lakes, and Energy
DNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
MIR	Michigan Institutional Roads
NAVD	North American Vertical Datum
NHS	National Highway System

Acronym	Description
NPDES	National Pollutant Discharge Elimination System
NVD	National Vertical Datum
OEC	Omissions/Errors/Check
OJT	On the Job Training
PCS	Project Area Contamination Survey
PC	Point on Curve
PCU	Project Coordination Unit
PE	Preliminary Engineering
PI	Point of Intersection
PMS	Pavement Management System
POB	Point of Beginning
POE	Point of Ending
PPMS	Program/Project Management System
PRSC	Pavement Review Selection Committee
PT	Point on Tangent
QAQC	Quality Assurance/Quality Control
ROR	Region Office Review
ROW	Right of Way
RQFS	Road Quality Forecasting System
RRS	Region/TSC Resource Specialist
S&E	Specifications and Estimates
SLD	Special Liquidated Damages
STIP	Statewide Transportation Improvement Plan
SUE	Subsurface Utility Engineering
SUP	Special Use Permits
TSC	Transportation Service Center
URTS	Utility Relocation Tracking System
USGS	United States Geological Survey
USPLSS	United States Public Land Survey System
VE	Value Engineering
VECP	Value Engineering Change Proposal