BASELINE CRITERIA PRACTITIONER'S GUIDE

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1.0 PURPOSE

This publication provides further procedure and technical guidance for practitioners in accordance with Engineering Memo 21-03, *MDT Geometric Design Criteria and Design Exceptions*. It establishes controlling and non-controlling baseline criteria for design elements, documents baseline criteria and replaces all design memos establishing, defining, or identifying MDT Geometric Design Standards prior to the effective date of this document. It provides guidance for the appropriate use and documentation of context specific criteria and scope specific application for these procedures. Proposed deviations from baseline criteria and context specific criteria should provide consistency with project purpose and need, and include considerations for expected safety performance, expected operational performance and facility condition.

2.0 DEFINITIONS

Baseline Criteria - Published quantitative design criteria to be used as uniform baseline design dimensions or values. A baseline criterion is a controlling criterion/standard if it is applicable to a design element that requires a design exception. A baseline criterion is not a controlling criterion/standard otherwise.

Context Specific Criteria - Established quantitative design criteria to be used in place of uniform baseline design dimensions or values, for projects or locations where context indicates deviation from the baseline criteria is desirable. A context specific criterion is a controlling criterion/standard if it is applicable to a design element that requires a design exception. A context specific criterion is not a controlling criterion/standard otherwise.

Scope Specific Considerations - Projects, with a limited and targeted purpose and need, that address a specific safety, operational, or serviceability deficiency may be excluded in whole or in part from meeting the requirements of the Engineering Memo 21-03. Hazard elimination, emergency repair, and small infrastructure repair or replacement projects are examples of projects meeting this requirement. Scope specific considerations may also apply for connection or transition work to existing roadway features not included in the project scope.

Commission Designated Highways – This includes highways and highways use rights of way for Interstate, Non-Interstate National Highway System (NHS), Primary, Secondary and Urban highways as specified in MCA 60-1-103. Commission Designated Highways are also referred to as “On-System” routes for purposes of these procedures.

State Highways – The highways throughout the state that are not located on the Commission Designated Highway System but are on the state maintenance system as specified in MCA 60-1-103.

Controlling Criteria - A FHWA term defining design elements established by FHWA rulemaking which have substantial importance for the safe and efficient operation of roadways on the (NHS). Controlling criteria are the criteria that require formal documentation for deviations from standards not meeting 23 CFR 625.

Design Speed – A selected speed used to determine the various geometric design features of the roadway. The selected design speed should be a logical one with respect to the anticipated operating speed, topography, adjacent land use, modal mix, and the functional classification of the roadway.

High-speed - Design speed greater than or equal to 50 mph.

Urban Areas - Those places within boundaries set by the responsible State and local officials, or a place that has an urbanized character. Urban areas have three categories.

- Urbanized Area - Those areas with a population greater than 50,000, as designated by the Bureau of the Census.
- Small Urban Areas - Those areas with a population greater than 5,000, and not within any Urbanized Areas.
- Urban fringe – Those areas characterized as a blend of urban and rural character and user needs.

Standard - MDT term for design elements established by this procedure that require a design exception.

Variance - Approved deviation from baseline criteria for design controls that do not require a design exception.

Standard Encroachment – A non-geometric roadside feature, used to enhance the operation and safety for all modes of transportation applicable to the roadway location and context. Traffic signals, luminaires/decorative lighting, trees, railroad crossing signals and arms, road closure gates/bollards, and overhead sign supports are standard encroachments.

3.0 BACKGROUND

MDT Geometric Design Standards for rural roadways were last updated and approved by the MT Transportation Commission in 1992. MDT Geometric Design Standards for Urban and Developed Areas were last updated and approved by the MT Transportation Commission in 2001. Transportation Commission guidance has changed since the design standards were last published. Engineering Memo 21-03 establishes authority and procedure to define baseline criteria and design elements requiring design exceptions and variances.

FHWA established 13 controlling criteria in 1985 prior to establishment of the NHS. FHWA published a notice to the Federal Register on May 5, 2016 reducing the number of controlling criteria for design from thirteen to ten. FHWA controlling criteria are applicable to design of projects on the National Highway System. The ten FHWA controlling criteria are:

- Design Speed
- Lane Width
- Shoulder Width
- Horizontal Curve Radius
- Superelevation Rate
- Stopping Sight Distance
- Maximum Grade
- Cross Slope
- Vertical Clearance
- Design Loading Structural Capacity

Stopping Sight Distance applies to horizontal and vertical alignments except for sag vertical curves. Design Loading Structural Capacity and Design Speed are controlling criteria for all NHS facilities. The remaining eight criteria are controlling criteria for high-speed NHS facilities. MDT procedure includes additional design elements and conditions that meet or exceed FHWA requirements for design exceptions. For example, MDT requires a design exception for Vertical Clearance for all facilities and for Clear Zone violations on all high-speed facilities in addition to FHWA controlling criteria. MDT requirements for design elements requiring design exceptions and variances, and their baseline criteria are detailed in this guide and are applicable to all On-System routes and State Highways.

23 CFR 625 establishes the AASHTO "*A Policy on Geometric Design of Highways and Streets*" (Green Book) as the standards for non-Interstate NHS facilities, and the AASHTO "*A Policy on Design Standards – Interstate System*" for standards on the NHS Interstate System. The Green Book 7th Edition was released in 2018. The Green Book has undergone several revisions since MDT standards were last formally adopted. The 7th edition of this publication reflects dramatic changes from previous editions of the Green Book. The 7th edition emphasizes a need to shift design philosophy towards performance-based practical design and context classification. This shift focuses on determining appropriate design dimensions based on project-specific conditions, and existing and future roadway performance more than on meeting specific nominal design criteria. It also emphasizes consideration of all modes of transportation within the combination of context and functional classifications. The upcoming 8th edition plans to expand this concept further, with additional design guidance based on the context classifications and transitions included in chapters for each functional classification.

Flexibility in design exists even within full AASHTO guidance. In some cases, MDT has established baseline criteria for use on the NHS, within Montana, where AASHTO provides only general guidance or a range of acceptable values. AASHTO also provides some guidance and criteria for new context classifications (and transition areas between context classifications) whereas MDT's baseline criteria remain separated into broader contexts of urban and rural. With this release of MDT Geometric Design Criteria procedure and guidance, we are introducing and encouraging the use of Context Specific Criteria and Scope Specific Considerations to incorporate more flexibility within our standards and encourage the selection of design criteria that better meets the purpose and need of each project while providing necessary performance improvements for all modes of transportation that use the facility. Users of this guide are encouraged to review the Preface and Chapter 1 of the 7th edition Green Book and Chapters 1 and 2 of the current MDT Road Design Manual for additional background on establishing geometric design controls based on performance based practical design and fitting design appropriately to contexts.

4.0 PROCEDURE AND GUIDANCE

Procedures for approval and documentation of context specific criteria, scope specific considerations, design exceptions and variances are provided in Engineering Memo 21-03.

This guide is applicable to all On-System and State Highways projects with the following exceptions:

- Projects that are not Federally funded and are located on non-NHS Urban On-System routes that have local maintenance responsibility.

- Projects that are not Federally funded and are located on Secondary routes that have local maintenance responsibility.
- Projects that are exempt due to approved scope specific considerations.
- Some Resurfacing, Restoration and Rehabilitation (3R) projects as identified in Guidelines for Nomination and Development of Pavement Projects.

BASELINE CRITERIA

Except for the Interstate System, selection of baseline design values depends on the functional classification of the highway facility rather than a system designation. This is a somewhat significant change from previous publications of MDT geometric design criteria. In the past, non-Interstate NHS Primary routes and Principal Arterials were identified as one category, or interchangeable definitions of a particular type of route. Similarly, Minor Arterials and non-NHS (or State) Primary routes were lumped together, as were Major Collector and State Secondary highways. Although this seems to hold true for most cases, the functional classification and system designation of a given route are independent of each other. As functional classifications are updated, it is likely that some state secondary highways will be functionally classified as something other than a Major Collector, and the design criteria for their new functional classification will apply. Descriptions for each functional classification category are provided in Chapter 2, Section 2.2 of the RDM. The most recent version of the MDT Functional Classification Map is provided at the following link on the Montana State Official Website. MDT Functional Classification Map

Beyond functional classification, the rural and urban contexts and adjacent terrain categories (level, rolling and mountainous) have been used to further distinguish appropriate design values for different routes within the functional classification. We have maintained these same general categories in our Baseline Criteria tables; however, variations exist within these contexts that further require evaluation for the proper determination of baseline criteria appropriate for a project. Ultimately, most of the baseline criteria applicable to a project comes down to functional classification and Design Speed, as most of the other standard dimensions are calculated or otherwise dependent on these and design year AADT. For rural roadways that operate within normal rural open road conditions, the Baseline Criteria tables list *Minimum* Design Speeds based on functional class and terrain. Actual Design Speeds selected should be based on the amount and make up of traffic and the terrain's affect on expected operating speeds rather than assuming the minimum allowable value based solely on the terrain classification. This is particularly true with respect to grades, where the nominal value is not qualified by length of grade, design year AADT, percent trucks, existing or proposed climbing lanes, etc.

The general urban and rural context classifications have been expanded within the 7th edition of the Green Book into five classes, with urban now divided into suburban, urban, and urban core context classes and the rural classification now including rural town as a separate context class. Even with the addition of these new context classifications, variables exist that make it difficult to establish baseline criteria to fit every location. Instead, the baseline criteria table for urban routes list value ranges that encompass all these contexts, and engineering analysis and judgment of the project affects and needs of all modes of transportation are required to determine the appropriate Design Speed and other criteria.

Baseline design values can also depend on whether a roadway is part of the NHS or not. The minimum shoulder width for non-freeway arterials (principle or minor) is 4 feet for NHS routes and 0 feet for non-NHS routes, depending on the design year traffic volumes. Where separate NHS and non-NHS values apply, they are identified in the baseline criteria tables

at the end of this document. All MDT baseline criteria not explicitly identified as “non-NHS” meets or exceeds NHS minimum standards for controlling criteria for the published functional classification and minimum design speed. Additionally, AASHTO provides design criteria for non-freeway Arterials combined, whereas MDT has separated these criteria between minor and principal arterial functional classifications. If the NHS route is an arterial, the minor arterial criteria values meet or exceed the AASHTO standard as required by 23 CFR 625.

Local agencies may have developed their own geometric design criteria for local facilities. If a facility is not On-system, it may be acceptable to use the local agency criteria where there are conflicts with the MDT design criteria. Decisions to use local agency criteria should be made by the design team on a case-by-case basis and documented as context specific criteria.

CONTEXT SPECIFIC CRITERIA

In addition to the rural town, suburban, and urban core context classifications described above, stop-controlled intersections, low speed roundabouts, at grade railroad crossings, transition areas, and other special contexts can exist or be planned in a rural setting. In some instances, the entire project may be considered having a different function or use requirement that warrants context specific consideration, as the uniform baseline criteria for rural roadways assumes open road conditions. Highways through locations with heavy tourist or recreation traffic, particularly non-motorized modes, could warrant special consideration as would very short routes, locations where routes terminate, where functional classification is changing, or where terrain or other features are extremely limiting. Context specific considerations exist for routes of all functional classification but are most likely to be associated with collectors and minor arterials, where the greater access function of the route does not align with the greater mobility associated with rural baseline criteria.

Where context specific considerations exist, relative context specific criteria should be used in place of the uniform baseline criteria to better meet the requirements of the specific roadway contexts, and all users. Unless exempted or altered by scope specific considerations, deviations from the baseline or approved context specific design criteria require a design exception or a variance as described in the Design Deviation Table. All context specific considerations and criteria used in place of baseline criteria on a project is documented as early as possible within milestone reports through the Scope of Work (SOW) report. All context specific criteria used on an NHS route must meet AASHTO minimum/limiting criteria for controlling criteria to meet 23 CFR 625 requirements.

SCOPE SPECIFIC CONSIDERATIONS

Some projects are scoped with a very specific and targeted purpose and need, to address a safety, operational, or serviceability concern. In other cases, the need to connect to existing features at project termini or within the project makes meeting all geometric design criteria impractical through those transitions. For these situations, scope specific considerations can be documented and approved to exempt the project or location from meeting any or all design criteria requirements, including those for NHS facilities. A safety project is a good example where scope specific considerations apply, as the purpose and need of the project is to address a specific crash type or trend at a location with appropriate and cost-effective mitigation measures. Emergency repair projects, small bridge replacements with culverts, intersection improvement projects, and Major Rehabilitation work intended to address structural, or road condition issues often will have scope specific considerations. Scope specific criteria are documented in milestone reports through the SOW report. The standard report templates will be modified to include discussion of scope specific considerations and

the geometric design criteria requirements that they exempt for the project or location. All scope specific criteria documented in an approved SOW report or SOW addendum are considered approved for use as described in the report.

All sub-standard design elements exempted from meeting requirements of these procedures due to scope specific considerations must maintain or improve the as-built or in place condition. Exemption from meeting geometric design criteria does not reduce the requirement to evaluate the effect the proposed work may have on the safety and operation of all users of the roadway. Care must be taken to ensure that a narrow-focused approach to addressing a specific need for some users does not have unintended adverse effects on others. Substandard design elements that are reduced from their as-built or in place condition require a design exception if the facility is on the NHS and the element is an FHWA controlling criteria, or a variance for all other MDT baseline criteria.

The ability to exempt or limit the requirements of these procedures through scope specific considerations does not apply to projects for new construction or those proposed through the System Impact Action Process (SIAP).

5.0 DESIGN DEVIATION AND BASELINE CRITERIA SUMMARY TABLES

Project purpose and need should emphasize quantitative and/or qualitative performance measures. Design practices, guidance and procedures should encourage and support flexibility and focus on meeting MDT goals and a defined, project-specific purpose and need. Baseline criteria should be used as the fundamental baseline, or starting point, for design values and dimensions. Design criteria summary tables located in this section are intended to provide a resource for the design team to have a concise listing of design values when context specific criteria have not been identified. However, additional RDM sections are referenced in the design criteria tables for more information on the design elements or for tables when values are variable. In addition, the tables include comments in the spreadsheet cells, which are critical to the proper use of the design criteria tables.

Practical application of the requirements for design exceptions and variances is scalable depending on the project work type. Refer to the Guidelines for Nomination and Development of Pavement Projects for scalable application of design exceptions and variances. Scope specific considerations may also be used to modify design exception and variance requirements within broad work types such as Major Rehab. The conditions for the requirements of a design exception versus a variance in this guidance is applicable to the requirements for design exceptions in the Guidelines for Nomination and Development of Pavement Projects

The table below summarizes the design elements that are standard criteria that require a design exception or design variance and the non-standard design elements that may only require documentation in the scope of work report, or other milestone report. Use standard report templates to document design exceptions and design variances as indicated in the table. Design variances may be documented in the SOW report, SOW addendum, or in a separate Design Variance report. The current Design Exception Short Form will be changed to a Design Variance report, and all other reference that identifies a “Design Exception Short Form” should be considered “Design Variance”. This table is inclusive for all elements that require a design exception or variance. Some elements have been included that either required formal documentation in the past or were often mistakenly considered to need a design exception and are only included for added clarity.

Design Element	All Freeways, Rural Highways and High-Speed Urban	Low-Speed Urban excluding Freeways
Structural Loading Capacity	Exception	Exception
Design Speed	Exception	Exception
Lane Width	Exception	Variance
Shoulder Width	Exception	Variance
Horizontal Curve Radius	Exception	None
Full Superelevation Rate	Exception	None
Spiral Curve Selection	Document in milestone report	None
Superelevation Transition	Document in milestone report	None
Stopping Sight Distance*	Exception	None
Maximum Grade	Exception	None
Cross Slope	Exception	Variance
Clear Zone	Exception	Variance**
Vertical Clearance	Exception	Exception
Intersection Sight Distance	Variance	Variance
Ditch Configuration (inslope width and slope & bottom width and slope)	Document in milestone report	None
Cut Backslope	None	None
Fill Slope	Document in milestone report***	None
Median Width	Variance	Variance
MASH Hardware	Document in SOW report	Document in SOW report
Bridge Width****	Document in SOW report	Document in SOW report

* except sag vertical curves
** standard encroachments do not require a variance for clear zone. Minimum offset is required as noted in the Urban Baseline Criteria table.
*** For spot locations only. Document systematic fill slope changes as Context Specific Criteria in SOW report.
**** Bridge width is no longer controlling criteria. Refer to: Bridge Width Standards and Guidelines design memo

MDT Baseline Criteria for the Interstate System, Principal Arterials, Minor Arterials, Collectors and Local Roads are shown in the tables of the Design Standards spreadsheet. The applicable baseline criteria for State Highways are dependent on the roadway functional classification.

Note: The following pages contain tables that are linked from the Design Standards spreadsheet which layout the Baseline Criteria for Rural and Urban Facilities. The cells with a purple shape in the upper right corner have a comment(s) associated with them. Comment summaries are listed by cell below each table.

Design Element			Rural MDT Baseline Criteria						
			Interstate[a]	Arterial		Collector[a]	Local Roads[a,b]		
				Principal	Minor	Major Collector	Paved	Gravel	RDM Section
Design Control	Design Speed[b] (minimum)	Level	70 mph	70 mph	60 mph	60 mph	50 mph	40 mph	2.5
		Rolling	70 mph	60 mph	55 mph	50 mph	40 mph	30 mph	
		Mountainous	50 mph	50 mph	45 mph	40 mph	30 mph	20 mph	
Roadway Elements	Travel Lane Width		12'			11'	11'	12'	5.2
	Minimum Number of Lanes		2 in each direction	N/A					
	Shoulder Width		10' outside; 4' inside	Varies with AADT		Varies with AADT	1'	0'	
	Cross Slope	Travel Lane	2%				2%	3%	
		Shoulder	2%				2%	3%	
Roadside Elements	Ditch	Inslope	6:1 (10' width)			6:1 (10' width) for DHV≥200, 4:1 (6' width) for DHV<200			5.4
		Width	10'			10'	V-Ditch		
		Slope	20:1 towards backslope						
	Backslope Cut Depth	0-5'	5:1				4:1		5.4
		5-10'	Level/Rolling 4:1; Mountainous 3:1				Level/Rolling 3:1; Mountainous 2:1		
		10-15'	Level/Rolling 3:1; Mountainous 2:1				Level/Rolling 2:1; Mountainous 1.5:1		
		>15'	Level/Rolling 2:1; Mountainous 1.5:1				1.5:1		
	Fill Slopes	Fill Height 0-10'	6:1			6:1 for DHV≥200 4:1 for DHV<200	4:1		5.4
		Fill Height 10-20'	4:1			4:1 for DHV≥200 3:1 for DHV<200	3:1		
		Fill Height 20-30'	3:1				1.5:1		
		Fill Height > 30'	2:1						
	Median Width	Level	50' minimum	See RDM Section 5.3					5.3
		Rolling	50' minimum						
		Mountainous	10' minimum						
	Clear Zone		See RDM Section 9.2						9.2
Alignment Elements	SSD		See RDM Section 2.8						2.8
	ISD		N/A	See RDM Section 2.8					2.8
	Horizontal Alignment	Minimum Radius (e=8%)	See RDM Section 3.2.3						3.2
		Spiral Curve Selection	e ≥ 7%				N/A		3.2
		Superelevation Rate	e_{max} = 8%				emax = 8%	e_{max} = 4%	3.3
	Vertical Alignment	Maximum Grade Level	3%	3%	3%	5%	6%	7%	4.3
		Maximum Grade Rolling	4%	4%	5%	7%	10%	10%	
		Maximum Grade Mountainous	6% for V < 65 mph 5% for V ≥ 65 mph	7%	7%	10%	14%	16%	
	Minimum Vertical Clearance		17'			16.5'	15.0'		4.5
	Loading Structural Capacity		HL-93						

(a) Federal functional classification defined by MDT and approved by the Montana Transportation Commission and FHWA.

(b) The design criteria for rural collector roads should be used for Local Roads > 2000 AADT and/or functionally classified as a rural collector. For local roads with current AADT ≤ 2000, County or MDT local road standards or, AASHTO Guidelines for Design of Very Low-Volume Local Roads may be used as the basis of design.

Cell: E3
Values are for new construction and reconstruction only, for 3R projects, use the standards in place for interstate at the time of original construction or when included in the interstate system.

Cell: L6
See Chapter 2, Section 2.5 of the RDM for selection of design speed. For local roads requiring a higher design speed, the criteria for rural collector roads should be used. A 30-mph design speed may be used, but only if the adjacent terrain presents obstacles that render the use of a higher design speed impractical. A formal design exception for design speed is not required for rural local roads. However, deviation from the design speeds listed here must be documented in the PFR, AGR and SOW reports.

Cell: E9
For NHS Arterials roadway width is based on the Route Segment Map or the AASHTO Green Book standards, whichever is more conservative. For Non-NHS Arterials roadway width is based on the Route Segment Map. The Green Book provides values for minimum width of traveled way and usable shoulder for rural arterials.

Cell: E11
The outside shoulder may be reduced to 6' in mountainous terrain where costs are prohibitive to providing wider shoulders. The following will apply to inside shoulder width:
a. The minimum standard criteria for inside shoulder is 10’ wide when there are 3 or more through lanes.
b. The minimum offset is 4’ from the edge of traveled way to a vertical element greater than 1' high (other than abutments, piers or walls).

Cell: F11
Use AASHTO values for Arterials.

Cell: J11
Non-NHS Arterials and collectors:

Design AADT	0 – 299	300 – 999	1,000 – 1,999	2,000 – 3,000	> 3000
Shoulder Width	0*	2 ft	4 ft	6 ft	8 ft

Provide minimum 2’ shy distance for adjacent roadside guardrail/barrier.

NHS Arterials:

Design AADT	0 – 399	400 – 2000	> 2000
Shoulder Width	4	6 ft	8 ft

Cell: E13
Existing shoulder slopes on the Interstate may be 3.75%. If the proposed pavement work is resurfacing, the existing 3.75% slope may be retained. If the proposed pavement work is reconstruction or major rehabilitation, the shoulder slope should match the cross slope of the traveled way, typically 2%.

Cell: J14
A V-ditch may be used when documented in the appropriate Milestone Report. Check ditch section traversability.
Cell: J15
A V-ditch may be used when documented in the appropriate Milestone Report. Check ditch section traversability.

Cell: L15
Check ditch section traversability.

Cell: C17
The backslope through rock cut sections will be determined by the MDT Geotechnical Section.

Cell: C21
In rock fills over 10’ high, the typical fill slope is 1.5:1. In rock fills less than or equal to 10’, the typical slope is 6:1.

Cell: F25
For TWLTLs the minimum width is 14'.

Cell: E27
The minimum median width of 10’ may be used in areas of rugged mountainous terrain. It may also be used on any long and unusually costly bridges. The minimum median width should be the combined width of the two inside shoulders and the width of the base of the barrier (e.g., 4’ shoulder, 2’ foot barrier, and 4’ shoulder).

Cell: L33
Refer to AASHTO's Guidelines for Geometric Design of Low-Volume Roads and assume a 5-mph reduction in design speed for determining superelevation for design speeds of 45 mph or less. e_{max}=4% for speeds less than or equal to 45 mph.

Cell: H34
Grade ranges correspond to the Design Speed ranges listed above, for all NHS Arterials, the following apply:

Design Speed	45 mph	50 mph	55 mph	60 mph	> 60 mph
Max Grade (%)-Level Terrain	5	4	4	3	3
Max Grade (%)-Rolling Terrain	6	5	5	4	4
Max Grade (%)-Mountainous	7	7	6	6	5

Cell: E36
Grades of up to 7% may be provided where needed in mountainous terrain.

Cell: J36
Short lengths of grade in rural areas, such as grades less than 500’ in length, one-way downgrades, and grades on low-volume rural collectors (AADT < 2000 veh/day) may be up to 2% steeper than the grades in the table.

Cell: L36
Short lengths of grade in rural areas, such as grades less than 500’ in length, one-way downgrades, and grades on low-volume roads (AADT < 2000 veh/day) may be up to 2% steeper than the grades in the table.

Cell: C37
For major rehab scopes and above, the clearance is as shown. For minor rehab scopes and below, the clearance can be reduced by 6".

Cell: E37
The clearance applies to a facility passing under a bridge. The minimum clearance includes a 6” additional allowance for future overlays. Pedestrian overpasses require an additional 1 ft. Coordinate with Traffic.

Cell: J37
The clearance applies to the collector passing under a bridge. The minimum clearance includes a 6” additional allowance for future overlays.

Cell: L37
The clearance applies to the local road passing under a bridge. The minimum clearance includes a 6” additional allowance for future overlays.

Cell: C38
Applies to FHWA controlling criteria for all NHS facility types.

Design Element				Urban MDT Baseline Criteria									RDM Section
				Interstate[a]	Arterial				Collector[a]		Local Roads[a]		
					Principal[a]		Minor[a]						
					Curbed	Uncurbed	Curbed	Uncurbed	Curbed	Uncurbed	Curbed	Uncurbed	
Design Control	Design Speed			50 mph - 70 mph	25 mph - 55 mph		25 mph - 55 mph		25 mph - 50 mph		20 mph - 30 mph		2.5
Roadway Elements	Travel Lane Width			12'	12'		11'		10'		10'		5.2
	Minimum Number of Lanes			2 in each direction	N/A								5.2
	Shoulder Width	Curbside (RT)		10'	0'	6'	0'	4'	0'	4'	0'	2'	5.2
		Inside (LT)		4'	N/A								5.2
	Cross Slope	Travel Lane		2%	1% - 4%	2%	1% - 4%	2%	1% - 4%	2%	2% - 3% Paved 2.5% - 7% Unpaved	1.5 % - 2% Paved 2% - 6 % Unpaved	5.2
		Shoulder		2%	1% - 4%	2%	1% - 4%	2%	1% - 4%	2%	2% - 3% Paved 2.5% - 7% Unpaved	1.5% - 2% Paved 2% - 6% Unpaved	
Roadside Elements	Ditch	Inslope		6:1	4:1		4:1		4:1		4:1		
		Width		10'	Traversable V-ditch								5.4
		Slope		20:1									
	Backslope Cut Depth			Varies									5.4
	Fill Slopes												5.4
	Median Width	Level		10'	4'								5.3
		Rolling											
		Mountainous											
	Clear Zone			See RDM Section 9.2									9.2
Alignment Elements	SSD applies to design speed ≥50 mph			Varies; calculate based on design speed.									2.8
	ISD			N/A	Varies; calculate based on design speed.								2.8
	Horizontal Alignment	Minimum Radius		Varies; calculate based on design speed.									3.2
		Spiral Curve Selection		See RDM Section 3.2	N/A								3.2
		Superelevation Rate[b]		e_{max} = 8%	e_{max} = 4%		e_{max} = 4%		e_{max} = 4%		e_{max}=4%		3.3
	Vertical Alignment	Maximum Grade Level		4% - 5%	5% - 7%				7% - 9%		15%		4.3
		Maximum Grade Rolling		5% - 6%	6% - 10%				8% - 12%				
		Maximum Grade Mountainous		6% - 7%	8% - 12%				10% - 13%				
	Minimum Vertical Clearance			17'					16.5'		14'		4.5
	Loading Structural Capacity			HL-93									2.9

(a) Federal functional classification defined by MDT and approved by the Montana Transportation Commission and FHWA.

(b) e_{max} = 4% if the design speed is ≤ 40 mph. e_{max} = 8% if the design speed is > 40 mph.

Cell: F5
The design speed for urban principal arterials should match the urban context classification, driver expectancy, and consider needs of multimodal users. In the transitional areas between rural and urban sections of roadway, the use of the criteria for rural principal arterials may be appropriate. However, the determination of the design speed for transitional areas should be based on consideration of roadside development, number and type of approaches, lane configuration and traffic control devices. The posted speed should also be considered as the design speed for urban facilities.

Cell: H5
The design speed for urban minor arterials should match the urban context classification, driver expectancy, and consider needs of multimodal users. In the transitional areas between rural and urban sections of roadway, the use of the criteria for rural minor arterials may be appropriate. However, the determination of the design speed for transitional areas should be based on consideration of roadside development, number and type of approaches, lane configuration and traffic control devices. The posted speed should also be considered as the design speed for urban facilities.

Cell: J5
The design speed for urban collectors should match the urban context classification, driver expectancy, and consider needs of multimodal users. In the transitional areas between rural and urban sections of roadway, the use of the criteria for rural collectors may be appropriate. However, the determination of the design speed for transitional areas should be based on consideration of roadside development, number and type of approaches, lane configuration and traffic control devices. The posted speed should also be considered as the design speed for urban facilities.

Cell: F8
For multilane facilities, the interior lane width is 11’ and the exterior lane width is 12’. This is also applicable for an exclusive left-turn lane with a flush median, as well as for a TWLTL. The lane width does not include the gutter section on curbed facilities. Add 3' where a curb lane is provided for bicycles.

Cell: H8
For multilane facilities, the interior and exterior lane width is 11’. The lane width does not include the gutter section on curbed facilities. Add 3’ where a curb lane is provided for accommodating bicycles.

Cell: J8
The lane width does not include the gutter section on curbed facilities. Add 3’ where a wide curb lane is provided for accommodating bicycles.

Cell: L8
Travel lane widths should be 10-11’ and in industrial areas they should be 12’. Where right of way is severely limited, 9’ lanes can be used in residential areas and 11’ lanes can be used in industrial areas.

Cell: E10
8' is permissible in mountainous terrain.

Cell: E11
1. 10' wide for 3 or more through lanes in one direction.
2. 2' desirable, and minimum 1', where continuous curbs are used in narrow medians on ramps.
3. The minimum offset is 4' from the edge of traveled way to a vertical element greater than 1’ in height (other than abutments, piers or walls).

Cell: F12
Typically 2%

Cell: H12
Typically 2%

Cell: J12
Typically 2%

Cell: E13
Existing shoulder slopes on the Interstate may be 3.75%. If the proposed pavement work is resurfacing, the existing 3.75% slope may be retained. If the proposed pavement work is full-depth reconstruction or major rehabilitation, the shoulder slope should match the cross slope of the traveled way, typically 2%.

Cell: F13
Typically 2%

Cell: H13
Typically 2%

Cell: J13
Typically 2%

Cell: L13
Typically it will be the same as travel lane.

Cell: M13
Typically it will be the same as travel lane.

Cell: E14
10’ inslope width can be a minimum of 6’ for rehabilitation projects.

Cell: F15
A ditch with a bottom width of 10' at 20:1 is preferred, however site constraints may necessitate narrowing this width or require the use of a v-ditch. The v-ditch may be non-traversable if the ditch bottom is located outside of the clear zone.

Cell: E16
Down towards backslope.

Cell: C17
Backslope through rock sections will be determined by MDT Geotechnical Section and typically will not by steeper than 0.25:1

Cell: E17
Use rural criteria if roadway context is appropriate.

Cell: C18
Locate hinge points for non-recoverable slopes outside of the clear zone. In rock fills over 10' high the typical fill slope is 1.5:1. In rock fills under 10' high the typical slope is 6:1.

Cell: F19
The raised median width needs to be added to the exclusive left-turn lane width. See Chapter 5, Section 5.3 of the RDM for additional information on median width.

Cell: E22
The lateral offset from the face of curb to vertical obstructions (signs, utility poles, luminaire supports, fire hydrants, etc.) should be analyzed in Urban areas. A minimum of 1.5’ from the face of the curb should be provided for all objects.

Cell: F24
See Chapter 2, Section 2.8 of the RDM and the AASHTO Green Book for additional information.

Cell: F28
See Chapter 3, Section 3.3 of the RDM for superelevation rates based on design speed and curve radii.

Cell: H28
See Chapter 3, Section 3.3 of the RDM for superelevation rates based on design speed and curve radii.

Cell: J28
See Chapter 3, Section 3.3 of the RDM for superelevation rates based on design speed and curve radii.

Cell: L28
See Chapter 3, Section 3.3 of the RDM for superelevation rates based on design speed and curve radii. If the terrain dictates sharp curvature, a maximum superelevation rate of 6% may be justified if the curve is long enough to provide adequate superelevation transitions.

Cell: E29
Grade ranges correspond to the Design Speed ranges listed above, see AASTHO Interstate Standards. Curbed facilities have a desired minimum grade of 0.5%, but a minimum grade of 0.3% may be used.

Cell: F29
Grade ranges correspond to the Design Speed ranges listed above, see AASTHO Green Book. Curbed facilities have a desired minimum grade of 0.5%, but a minimum grade of 0.3% may be used.

Cell: J29
Grade ranges correspond to the Design Speed ranges listed above, see AASTHO Green Book. Curbed facilities have a desired minimum grade of 0.5%, but a minimum grade of 0.3% may be used.

Cell: L29
Local roads in commercial and industrial areas should have grades less than 8%, and flatter grades are encouraged. Curbed facilities have a

desired minimum grade of 0.5%, but a minimum grade of 0.3% may be used.

Cell: E32
The clearance applies to the freeway or arterial passing under a bridge. The minimum clearance includes a 6” additional allowance for future overlays. Pedestrian overpasses require an additional 1 ft. Coordinate with Traffic.

Cell: J32
The clearance applies to the collector passing under a bridge. The minimum clearance includes a 6-inch additional allowance for future overlays.

Cell: C33
Applies to FHWA controlling criteria for all NHS facility types.