Chapter Twenty-four
BASIC DESIGN CONTROLS

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Chapter Twenty-four
BASIC DESIGN CONTROLS

Geometric design is predicated on many basic controls which establish the overall objective of the highway facility and identify the basic purpose of the highway project. Chapter Twenty-four presents these basic controls that impact geometric design. The Chapter includes a discussion on the functional classification system, speed, access control, sight distance and the design exception process. The application of these items to a project will impact all elements of geometric design.

24.1 DEFINITIONS

24.1.1 Qualifying Words

Many qualifying words are used in geometric design and in this Manual. For consistency and uniformity in the application of various design criteria, the following definitions apply:

1. Shall, require, will, must. A mandatory condition. Designers are obligated to adhere to the criteria and applications presented in this context or to perform the evaluation indicated. For the application of geometric design criteria, this Manual limits the use of these words.

2. Should, recommend. An advisory condition. Designers are strongly encouraged to follow the criteria and guidance presented in this context, unless there is reasonable justification not to do so.

3. May, could, can, suggest, consider. A permissive condition. Designers are allowed to apply individual judgment and discretion to the criteria when presented in this context. The decision will be based on a case-by-case assessment.

4. Desirable, preferred. An indication that the designer should make every reasonable effort to meet the criteria and that the designer should only use a "lesser" design after due consideration of the "better" design.

5. Ideal. Indicating a standard of perfection (e.g., traffic capacity under "ideal" conditions).

6. Minimum, maximum, upper, lower (limits). Representative of generally accepted limits within the design community but not necessarily suggesting that these

limits are inviolable. However, where the criteria presented in this context will not be met, the designer will in many cases need approval.

7. Practical, feasible, cost-effective, reasonable. Advising the designer that the decision to apply the design criteria should be based on a subjective analysis of the anticipated benefits and costs associated with the impacts of the decision. No formal analysis (e.g., cost-effectiveness analysis) is intended, unless otherwise stated.

8. Possible. Indicating that which can be accomplished. Because of its rather restrictive implication, this word will not be used in this Manual for the application of geometric design criteria.

9. Significant, major. Indicating that the consequences from a given action are obvious to most observers and, in many cases, can be readily measured.

10. Insignificant, minor. Indicating that the consequences from a given action are relatively small and not an important factor in the decision-making for geometric design.

11. Standard. Indicating a design value that cannot be violated without severe consequences. This suggestion is generally inconsistent with geometric design criteria. Therefore, “standard” will not be used in this Manual to apply to geometric design criteria.

12. Guideline. Indicating a design value which establishes an approximate threshold that should be met if considered practical.

13. Criteria. A term typically used to apply to design values, usually with no suggestion on the criticality of the design value. Because of its basically neutral implication, this Manual frequently uses “criteria” to refer to the design values presented.

14. Typical. Indicating a design practice which is most often used in application and which is likely to be the “best” treatment at a given site.

15. Target. If practical, target criteria is the criteria the designer should be striving to meet. However, not meeting these criteria will typically not require a justification.

16. Acceptable. Design criteria that do not meet desirable values, but yet is considered to be reasonable and safe for design purposes.

17. Policy. Indicating MDT practice which the Department generally expects the designer to follow, unless otherwise justified.

24.1.2 Acronyms

The following acronyms may be used in this Manual:

1. AASHTO. American Association of State Highway and Transportation Officials.
2. FHWA. Federal Highway Administration.
3. HCM. Highway Capacity Manual.
4. ITE. Institute of Transportation Engineers.
5. ISTEA. Intermodal Surface Transportation Efficiency Act of 1991.
6. MUTCD. Manual on Uniform Traffic Control Devices.
7. NCHRP. National Cooperative Highway Research Program.
8. NHS. National Highway System.
9. STP. Surface Transportation Program.
10. TEA-21. Transportation Equity Act for the 21st Century.
11. TRB. Transportation Research Board.
12. USDOT. United States Department of Transportation.
13. PS&E. Plans, Specifications and Estimates.

24.2 HIGHWAY SYSTEMS

24.2.1 Classification Systems

The MDT Geometric Design Standards and Route Segment Plans were approved by the Montana Transportation Commission in 1992. They have been adopted as the design standards for the highway system. These standards correlate to the highway funding categories. Figure 24.2A provides a general correlation between the funding classification and the functional classification system. Figure 12-1 of the Montana Road Design Manual provides the functional classification of State highways in Montana. The design guidelines for off-system roadways are chosen by functional classification.

Geometric Design Standards (Funding Classification)	Functional Classification System
NH Interstate	Principal Arterial (Freeways)
NH Non-Interstate	Principal Arterial
STP Primary	Minor Arterial
STP Secondary	Major Collector
Urban	Urban

FUNDING CLASSIFICATION VERSUS FUNCTIONAL CLASSIFICATION

Figure 24.2A

24.2.2 Functional Classification System

The functional classification concept is one of the most important determining factors in geometric design. In this concept, highways are grouped by the character of service they provide. Functional classification recognizes that the public highway network in Montana serves two basic and often conflicting functions — travel mobility and access to property. Each highway or street will provide varying levels of access and mobility, depending upon its intended service. In the functional classification scheme, the overall objective is that the highway system, when viewed in its entirety, will yield an optimum balance between its access and mobility purposes. If this objective is achieved, the benefits to the traveling public are maximized.

The functional classification system provides the guidelines for determining the geometric design of individual highways and streets. These guidelines equal or exceed the geometric design criteria that would be used based on the highway funding category. Once the function of the highway facility is defined, the designer can select an appropriate design speed, roadway width, roadside safety elements, amenities and other design values. All of Part IV "Geometrics" in the Montana Traffic Engineering Manual is based upon this systematic concept to determining geometric design.

The Rail, Transit and Planning Division has functionally classified all public roads and streets within Montana. For geometric design, it is necessary to identify the predicted functional class of the road or street for the selected design year (e.g., 20 years beyond the project completion date). The Rail, Transit and Planning Division will provide this information to the designer.

24.2.2.1 Arterials

Arterial highways are characterized by a capacity to quickly move relatively large volumes of traffic and an often restricted function to serve abutting properties. The arterial system typically provides for high travel speeds and the longest trip movements. The arterial functional class is subdivided into principal and minor categories for rural and urban areas:

1. Principal Arterials. In both rural and urban areas, the principal arterials provide the highest traffic volumes and the greatest trip lengths. Principal arterials can be further subdivided into the following classifications:

    a. Freeways. The freeway, which includes Interstate highways, is the highest level of arterial. These facilities are characterized by full control of access, high design speeds and a high level of driver comfort and safety. For these reasons, freeways are considered a special type of highway within the functional classification system, and separate geometric design criteria have been developed for these facilities. Unless otherwise noted, Interstate System projects will be designed according to freeway design criteria.

    b. (Other) Principal Arterials. These facilities may be 2 or more lanes with or without a median. In many cases, the level of geometric design is equivalent to that of freeways (e.g., 12 ft (3.6 m) lane widths are required on all principal arterials). Unless otherwise noted, all principal arterials will be designed according to principal arterial criteria, whether or not the facility is on the NHS.

2. Minor Arterials. In rural areas, minor arterials will provide a mix of interstate and interregional travel service. In urban areas, minor arterials may carry local bus routes and provide intra-community connections. When compared to the

principal arterial system, the minor arterials accommodate shorter trip lengths and lower traffic volumes, but they provide more access to property.

24.2.2.2 Collectors

Collector routes are characterized by a roughly even distribution of their access and mobility functions. Traffic volumes will typically be somewhat lower than those of arterials. In rural areas, collectors serve intra-regional needs and provide connections to the arterial system. All cities and towns within a region will be connected. In urban areas, collectors act as intermediate links between the arterial system and points of origin and destination. Urban collectors typically penetrate residential neighborhoods and commercial/industrial areas. Local bus routes will often include collector streets.

24.2.2.3 Local Roads and Streets

All public roads and streets not classified as arterials or collectors are classified as local roads and streets. Local roads and streets are characterized by their many points of direct access to adjacent properties and their relatively minor value in accommodating mobility. Speeds and volumes are usually low and trip distances short. Through traffic is often deliberately discouraged.

24.2.3 Federal-Aid System

Section 8.2 of the Montana Road Design Manual discusses the Federal-aid system.

24.2.4 National Network (for Trucks)

The Surface Transportation Assistance Act (STAA) of 1982 required that the US Secretary of Transportation, in cooperation with the State highway agencies, designate a national network of highways that allow the passage of trucks of specified minimum dimensions and weight. The objective of the STAA is to promote uniformity throughout the nation for legal truck sizes and weights on a National Network. The Network includes all Interstate highways and significant portions of the former Federal-aid primary system (before the 1991 ISTEA) built to accommodate large-truck travel. In addition, the STAA requires that “reasonable access” be provided along other routes for the STAA commercial vehicles from the National Network to terminals and to facilities for food, fuel, repair and rest and, for household goods carriers, to points of loading and unloading.

In Montana, the National Network includes the Interstate highway system. The designer should note that the WB-67 (WB-20) is allowed on all public roads in the State. The WB-100T (WB-30T) (triple semitrailer) is only allowed on the Interstate system and for reasonable access to the system. MDT has defined “reasonable access” as 1 mile (1.6 km) from any interchange.

24.3 SPEED

24.3.1 Definitions

1. Design Speed. Speed selected to determine the various geometric design features of the roadway. Section 24.3.2 discusses the selection of design speed in general. Chapter Twelve of the Montana Road Design Manual presents specific design speed criteria for various conditions.

2. Low Speed. For geometric design purposes, low speed is defined as 45 mph (70 km/h) or less.

3. High Speed. For geometric design purposes, high speed is defined as greater than 45 mph (70 km/h).

4. Average Running Speed. Running speed is the average speed of a vehicle over a specified section of highway. It is equal to the distance traveled divided by the running time (the time the vehicle is in motion). The average running speed is the distance summation for all vehicles during a specified time divided by the running time summation for all vehicles.

5. Average Travel Speed. Average travel speed is the distance summation for all vehicles divided by the total time summation for all vehicles, including stopped delays. (Note: Average running speed only includes the time the vehicle is in motion. Therefore, on uninterrupted flow facilities that are not congested, the average running speed and average travel speed are equal.)

6. 85th-Percentile Speed. The 85th-percentile speed is the speed at or below which 85 percent of the traffic is moving. The most common application of the value is its use as a major factor in determining the posted, legal speed limit for a highway section. In most cases, field measurements for the 85th-percentile speed will be conducted during off-peak hours when drivers are free to select their desired speed.

7. Pace Speed. Pace speed is defined as that 10 mph (15 km/h) increment of spot speeds that includes the range of speeds in which the highest number of observations recorded.

8. Posted Speed Limit. The posted speed limit is based on a traffic engineering study considering:

    a. the 85th-percentile speed;

b. pace, the 10 mph (15 km/h) range of speeds in which the highest number observations are recorded;

c. speed profile;

d. Montana Code;

e. type and density of roadside development;

f. functional classification and type of area;

g. adjacent sections;

h. the crash experience during at least the previous year;

i. road surface characteristics, shoulder condition, grade, alignment and sight distance; and

j. parking practices and pedestrian activity.

For additional guidance on selecting posted speed limits, see Section 40.4.2.

24.3.2 Design Speed Selection

The selected design speed is based on the following:

1. Functional Classification. In general, the higher class facilities are designed with a higher design speed than the lower class facilities.

2. Urban/Rural. Design speeds in rural areas are generally higher than those in urban areas. This is consistent with the typically fewer constraints in rural areas (e.g., less development).

3. Terrain. The flatter the terrain, the higher the selected design speed will be. This is consistent with the typically higher construction costs associated with more rugged terrain.

4. Driver Expectancy. The selected design speed should be consistent with driver expectancy. The designer should consider the following when selecting a design speed:

    a. avoid major changes in the design speed throughout the project limits;

b. where necessary, provide transitional design speeds between sections adjacent to the project;

c. do not place minimum radius horizontal curves at the end of long tangents; and

d. consider the expected posted speed in the selection of the design speed.

For geometric design application, the relationship between these design elements and the selected design speed reflects general cost-effective considerations. The value of a transportation facility in carrying goods and people is judged by its convenience and economy, which are directly related to its speed. See Chapter Twelve of the Montana Road Design Manual for specific design speed criteria.

24.4 ACCESS CONTROL (DEFINITIONS)

Access control is defined as the condition where the public authority fully or partially controls the right of abutting owners to have access to and from the public highway. Access control may be exercised by statute, zoning, right-of-way purchases, approach controls and permits, turning and parking regulations or geometric design (e.g., approach spacing).

The following provides definitions for the three basic types of access control:

1. Full Access Control. Access is allowed only at specified interchanges or at specified public approaches. It is intended to give high priority to the uninterrupted movement of through traffic. At-grade access is inconsistent with full access control.

2. Limited Access Control. Access is allowed at specified public roads or at private driveways as specified in legal agreements and/or deeds. The established street system is given first priority in access to the highway. When it is determined that reasonable private access cannot be provided using the public access, direct private access may be allowed at specific points.

3. Regulated Access. Access is managed through the granting of revocable permits to private parties to construct and maintain an approach. This level is intended to strike a balance between the through mobility on the highway and accessibility to adjacent land use.

Limited access control and regulated access is exercised by the Department on the State highway system (see the MDT Approach Standards for Montana Highways) and by the local jurisdiction on other facilities to determine where private interests may have access to and from the public road system.

24.5 SIGHT DISTANCE

24.5.1 Stopping Sight Distance

Stopping sight distance (SSD) is the sum of the distance traveled during a driver's perception/reaction or brake reaction time and the distance traveled while braking to a stop. To calculate SSD on level grade, the following formula is used:

$$SSD = 1.47\ Vt + 1.075\ \frac{V^2}{a}$$ (US Customary) (Equation 24.5-1)

$$SSD = 0.278\ Vt + 0.039\ \frac{V^2}{a}$$ (Metric) (Equation 24.5-1)

where:
- SSD = stopping sight distance, ft (m)
- V = design speed, mph (km/h)
- t = brake reaction time, 2.5 s
- a = deceleration rate, 11.2 ft/s^2 (3.4 m/s^2)

Figure 24.5A provides stopping sight distances for passenger cars on level grade. The designer should try to exceed these values. Only use the values in Figure 24.5A where greater values are impractical due to natural features or existing development. When applying the SSD values, the height of eye is assumed to be 3.5 ft (1080 mm) and the height of object 2.0 ft (600 mm).

For operational reviews on existing roadways, the designer may want to check the grade adjusted SSD from the AASHTO A Policy on Geometric Design of Highways and Streets.

24.5.2 Passing Sight Distance

Passing sight distance considerations are limited to 2-lane, 2-way highways. On these facilities, vehicles may overtake slower moving vehicles, and the passing maneuver must be accomplished on a lane used by opposing traffic.

Figure 24.5B provides the minimum passing sight distance for design on 2-lane, 2-way highways. These distances allow the passing vehicle to safely complete the passing maneuver. These values should not be confused with the values presented in the MUTCD for the placement of no-passing zone stripes, which are based on different operational assumptions (i.e., distance for the passing vehicle to abort the passing maneuver). The designer should also realize that the highway capacity adjustment in

US Customary					Metric				
Design Speed (mph)	Brake[1] Reaction Distance (ft)	Braking[2] Distance On Level (ft)	Stopping Sight Distance		Design Speed (km/h)	Brake[1] Reaction Distance (m)	Braking[2] Distance On Level (m)	Stopping Sight Distance	
			Calculated (ft)	Design (ft)				Calculated (m)	Design (m)
20	73.5	38.4	111.9	115	30	20.9	10.3	31.2	35
25	91.9	60.0	151.9	155	40	27.8	18.4	46.2	50
30	110.3	86.4	196.7	200	50	34.8	28.7	63.5	65
35	128.6	117.6	246.2	250	60	41.7	41.3	83.0	85
40	147.0	153.6	300.6	305	70	48.7	56.2	104.9	105
45	165.4	194.4	359.8	360	80	55.6	73.4	129.0	130
50	183.8	240.0	423.8	425	90	62.6	92.9	155.5	160
55	202.1	290.3	492.4	495	100	69.5	114.7	184.2	185
60	220.5	345.5	566.0	570	110	76.5	138.8	215.3	220
65	238.9	405.5	644.4	645	120	83.4	165.2	248.6	250
70	257.3	470.3	727.6	730					
75	275.6	539.9	815.5	820					

Notes:

1. *Brake reaction distance based on a time of 2.5 s.*
2. *Driver deceleration based on a rate of 11.2 ft/s^2 (3.4 m/s^2).*

STOPPING SIGHT DISTANCE
(Level Grades)

Figure 24.5A

the Highway Capacity Manual for 2-lane, 2-way highways is based on the MUTCD criteria for marking no-passing zones. It is not based on the percent of passing sight distance from the AASHTO A Policy on Geometric Design of Highways and Streets and shown in Figure 24.5B.

On rural reconstruction projects, the designer should attempt to provide passing sight distance over as much of the highway length as practical. It will generally not be cost effective, however, to make significant improvements to the horizontal and vertical alignment solely to increase the available passing sight distance. When determining the percent of passing sight distance, consider the following factors:

1. traffic volumes,
2. truck volumes, and
3. safety.

Passing sight distance is measured from a 3.5 ft (1080 mm) height of eye to a 3.5 ft (1080 mm) height of object. The 3.5 ft (1080 mm) height of object allows 0.82 ft (250 mm) of a typical passenger car to be seen by the opposing driver. For guidance on the theoretical development of passing sight distances, see the AASHTO A Policy on Geometric Design of Highways and Streets.

24.5.3 Passing Lanes

Passing lanes are defined as a short added lane provided in one or both directions of travel on a 2-lane, 2-way highway to improve passing opportunities. They may present a relatively low-cost improvement for traffic operations by breaking up traffic platoons and reducing delay on facilities with inadequate passing opportunities. Truck-climbing lanes are one type of passing lane used on steep grades to provide passenger cars with an opportunity to pass slow-moving trucks. The criteria for and design of truck-climbing lanes are discussed in Chapter Thirty.

Passing lanes other than truck-climbing lanes may be necessary on 2-lane facilities where the desired level of service or capacity cannot be obtained. Passing lanes also may be determined to be necessary based on an engineering study that includes judgment, operational experience and a capacity analysis. Passing lane design should be coordinated with access management. The use of a passing lane will be determined on a case-by-case basis. For more information on passing lane guidance, see the FHWA publication Low Cost Methods for Improving Traffic Operations on Two-Lane Roads, Report No. FHWA-IP-87-2. The Report discusses the following for passing lanes:

US Customary				Metric			
Design Speed (mph)	Assumed Speeds (mph)		Passing Sight Distance (ft)	Design Speed (km/h)	Assumed Speeds (km/h)		Passing Sight Distance (m)
	Passed Vehicle	Passing Vehicle	Rounded for Design		Passed Vehicle	Passing Vehicle	Rounded for Design
20	18	28	710	30	29	44	200
25	22	32	900	40	36	51	270
30	26	36	1090	50	44	59	345
35	30	40	1280	60	51	66	410
40	34	44	1470	70	59	74	485
45	37	47	1625	80	65	80	540
50	41	51	1835	90	73	88	615
55	44	54	1985	100	79	94	670
60	47	57	2135	110	85	100	730
65	50	60	2285	120	90	105	775
70	54	64	2480				
75	56	66	2580				

MINIMUM PASSING SIGHT DISTANCE (PSD)
(2-LANE HIGHWAYS)

Figure 24.5B

1. their location and configuration,
2. their length and spacing,
3. geometrics,
4. signing and pavement marking, and
5. operational and safety effectiveness.

The HCM also presents a methodology adjustments that may be made to the highway capacity methodology in the Highway Capacity Manual to estimate the level-of-service benefits from adding passing lanes to 2-way facilities.

24.6 FHWA INVOLVEMENT

24.6.1 FHWA Authority

FHWA has oversight (review and approval authority) for specific program and project level actions as noted below. MDT will be accountable for program and project level actions within their authority for all other Federal-aid projects.

FHWA will have specific approval authority for the following program level actions including, but not limited to:

1. authorization and obligation of Federal-aid funds for all Federal-aid projects (PE, IC, ROW, Construction);
2. right-of-way actions, including change in access control or other use or occupancy of acquired property along the Interstate. Procedures for acquisition, rental, leasing, maintenance and disposal of real property acquired with 23 USC funds will be in accordance with the MDT Right-of-Way Operations Manual;
3. approval of MDT Right-of-Way Operations Manual;
4. approval of MDT Indirect Cost Allocation Plan;
5. environmental documents for all Federal-aid projects;
6. civil rights and DBE programs;
7. Federal-aid project final vouchers;
8. MDT Standard Specifications, Supplemental Specifications and MDT Detailed Drawings;
9. Statewide Transportation Improvement Program (STIP); and
10. Vehicle Size and Weight, Heavy Vehicle Use Tax and other required certifications.

24.6.2 Oversight Responsibilities

24.6.2.1 General

Oversight actions that may be performed by FHWA and MDT include:

1. approving project concept/development documents (e.g., Preliminary Field Review Report, Scope of Work Report, Plan-in-Hand Report, pavement surfacing designs and final PS&E's for these projects;

2. approving design exceptions;

3. authorization to advertise projects, constitutes PS&E approval;

4. award or concurrence in award of construction contracts;

5. approving contract claims;

6. approving contract change orders, defined as scope-of-work changes, change of termini, design changes, major quantity changes, negotiated items not found in the original contract and change of materials prior to the work being done; and

7. project final acceptance reports.

24.6.2.2 FHWA Oversight

FHWA retains oversight authority for the following types of projects:

1. for all reconstruction projects of at least $3 million on the NHS (at least $1 million on the Interstate System), and

2. for all pavement preservation and rehabilitation projects on the NHS (including the Interstate System) with a total estimated construction cost of at least $3 million.

24.6.2.3 MDT Oversight

MDT is delegated oversight authority:

1. for all other Federal-aid projects on the NHS (including Interstate System);

2. for all Federal-aid CTEP, guardrail, striping/pavement marking and traffic signal projects regardless of the total construction cost or highway system (i.e., NHS or Interstate); and

3. for all Federal-aid projects not on the NHS.

MDT can also request FHWA assistance and/or formal action on any other FAHP program or project level issue.

24.7 ADHERENCE TO GEOMETRIC DESIGN CRITERIA

Part IV "Geometrics" and, in particular, Chapter Twelve of the Montana Road Design Manual presents numerous criteria on geometric design for application on individual geometric design projects. In general, the designer is responsible for making every reasonable effort to meet these criteria in the project design. However, this will not always be practical. This Section discusses the Department's procedures for identifying, justifying and processing exceptions to the geometric design criteria in the Montana Traffic Engineering Manual and Montana Road Design Manual.

24.7.1 Department Intent

The general intent of the Montana Department of Transportation is that all geometric design criteria in this Manual should be met and, wherever practical, the proposed design should exceed the minimum criteria. Where a range of values is presented, the designer should make every reasonable effort to provide a design which equals or exceeds the upper value. This is intended to ensure that the Department will provide a highway system that meets the transportation needs of the State and provides a reasonable level of safety, comfort and convenience for the traveling public. However, recognizing that this will not always be practical, the Department has established a process to identify, evaluate and approve exceptions to geometric design criteria.

24.7.2 Geometric Design Exceptions

24.7.2.1 General

This Section presents those geometric design elements which require a design exception when the proposed design does not meet the applicable criteria. The "controlling" design criteria are highway elements that are judged to be the most critical indicators of a highway's overall safety and serviceability.

24.7.2.2 Design Elements

The designer must seek a MDT/FHWA design exception when the proposed design includes any of the following elements that do not meet MDT criteria:

1. design speeds;

2. horizontal alignment elements:

a. minimum radii,
b. warrants for spiral curves, and
c. sight distance at curves based on SSD;

3. vertical alignment elements:

   a. crest and sag vertical curves based on SSD,
   b. maximum grades, and
   c. vertical clearances;

4. lane and shoulder widths for:

   a. through travel lanes,
   b. auxiliary lanes, and
   c. ramps;

5. bridge widths;

6. superelevation rates and transition lengths;

7. cross slopes on travel lanes;

8. cut and fill slopes;

9. roadside clear zones, including the adjustment for horizontal curves;

10. unshielded obstacles within the clear zone and shielded obstacles outside of the clear zone;

11. horizontal clearances to obstructions on curbed facilities (obstructions with 1.5 ft (0.5 m) of curb);

12. embankment slopes that are flatter than required by the MDT design criteria, including those left-in-place;

13. roadside hardware details (e.g., post spacing);

14. a minimum 2 ft (600 mm) offset between the face of a roadside barrier and the edge of the traveled way;

15. raised medians less than 20 ft (6.0 m); and

16. intersection sight distances.

24.7.3 Project Application

24.7.3.1 MDT

The MDT geometric design exception process applies to all capital improvement projects under the jurisdiction of the Department with the following exceptions:

1. State and Federally-funded pavement preservation projects,
2. projects on off-system roads, and/or
3. safety projects.

For all of the projects listed above, except the State-funded pavement preservation projects, the elements that do not comply with the MDT design criteria will be described in the Scope of Work report. The discussion should provide limited documentation for the justification of the design exceptions.

24.7.3.2 FHWA

As noted in Section 24.6, requests for design exceptions will be submitted to FHWA for all projects on the NHS. The request for design exceptions will be submitted internally to MDT for all projects in the STP. The MDT criteria will be utilized by both entities in the evaluation of the design elements.

24.7.4 Documentation

The type and detail of the documentation needed to justify a design exception will be determined on a case-by-case basis. The following provides potential items that may be addressed in the documentation for a specific design exception:

1. crash data,
2. environmental impacts,
3. right-of-way impacts,
4. construction costs, and
5. serviceability impacts (e.g., traffic level of service).

24.7.5 Procedures

The following procedure will be used to process a proposed geometric design exception when the Traffic Engineering Section is the project lead:

1. Project Engineer. The Project Engineer will assemble the package for the design exception request. The package will be submitted to the Traffic and Safety Engineer through the Traffic Engineer.

2. Traffic and Safety Engineer. The Traffic and Safety Engineer will review the design exception package and, if in agreement, will sign the request. This will complete the internal MDT process. In rare cases where the Traffic and Safety Engineer believes necessary, the design exception request may be submitted to the Highway Engineer or the Engineering Division Administrator for action.

   If FHWA approval is needed, the Traffic and Safety Engineer will submit the package to the FHWA Division Office.

3. FHWA. On applicable projects, the FHWA will review the design exception request and, if in agreement, will sign the request and return the package to the Traffic and Safety Engineer.

4. Design Exception Denial. If the Traffic and Safety Engineer and/or FHWA has denied the design exception request, the Project Engineer will use the following steps:

   a. The Project Engineer will first try to meet MDT criteria.

   b. If the MDT design criteria cannot be met, the Project Engineer will develop alternatives and submit documentation to the Traffic Engineer.

   c. The Traffic Engineer will meet with the Traffic and Safety Engineer and the Project Engineer, discuss the issues and decide if a new design exception submittal is needed or if the issue can be resolved.

24.8 CROSS SECTION ELEMENTS

Figures 24.8A, 24.8B and 24.8C provide the basic nomenclature for cross section elements for Interstates, rural highways and urban streets. The following definitions apply to the highway cross section:

1. Auxiliary Lane. The portion of the roadway adjoining the through traveled way for purposes supplementary to through traffic movement including parking, speed change, turning, storage for turning, weaving or truck climbing.

2. Back Slope. The side slope created by the connection of the ditch bottom, upward and outward, to the natural ground.

3. Buffer. Where used, the area or strip, also known as a boulevard, between the roadway and a sidewalk.

4. Cross Slope. The slope in the cross section view of the travel lanes, expressed as a percent, based on the change in vertical compared to the change in horizontal.

5. Depressed Median. A median that is lower in elevation than the traveled way and designed to carry a certain portion of the roadway runoff.

6. Fill Slopes. Slopes extending outward and downward from the hinge point to intersect the natural ground line.

7. Flush Median. A paved median that is level with the surface of the adjacent roadway pavement.

8. Hinge Point (Freeways). The point from which the fill height and depth of cut are determined. For fills, the point is located at the intersection of the inslope extension and the fill slope. For cuts, the hinge point is located at the toe of the back slope.

9. Hinge Point (Non-Freeways). The point from which the fill height and depth of cut are determined. For fills, the point is located at the intersection of the subgrade cross slope and the fill slope for tangent sections and the low side of superelevated sections. On the high side of superelevated sections, the point is located on the fill slope at a distance from the centerline equal to the distance from the centerline to the hinge point on the tangent section. For cuts, the hinge point is located at the toe of the back slope.

10. Inslope. The side slope in a cut section created by connecting the subgrade shoulder to the ditch bottom, downward and outward.

11. Median. The portion of a divided highway separating the two traveled ways for traffic in opposite directions. The median width includes both inside shoulders.

12. Median Slope. The slope in the cross section view of a depressed median beyond the surfacing inslope, expressed as a ratio of the change in horizontal to the change in vertical.

13. Paved Walkway. That portion of the highway section constructed adjacent to facilities without curb and gutter, with a minimum 3 ft (1 m) buffer area, for use by pedestrians.

14. Raised Median. A median which contains a raised portion or island within its limits.

15. Roadside. A general term denoting the area adjoining the outer edge of the roadway.

16. Roadway Section. The combination of the traveled way, both shoulders and any auxiliary lanes on the highway mainline.

17. Shelf. On curbed urban facilities without sidewalks, the relatively flat area (2% slope) located between the back of the curb and the break for the fill slope or back slope.

18. Shoulder. The portion of the roadway contiguous to the traveled way for the accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses. On sections with curb and gutter, the shoulder extends to the face of the curb.

19. Shoulder Slope. The slope in the cross section view of the shoulders, expressed as a percent.

20. Shoulder Width. The width of the shoulder measured from the edge of traveled way to the intersection of the shoulder slope and surfacing inslope planes. On curb and gutter sections, the width of the shoulder is measured from the edge of the traveled way to a point 0.5 ft (0.15 m) in front of the back of curb.

21. Sidewalk. That portion of the highway section constructed for the use of pedestrians used in combination with curb and gutter.

22. Slope Offset. On curbed facilities with sidewalks, the area between the back of the sidewalk and the break for the fill slope or back slope.

23. Sloping (Mountable) Curb. A longitudinal element, typically concrete, placed at the roadway edge for delineation, to control drainage, to control access, etc. Sloping curbs have a height of 6 in (150 mm) or less with a face no steeper than 1 horizontal to 3 vertical.

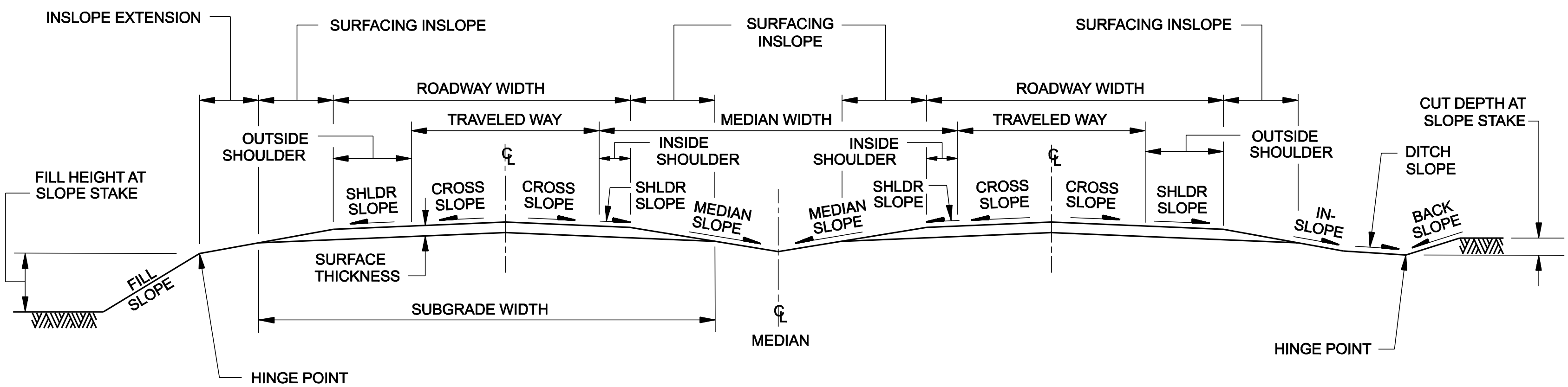
24. Surfacing Inslope. The slope extending from the edge of shoulder to the subgrade shoulder point, expressed as a ratio of the change in horizontal to the change in vertical.

25. Toe of Slope. The intersection of the fill slope or inslope with the natural ground or ditch bottom.

26. Top of (Cut) Slope. The intersection of the back slope with the natural ground.

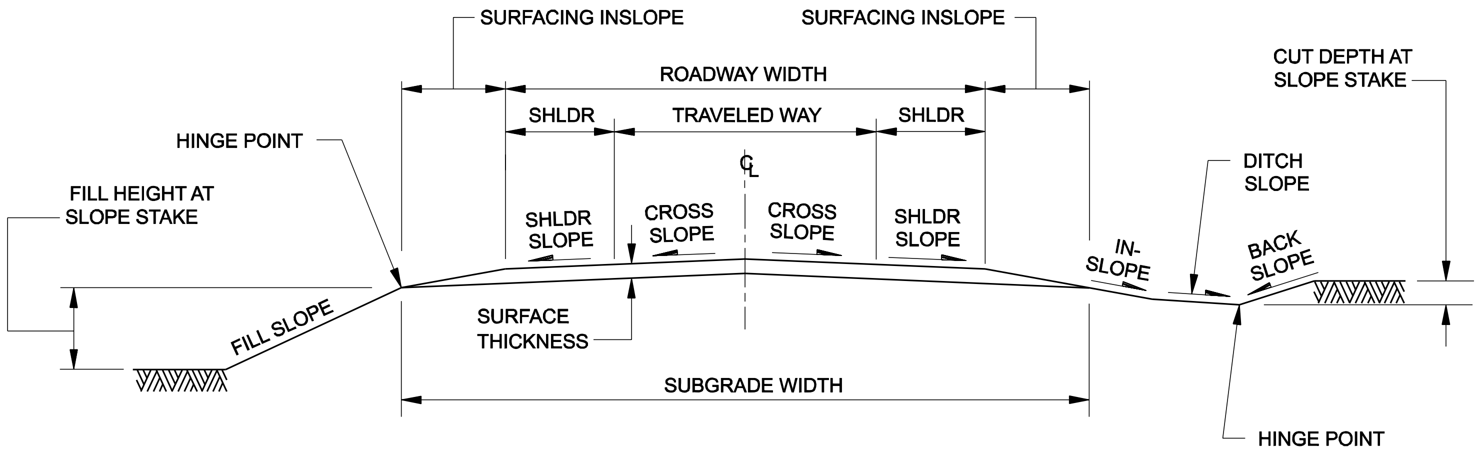
27. Traveled Way. The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

28. Vertical (Barrier) Curb. A longitudinal element, typically concrete, placed at the roadway edge for delineation, to control drainage, to control access, etc. Vertical curbs may range in height between 6 in (150 mm) and 1 ft (300 mm) with a face steeper than 1 horizontal to 3 vertical.



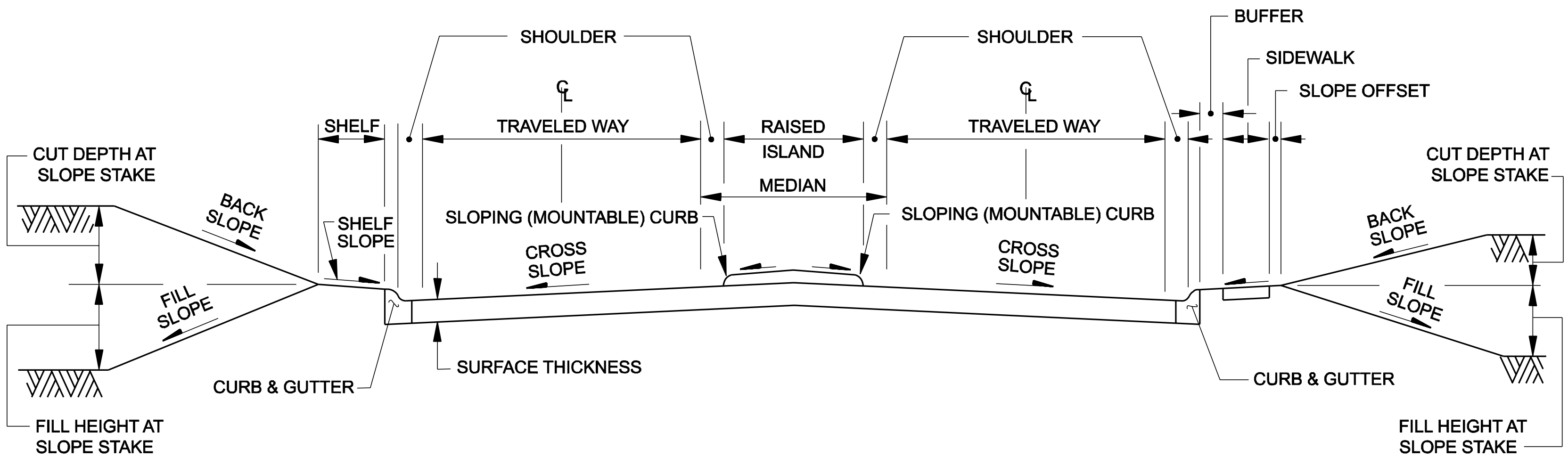
FREEWAY NOMENCLATURE

Figure 24.8A



RURAL HIGHWAY NOMENCLATURE
(Non-Freeways)

Figure 24.8B



URBAN STREET NOMENCLATURE

Figure 24.8C