FDM 11-3-1 Policy & Principles

May 15, 2019

1.1 General

This procedure has been prepared to explain the Department's beliefs and approach to design policy and aesthetics for community-sensitive design during project development.

Transportation projects are not an end in themselves, but a vital means to reach many end points. WisDOT's vision is to deliver a comprehensive transportation network that provides safe, user-friendly access and mobility, and, at the same time, responds to the values of Wisconsin citizens.

1.2 Design Policy: "Community Sensitive Design"

It is WisDOT policy to use a "Community Sensitive Design" (CSD) approach to enhance transportation project development and resulting solutions. CSD is an approach of creating public works projects that function safely, efficiently, and are pleasing to both the users and the neighboring communities.

CSD is also known as Context Sensitive Solutions (CSS) in National literature and engineering guides.

Community Sensitive Design is a collaborative interdisciplinary approach that includes early involvement of all stakeholders to ensure that transportation projects not only provide safety and mobility but are also in harmony with communities and the natural, social, economic, and cultural environments. All projects shall include a CSD approach, however the application of the various CSD elements will vary significantly based on project complexity and scope. All projects shall include an appropriate level of public involvement to ensure that stakeholder issues relevant to the project scope are addressed. However, limited scope projects, such as Perpetuation (S-1) and some Rehabilitation (S-2) projects will mainly have CSD elements implemented by the Department limited to work within the shoulder to shoulder or face to face curb points. S-1 (Perpetuation), S-2 (Rehabilitation and Reconstruction-Type Modernization) and S-3 (Modernization) are defined in FDM 11-1-10. This integration of projects into the community and environment requires careful planning. Consequences from differing perspectives must be balanced, and the design tailored to fit a project's circumstances and scope.

In accomplishing this, a variety of design, construction and safety analyses must be considered, along with environmental considerations. Justifications to design criteria may be used, where appropriate and necessary. These will be documented as alternatives in the Safety Certification Document (SCD) and a final alternative will be selected and approved in the Final Scoping Document (FSD) or in some cases outside of the scoping process with documentation provided in Design Study Report (DSR) Design Justifications (DJs) sections. The selection of an alternative will contain the necessary analysis of the consequences and tradeoffs involved.

1.3 A Changing Context for Transportation

The impacts from delivering transportation facilities and dealing with community expectations are causing transportation agencies to do their work within a broader framework or context. Traditional transportation needs such as access to land and markets, mobility, and safety in travel continue to grow. However, added to the traditional needs are concerns about where and how the transportation facilities are to be developed, designed and funded. The impacts of growth and transportation can be either positive or negative and increasingly hard to balance.

Society expects these agencies to be more sensitive to the context within which transportation facilities exist. This has led to a significant number of laws, rules, and regulations designed to protect society and the natural world from the impacts of growth, and transportation facility changes.

This context requires that many perspectives and interests be considered in the project development and design process before major design decisions are made. These perspectives include environmental considerations and community values and interests. Federal legislation consisting of ISTEA in 1991, TEA-21 in 1998, SAFETEA-LU in 2005, MAP-21 in 2012 and FAST in 2015 recognized this need for balance, and for consideration of many interests and issues.

As a result, transportation agencies have found it necessary to adapt and transform the transportation project development process in such a way that it acknowledges the legitimacy of these many players and perspectives but does not conflict with providing needed safe and efficient transportation facilities. FHWA's "Flexibility in Design" document (https://www.fhwa.dot.gov/environment/publications/flexibility) was prepared considering the changing context of design decisions.

1.4 Outcomes of Community Sensitive Design

The outcomes of a community sensitive design approach are as follows:

- The project is a safe facility both for the user and the community.
- The project satisfies the purpose and need and involves the appropriate range of stakeholders. This agreement is forged in the earliest phase of project planning or project development and amended as warranted as the project develops. Include the Purpose and Need in the Environmental Document.
- The project is in harmony with the community and preserves environmental, scenic, aesthetic, historic and natural resource values of the area.
- The project meets the expectations of both designers and stakeholders and achieves a level of acceptance in people's minds.
- The project involves an efficient and effective use of resources (time, budget, community).
- The project is designed and built with minimal disruption to the community.
- The project adds value to the community.

1.5 Principles of Community Sensitive Design

Project development is successful when it leads to public works projects that fit the community and environmental context through which they pass. The following principles are the cornerstone of WisDOT's project development philosophy.

1. Involve customers and stakeholders early and continuously.
2. Use an interdisciplinary project development approach.
3. Emphasize good project management.
4. Be sensitive to environmental issues.
5. Provide an appropriately balanced, aesthetically pleasing quality product.
6. Provide safe and efficient facilities.
7. Deliver quality projects on time and within budget.

The above principles must be understood and applied if WisDOT is to be a leader in project and transportation development.

Integrating these principles into project development is more of an art than a science. No two projects are alike, and no engineering formula will guarantee successful project development. However, these guiding principles can provide some direction for what successful project development looks like.

1.5.1 Involve Customers and Stakeholders Early and Continuously

Community Sensitive project development starts with people and ends with people, i.e., customers and stakeholders, who use or reside along the improved facilities. Involving people before decisions are made is vital to obtaining trust and participation and helps to ensure that the transportation facility fits the community context and meets all aspects of environmental justice.

A public/agency participation thought process must be developed for all projects, while a formal public/agency participation plan is needed for large, complex projects. The Facilities Development Process guidance (especially the public/agency involvement sections) is a major resource available for use.

Customers may be hard to attract to meetings and creative means to involve them are often necessary. Stakeholders are often easier to involve because of their immediate concerns about access or impacts.

1.5.2 Use an Interdisciplinary Project Development Approach

Engineers are key players in delivering public works projects. Their discipline and expertise are critical to building facilities that will last and function safely and efficiently. However, engineers cannot do it all. Historians, archeologists, landscape architects, biologists, foresters, planners and other disciplines also contribute to the project development process.

A team approach is necessary to ensure that the project is considered in context with the land use, environment, and culture in which it is built. The disciplines that are brought to bear on an individual project will vary depending on the type and scope of project and its impacts. The collective eyes and creative energies of the team members may see opportunities that a single discipline may overlook. Early team involvement during scoping is often the key to a later successful integration of the various elements that contribute to project success.

1.5.3 Emphasize Good Project Management

The project manager (**PM**) is the key person who can ensure good customer, stakeholder, and interdisciplinary involvement. The PM can take a broad view of a project because he/she knows both the internal and external perspectives shaping the project and can integrate them into a well-balanced design. The PM is recognized as the external and internal contact and focal point for projects.

A project manager needs to be well trained in the project development process, as well as in the project management scheduling tools available. A PM also must recognize that he/she can't do the project development alone, but rather serves as the coordinator, decision maker or facilitator of decisions.

1.5.4 Be Sensitive To Environmental Issues

The impact of roadways on the environment need not be negative. Design and enhancement opportunities exist if creatively sought. The main principle is to identify, avoid, minimize, and mitigate social, environmental or economic impacts.

1.5.5 Provide an Aesthetically Pleasing Quality Product

The aesthetic and visual quality of highways and transportation facilities are important in a community sensitive design approach. Scenic views, community image, and roadside landscaping can play an important part in the driving experience. The aesthetic design of bridges can leave a lasting impression on communities, daily users, and tourists. As such, the design process should provide the opportunity for communities and other stakeholders to participate in a discussion about aesthetic treatments that might be incorporated on the project and what the cost participation responsibilities are.

Department policy on Perpetuation (S-1) Rehabilitation and Reconstruction-Type Modernization (S-2) projects is to make improvements to the facility without changing the existing geometric and cross-sectional features except where justified by a safety analysis performed as part of the Safety Certification Process (SCP). Appurtenant features (such as curb & gutter, sidewalks, drainage structures, etc.) will typically not be altered on these projects having a pavement treatment service life of 17 years or less. Maintaining existing roadway features minimizes the projects impacts on the natural and societal landscape and thus existing aesthetics will usually remain unaffected by the project. Correspondingly however, the addition of new aesthetic treatments will typically be beyond the scope of these projects. Aesthetic treatments appropriately fitting within the project scope, including the existing right of way, environmental impact footprint and project cost and schedule, may be needed in some cases as mitigation paid for with project funding if justified as part of the environmental process or may be included at the request of the locals, but with local commitment to its cost and maintenance.

However, projects having a pavement treatment service life of 18 years or more, whether Perpetuation (S-1) and Rehabilitation and Reconstruction-Type Modernization (S-2) projects or Modernization (S-3) projects [Reconstruction (S-2) and New Construction (S-3)], will typically replace some or all the appurtenant features and thus aesthetic treatments are more easily incorporated within the project scope. The scope of these projects is more likely to involve the acquisition of right of way and impacts to the natural and societal landscape and thus more likely to impact existing aesthetics along the project. The environmental process will determine what the project impacts are and what aesthetic mitigation is justified. Aesthetics outside of those deemed as environmental mitigation, can be discussed and typically integrated on the project, but will require local commitment for cost and maintenance.

Comprehensive aesthetics planning is a process that integrates the roadway with the community and creates a wealth of goodwill. Aesthetic design and design success must flow directly from the design process so that transportation public works projects complement communities, provide safety and mobility, and enhance visual quality.

1.5.6 Provide Safe and Efficient Facilities

Concern about customers, stakeholders, the environment, and aesthetics must not preclude safe and efficient design. The project and its elements must all be designed and constructed so that they function well and last through their design life.

The challenge is to be flexible, so that safety and operational integrity are in proper balance with other contextual factors. The use of appropriate safety performance analyses of existing roadway elements that will be performed as part of the SCP will help to facilitate this flexibility (See FDM 11-38).

1.5.7 Deliver Quality Projects on Time and Within Budget

Program delivery in a timely and cost-effective manner is a department objective. There is some concern about whether a community sensitive design approach will add to the time and cost of project delivery. Quality in the customer's eyes may be enhanced, but at what cost? The main goal is to make wise decisions during project development. Designers must consider the context of the project from the outset and to budget accordingly. This includes the opportunity for public participation in discussions about such things as aesthetic or trail improvements. It may include a less costly design if a lower design speed or improvement treatment is appropriate for the project.

The time to develop the project is likely to be longer in the early stages but quicker in the labor-intensive detail design/right-of-way acquisition phase. This is because the rework cycle is minimized through better involvement and agreement early in the process.

The cost and time elements need to be carefully considered so that the CSD approach is in balance with the project complexity, context and scope. There probably isn't a single formula one can apply since the tradeoffs between quality, cost, and time will largely be project and situation dependent.

FDM 11-3-5 Decision Making Guidance *May 17, 2022*

5.1 Introduction

As described in FDM 11-3-1, an important aspect of CSD is to deliver transportation projects that not only provide safety and mobility but are also in harmony with communities and the environment. This requires balancing design, construction and safety elements with impacts to the natural, social, economic and cultural environment.

Pursuant to Wis. Stat. 85.0205 (https://docs.legis.wisconsin.gov/statutes/statutes/85/0205/2) there is a limit on how much of the cost of a highway improvement project can be spent on elements determined to be aesthetic preferences of a community impacted by the improvement project. Refer to the Program Management Manual document number 03-25-15 for additional information and a list of eligible items.

This procedure provides guidance to help designers more comfortably make the appropriate design choices. Attachment 5.1 through 5.14 consist of decision-making matrices showing the following:

- Steps to follow,
- Project information and data to collect,
- Types of analyses to be completed, and
- Things to consider when applying flexibility in design, construction and safety elements.

Consult FHWA's Design - Geometric Design (https://www.fhwa.dot.gov/programadmin/standards.cfm), FHWA's "Flexibility in Highway Design" (https://www.fhwa.dot.gov/environment/publications/flexibility), and the AASHTO Bridging Document (http://sp.design.transportation.org/Documents/SCOD,Neuman,CH2MHill,FlexibilityGuide.pdf) for additional guidance.

5.2 Decision Making Steps

The decision-making steps are as follows:

1. Use the design criteria values recommended in the SCD for Perpetuation (S-1), Rehabilitation (S-2), appropriate Reconstruction Type Modernization (S-2) Projects or within the FDM design criteria and guidance for Modernization (S-3) projects for initial preliminary designs and design alternative alignments. Layout horizontal and vertical alignments to best fit the "lay of the land," and to reduce or soften impacts to community and environmentally sensitive areas. The design should meet the safety and mobility needs of the project at a financially acceptable cost, as indicated in the projects purpose and need.
2. For Rehabilitation (S-2) and those Reconstruction-Type Modernization (S-2) project segments not passing the SCP, begin by using the lowest end of the design criteria ranges in the FDM above the existing design criteria that are contributing to crashes first and then proceed to use upper values if needed to meet safety performance needs. For all other Modernization (S-3) projects, consider using the lower values for Reconstruction (S-2) Types and the higher values for New Construction (S-3) Types in the FDM design criteria or guidance first, and then only proceed to analyzing lower values if further flexibility in design criteria is needed to reduce impacts and to develop the best overall design. The use of lower design criteria values shall be justified, documented and approved through either the Department SCD or a Design Justification in the Design Study Report. This documentation will typically include such things as a description of the impacts that are being avoided or reduced, and a description of the crash history and other analyses completed to address safety concerns.
3. Consideration may be given to maintaining or using design criteria outside of FDM design criteria in situations where even the lowest FDM design criteria will cause excessive impacts to community or environmentally sensitive areas, and where it can be proven from the existing crash history or a predictive crash safety analysis that unacceptable safety problems do not or will not exist. For

controlling and non-controlling criteria, the use of design criteria outside of FDM values for existing design criteria with crash history problems or for the incorporation of new design criteria outside of FDM values requires an approved DJ. See FDM 11-1-20 and FDM 11-4-10 for information on preparing DJs.

The introduction of new values outside of FDM and AASHTO design criteria requires great care to ensure that the safety and operational characteristics of the new roadway design are compatible with the operational characteristics of the original roadway. These operational characteristics consist of such things as meeting driver expectations and maintaining existing vehicle operating speeds and consistency of operating speeds throughout the project. Appropriate mitigation measures should be used to warn drivers and to maintain consistent operating characteristics. Examples of mitigation measures for various design features are listed in Attachment 5.1 through 5.13.

5.3 Project Information, Data Collection and Analyses

To ensure that design criteria are applied appropriately, the following project information and data should be collected and analyzed:

5.3.1 Project Information

5.3.1.1 Type of Improvement

Appropriately choose the type of improvement (Modernization (S-2 & S-3), Rehabilitation (S-2), Perpetuation (S-1), etc.) that best reflects the purpose and need of the project. Design criteria flexibility is generally greater for Perpetuation (S-1) and Rehabilitation (S-2) projects than for Modernization (S-2 & S-3) projects.

5.3.1.2 Roadway Functional Classification

Flexibility in design criteria increases as the functional classification of roadways decreases. Based on functional classifications the following philosophies in applying design criteria should be followed:

Interstates, Other Freeways, and Expressways

There is the least design criteria flexibility for these facilities. CSD is applied mostly to the extent that the safety and mobility needs, and existing or new design criteria allow. CSD is largely achieved on these projects through roadway location selection, horizontal and vertical alignments that follow the “lay of the land,” aesthetic features that soften roadway impacts, and by use of roadside and median safety barriers to reduce roadway widths. Both FDM and AASHTO guidance generally consist of higher design criteria values. When alternatives are generated in the SCP, they should always begin within the range of values prior to going outside the ranges and only when needed to address unique circumstances.

Corridors 2020 Multilane and Two-lane Roadways

Follow a similar philosophy as the Interstate, Freeways and Expressways; but also include urban roadway design criteria in addition to rural roadway design criteria. Outside of the design criteria ranges of SCP alternatives with safety issues should be considered only under very unique circumstances, such as those pertaining to justifiable environmental impacts or excessive costs. Design criteria flexibility for these facilities generally consist of some lower widths for median shoulders on rural projects, some lower median and outside shoulder/curb offset widths on transitional/high speed urban roadways and some lower travel, parking lane and median widths on low speed urban roadways.

Non-Corridors 2020 Principal and Minor Arterials

The CSD philosophy is applied by making informed choices between the safety and mobility needs of the roadway and the social and environmental needs. Crash history is analyzed on these projects to determine where safety improvements are needed. Crash history and other data, such as vehicle operating speeds, can be used to make informed choices between geometric upgrades and social and environmental impacts.

The lowest design criteria should not be used if existing or predictive safety analyses show or determine that safety will be degraded as an outcome or if driver expectations will be violated. For example, proposing to upgrade lane and shoulder widths on a highway without proper consideration given to also upgrading the horizontal or vertical features could give drivers the impression that the entire roadway has been upgraded. This could encourage them to drive faster than the horizontal and vertical features can handle and thereby potentially increase crash rates.

Design criteria flexibility for rural roadways generally includes narrower shoulder widths and, in rolling terrain conditions, narrower lane widths on roadways with lower volumes or lower design speeds. Design criteria flexibility for urban roadways generally includes narrower median and outside shoulder/curb offset widths and narrower lane widths on lower volume transitional/high speed urban roadways and narrower travel and parking lane and median widths on low speed urban roadways.

Increased levels of congestion, above AASHTO guidance, are allowed per FDM 11-5-3.

Collectors, Locals and Town Roadways

Apply a similar CSD Philosophy to collectors, locals and town roads as described above for the Non-Corridors 2020 principal and minor arterials. The difference is that collectors, locals and town roads have additional flexibility available in design criteria and are more commonly allowed to operate at even higher congestion levels. Design Justifications to design criteria may be submitted as needed to avoid or reduce impacts to socially or environmentally sensitive areas.

5.3.1.3 Type of Terrain

The AASHTO policy for level, rolling, and mountainous terrain conditions reflects design practices related to cost and operational efficiency. Steep upward grades reduce vehicle operating speeds at the approach to crest vertical curves. The lower design speeds provided in the rolling terrain tables reflect these lower operating speeds and the economic constraints that are imposed in the construction of roadways under these conditions. Be cautious when designing sag vertical or sharp horizontal curves at the bottom of steep downgrades because vehicle operating speeds at these locations tend to increase. This can create difficulties, especially for large trucks, affecting their ability to decelerate safely. Level terrain is the predominant terrain in Wisconsin, but there are areas in the state that have rolling terrain.

5.3.1.4 Project Design Speed

Horizontal, vertical and cross-sectional design features are all affected by the project design speed. Lower design speeds allow increased flexibility in the ranges of design criteria values. The selection of design speed should generally be compatible with the operating characteristics, functional classification and predominant use (e.g., high mobility, local access, “Scenic Byway,” etc.) of the highway. See FDM 11-10-1 for guidance on the selection of design speed.

5.3.1.5 Construction Traffic Control

When considering potential impact, be aware that staging a construction project can increase impact to social, environmental and economic factors. Reducing staging or eliminating staging through a project detour can be the correct decision. All projects, especially non-freeway projects should consider methodology to reduce staging or utilize detours. In addition to reducing impacts to the factors listed above reduced staging or detours will likely:

- Reduce construction time and access impacts to residents and businesses and reducing length of exposure to the natural and physical environment
- Improve quality, which will increase the longevity of the roadway reducing impact of more frequent future construction projects
- Improve safety to both construction workers and local residents by reducing conflicts between them.
- Save money, by reducing construction duration, contracting risk, and improving lifecycle cost.

When considering construction traffic control options, a designer should be aware that local support must be developed. Much greater effort should be devoted to public involvement in order to develop local consent and support for a detour or limited staging option, especially on a higher volume roadway. Public involvement techniques listed in FDM 6-5-15 should be utilized, and likely with greater frequency to ensure the success of the project.

5.3.2 Data Collection

5.3.2.1 Existing and Projected Traffic Volumes

Traffic volumes affect the flexibility available in cross sectional design criteria. As traffic volumes increase the potential number of conflicts between vehicles and between vehicles and objects increases. This, in turn, increases the potential for a crash. Wider lane and shoulder widths provide additional lateral separation between vehicles and vehicles and roadside objects. This generally provides drivers with more room to perform avoidance and deceleration maneuvers. Review projected traffic volumes to be sure that they adequately reflect future development plans.

5.3.2.2 Operating Speeds

These tend to indicate how a highway is being driven and whether individual geometric elements meet driver expectations. Use this data to aid in selecting project design speeds, and when considering the use of the lowest design criteria. Consult with region’s traffic section when collecting and analyzing operating speed data.

5.3.2.3 Crash History

This indicates the types of safety improvements that should be considered in the design of a project. It also indicates the relative safety performance of various geometric elements or roadside safety features. Crash history information and analysis is to be documented in all SCDs and DJs when the use of design criteria values outside of the ranges are proposed.

5.3.2.4 Roadside Conditions

Field reviews and photo log observations of roadside conditions can help to identify and evaluate potential safety impacts of existing geometric elements or roadside features. Such things as vehicle tracks and skid marks and damage to roadside barriers or other roadside objects may indicate potential safety hazards that may not show up in the crash history data.

5.3.2.5 Pavement Friction

An assessment of existing or proposed pavement surface friction can help to evaluate the safety impacts associated with the use of lower curve radii or super-elevation rates. If a decision is made to retain or use a curve radius outside of the design criteria based on a thorough analysis of crash history, operating speeds and roadside conditions, construction of a pavement surface with an increased coefficient of friction in combination with the use of maximum super-elevation is a good mitigation measure.

5.3.3 Analyses

5.3.3.1 Operating Speed Analysis

Inspection of vehicle operating speeds can help to evaluate how the existing roadway is being driven and as to how well existing geometrics are meeting driver expectations. An ideal analysis would include the measurement of existing operating speeds at various locations throughout the project with special measurements made at locations where geometric features are of most concern. On projects with a complex or controversial decision-making process, actual measurements of operating speeds may be needed to help to generate or defend a final decision. In many cases however, the time and effort required to collect this data may not be cost effective. In those cases, the designer can get a feel for the effects of existing geometric features on vehicle operating speeds by:

- Driving the roadway or soliciting comments from other staff who have driven the roadway,
- Making field observations of vehicle operating speeds on various sections of the project or at individual geometric features that are of concern,
- Soliciting comments from law enforcement officials, other local officials or public citizens that drive or live near the highway,
- Calculating the average running speed from driving the project and comparing it to the posted speed limit and design speed,
- Reviewing crash history reports for those crashes in which excessive operating speeds were cited as a cause of the crash.

5.3.3.2 Crash History Analysis

Close inspection of crash history data is needed to evaluate the overall safety performance of the roadway and to assess which improvements to implement on a project when considering maintaining lower existing or propose new lower design criteria values. The safety analysis should go beyond the customary project crash rate comparisons to statewide averages to include a performance-based crash analysis. Performance based crash analyses consist of looking at individual crash types at concentrated locations and levels of severity, like is completed in the SCP. For instance, when evaluating the decision to use lower curve radii, the crash history should be reviewed at the curve location being analyzed to see if a crash history exists and to determine what may have caused the crashes. Documentation for DJs when needed, shall include an analysis of crash history as one of the justifications for approval.

The SCP analyses performed for Perpetuation (S-1), Rehabilitation (S-2) and Reconstruction Type Modernization (S-3) projects (See FDM 11-38) should be referred to for this effort.

5.3.3.3 Traffic Capacity and Level of Service Analysis

An analysis of a highways capacity and level of service is important to determine a highways ability to handle current and future traffic volumes. As a highway nears its capacity and the level of service decreases, the safety and mobility of a highway can become compromised. Use accepted traffic analysis formulas and models, such as the Highway Capacity Manual, to determine the incremental improvements or level of capacity expansion needed to meet the traffic needs for the project. See FDM 11-5-3 for more guidance on traffic analyses and recommended traffic analysis models and software

5.4 Things to Consider When Making Decisions on Design Criteria

Under Community Sensitive Design, designers should attempt to make geometric and other design elements conform to the “lay of the land” in order to minimize community and environmental impacts. These design elements are listed in Table 5.1.

***Table 5.1* Design Elements**

Design Elements	Description	
Highway Capacity and Traffic Control	Level of service (LOS), intersection traffic control warrants, signing and marking criteria	
Horizontal	Tangents, curves, super-elevations and transitions and sight distances	
Vertical	Grades, vertical curves, vertical clearances and sight distances	
Sight Distance	Stopping sight distances (SSDs), intersection sight distances (ISDs), passing sight distances (PSDs), decision sight distances (DSDs), approach sight distances (ASDs), driveway sight distances (DWSDs)	
Cross section	Lanes and Shoulders	Number of lanes, lane widths, shoulder widths, cross slopes, super-elevations, lateral clearances, curb and gutters, auxiliary lanes, passing and climbing lanes, horizontal clearances, shy distances, clear roadway widths of bridges, pavement structures, truck routes
	Medians	Types (raised, flush, or ditched), widths, slopes, lateral clearances and barriers
	Roadside	Side slopes, clear zones, sidewalk widths, sidewalk cross-slopes, driveway side-slopes, driveway culverts, terrace slopes, side ditches, culvert end treatments, retaining walls, roadside safety barriers and fencing
Intersections, RR Crossings, Interchanges, and Driveways	Locations, intersection angles, turning radii, horizontal and vertical roadway alignments, left/right turn lanes and tapers, median openings, channelization, approach grades, traffic controls, approach sight distances, intersection sight distances, vision triangles, design vehicles, parking and frontage road offsets	
Clearances	Clear roadway widths of bridges, clear zones, lateral clearances, horizontal clearances, vertical clearances and shy distances	
Drainage and Erosion Control	Design storms, drainage basin sizes and characteristics, hydrology, hydraulic characteristics (ditches, gutters, culverts, storm sewer pipes and inlets)	
Access Control	Controls (Ch. 84.09, 82.25, 84.295 stats, Trans 233, driveway permits, state access management system plans), access spacings, intersections, driveway locations, driveway uses and driveway design vehicles	
Bicycle accommodations	Locations, widths, cross slopes, longitudinal slopes, pavement structures, sight distances, vertical clearances, road crossings, driveway crossings, grates and median refuges	
Pedestrian and Handicap Accommodations	ADA requirements, locations, widths, cross slopes, longitudinal slopes, landings, handicap accessibility, pedestrian characteristics, curb zones, planter/furniture zones, pedestrian zones, frontage zones, surface textures, ramp designs, road crossings, driveway crossings, grates and median refuges	
Bridge	Clear roadway widths of bridges, cross slopes, super-elevations, horizontal clearances, vertical clearances, structural capacities, freeboards, hydraulic capacities, railings and roadside safety barriers.	

Design Elements	Description	
Construction Traffic Control	Use of detour routes, minimizing work zone stages, road user costs and delays, public involvement, speeds, traffic control devices: sizes, spacings and placements, traffic control zone components: advance warning areas, transition areas, activity areas (longitudinal and lateral buffer spaces, work spaces, traffic spaces), termination areas and all applicable previously discussed design elements	
Other	Trail crossings	Trail uses and hourly exposure factors
	Cattle passes	Numbers of cattle, sizes of openings, longitudinal grades and lengths of structures

Decision to use design criteria outside the FDM design criteria should be made informatively and based on thorough considerations of many factors. The types of factors that could be considered for all of the various geometric features involved on projects can be numerous, and not always readily apparent. To help guide designers through this decision-making process, Attachments 5.1 through 5.14 provide checklists of factors, titled “Things to Be Considered.” These are lists of factors to consider when making these design criteria decisions.

LIST OF ATTACHMENTS

Attachment 5.1	CSD Considerations for Horizontal Alignment
Attachment 5.2	CSD Considerations for Vertical Alignment
Attachment 5.3	CSD Considerations for Stopping Sight Distance
Attachment 5.4	CSD Considerations for Intersection Sight Distance
Attachment 5.5	CSD Considerations for Passing Sight Distance
Attachment 5.6	CSD Considerations for Decision Sight Distance
Attachment 5.7	CSD Considerations for Cross Section (Lane)
Attachment 5.8	CSD Considerations for Cross Section (Shoulder)
Attachment 5.9	CSD Considerations for Cross Section (Medians)
Attachment 5.10	CSD Considerations for Cross Section (Roadside)
Attachment 5.11	CSD Considerations for Intersections
Attachment 5.12	CSD Considerations for Access Control
Attachment 5.13	CSD Considerations for Pedestrian/Bicycle Accommodations
Attachment 5.14	CSD Considerations for Bridges