Design Standards and Exceptions for Controlling Design Criteria

Contact

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Forms

Document design standards and design exceptions in the Design Memo with the appropriate Design Standards Form(s) attached:

- Design Memo
- Bridge Repair Design Standards Form (for Bridge Office use)

What This Guidance Applies To

This guidance describes requirements for application, documentation and exception approval of the ***Controlling Design Criteria*** (Critical Design Elements)

What Are the Standards

MnDOT has two categories of design standards:

- New Construction/Reconstruction, and
- Preservation

New Construction/Reconstruction

New Construction/Reconstruction Standards are described in the *Road Design Manual* and the *LRFD Bridge Design Manual* and in various Tech Memos. Find the New Construction/Reconstruction standard for each of the 11 Controlling Design Criteria (10 designated by FHWA and one added by MnDOT) by following the links in the following forms:

- Highway Design Standards Form
- Ramp Design Standards Form

Preservation

Preservation Standards are the lesser of:

- The New Construction/Reconstruction Standards, or
- The existing condition

Which Standards to Use on Your Project

Use New / Reconstruction Standards for projects meeting one or more of the following criteria:

- Any project on a Principal Arterial Interstate, Principle Arterial Freeway/Expressway, and roadways with a freeway context (i.e. grade separated/access controlled segments of roadway)
- Bridge Replacement/New Bridge
- Road grading and surfacing
- Pavement replacement (bituminous or concrete) that disturbs the subgrade over a substantial length
- Road on a new alignment (more than "spot" locations)
  Spot alignment and profile corrections may be considered Preservation work if they do not exceed 20% of the project length.

Use Preservation Standards for the following (if not on a freeway):

Preservation Projects (3R)

- Resurfacing
- Pavement structural and joint repair
- Minor lane and shoulder widening
- Minor alterations to vertical grades and horizontal curves
  Typically, if this is no more than 20% of the project it is considered Preservation work.
- Bridge repair

Examples of Preservation Projects:

- Bituminous or concrete overlay
- Reclamation, recycling or pavement replacement that does not remove the entire pavement structure or disturb below the top of subgrade
- Channelization for turn lanes
- Shoulder paving, widening, or replacement
- Traffic barrier
- Signal revisions or new installations
- Freeway HOV ramp bypass lanes

Other Projects: Maintenance and Minor Projects

For Maintenance and Minor Projects – even on freeways – as long as existing design elements are not made worse, no Design Memo or design exception approval is required. (See Appendix for example projects).

Controlling Design Criteria (Critical Design Elements)

The Controlling Design Criteria (which have also been called Critical Design Elements) are items that have substantial importance to highway operations and safety, and that warrant special attention in

design decisions. *Effective May 5, 2016, the FHWA has reduced the number of controlling criteria from 13 to 10, except for low speed roads.* (See FHWA Memo/May 5, 2016 and the table below – *Controlling Design Criteria & Roadway Design Speed*).

MnDOT has 11 Controlling Design Criteria, the 10 designated by FHWA plus an additional element designated by MnDOT (Ramp Length, acceleration and deceleration).

See Highway Design Standards Form and Ramp Design Standards Form.

Roadway Design Speed

The 11 controlling criteria (see table below) apply to the following roadways:

- Interstate highways
- Freeways
- Roadways with a Design Speed greater than or equal to 50 mph

For all other roadways, the controlling criteria are the following:

- Structural Capacity
- Design Speed
- Ramp Length (acceleration and deceleration)

Controlling Design Criteria & Roadway Design Speed			
Controlling Design Criteria		**Design Speed of the Road**	
		45 mph or less	50 mph or greater
FHWA & MNDOT Designated	Design speed	X	X
	Lane width		X
	Shoulder width		X
	Structural capacity	X	X
	***** Stopping sight distance		X
	Horizontal curve radius		X
	Maximum grade		X
	Cross slope		X
	Superelevation rate		X
	Vertical clearance		X
MnDOT Designated	Ramp length (acceleration and deceleration)	X	X

* Stopping sight distance applies to horizontal and vertical alignments except for sag vertical curves.

Additional Bridge Standards for Bridge Repair projects

The Bridge Office has additional standards for Bridge Repair projects which are described in the Bridge Preservation and Improvement Guidelines.

Documentation Required

Document project design standards and design exceptions in the Design Memo with the appropriate Design Standards form(s). Include all 10 Controlling Design Criteria (11 if there is a ramp), except for low-speed roads (Design Speed ≤ 45 mph). For low-speed roads, document only Design Speed, Design Loading Structural Capacity, and Ramp Length.

If there are design exceptions: identify, describe, and provide justification for each exception.
A Design Memo with the appropriate Design Standard Form(s) is required for all projects, even if there are no design exceptions.

Project managers are encouraged to engage the State Geometrics Engineer early to help identify the need for Design Exceptions as well as to identify opportunities for applying design flexibility on the project.

Design Exceptions

Who Is Responsible

The Project Manager is responsible for identifying and documenting all elements outside of the design range indicated in MnDOT guidance, and for submitting formal design exceptions to the State Geometrics Engineer to obtain approval. The Bridge Office is responsible for identifying exceptions to certain bridge elements on Major Bridge Preservation projects and Bridge Rehabilitation projects, as designated in the Bridge Preservation and Improvement Guidelines.

What Exceptions Need Approval

Approval is required anytime there is an exception to the applicable standard for any of the 11 Controlling Design Criteria.

Justification of Design Exceptions

See the Design Memo template for guidance on writing the justification for exceptions.

Who Approves Design Exceptions

State Design Engineer

All exceptions to the Controlling Design Criteria for projects identified as **New Construction/Reconstruction** must be approved by the State Design Engineer.

All exceptions to the Controlling Design Criteria for projects identified as **Preservation**, or any elements outside of the design range indicated in MnDOT guidance, must be approved at the District level. All District approved design exception memos should be sent to the State Geometrics Engineer for record retention.

State Bridge Engineer

Before approval by the State Design Engineer, the State Bridge Engineer recommends for approval of any exceptions to

- Vertical Clearance
- Structural Capacity

The State Bridge Engineer also recommends for approval exceptions to certain bridge elements on **Major Bridge Preservation or Bridge Rehabilitation** projects. (See Bridge Preservation and Improvement Guidelines).

Approval Process for Design Exceptions

1. The **District** completes the Design Memo, including a complete description, thorough justification, and applicable Design Tables for each exception.

   NOTE: For projects that are or include **Major Bridge Preservation or Bridge Rehabilitation**:

   i. For the Major Bridge Preservation and/or Bridge Rehabilitation part of the project, the **Bridge Office** identifies exceptions to bridge elements designated in the Bridge Preservation and Improvement Guidelines.
   ii. The **Bridge Office** fills out the Bridge Rehabilitation Design Standards Form.
   iii. The **State Bridge Engineer** signs the cover sheet of Design Memo to recommend approval, and sends the Design Memo to the District.
   iv. The **District** reviews and completes the Design Memo.

2. If there are exceptions to Structural Capacity and/or Vertical Clearance:

   The **District** sends the Design Memo (DM) to the State Bridge Engineer for concurrence signature and the Bridge Office returns the DM to the District.

3. The **District** sends the Design Memo to the State Geometrics Engineer. If a Value Engineering (VE) study was done for the project the **District** also sends the final VE Study Report to the State Geometrics Engineer.

4. The **State Geometrics Engineer** and **State Design Engineer** review. If no concerns, the **State Design Engineer** approves by signature.

5. **State Geometrics Engineer** keeps a copy and sends the original to the District.

6. State Geometrics Engineer sends a copy of the approved DM to FHWA for record retention if design exception is on an interstate highway.

Appendix

Maintenance Projects

Maintenance is part of an overall preservation strategy. Pavement maintenance is used where the pavement is in good condition with significant remaining service life. It does not significantly increase structural capacity, but uses surface (or near-surface) treatments to structurally sound pavements to prevent deterioration of the pavement.

Examples of Maintenance Projects:

- Asphalt crack sealing
- Bituminous pavement seal coat
- Chip sealing
- Concrete joint rehabilitation projects
- Concrete dowel-bar retrofit
- Concrete repair: Isolated, partial and/or full-depth repairs to restore functionality of the slab; e.g., edge spalls, corner breaks
- Concrete joint sealing
- Concrete pavement surface planing / diamond grinding
- Slurry or micro-surfacing
- Thin and ultra-thin hot-mix asphalt overlay
- Removal or shielding of roadside obstacles

Minor Projects

Minor projects are usually small, with a well-defined scope.

Examples of Minor Projects:

- Bikeway or recreational trail projects

- Buildings, construction or removal of
- Buses; operation, capital improvement or grants
- Culvert extension
- Culvert repair
- Culvert replacement
- Edge drains
- Enhancement or environmental mitigation projects which do not affect the mainline
- Erosion repair
- Fencing
- Freeway metering
- Landscaping
- Lighting
- Pavement re-striping (provided through-lane widths are not altered)
- Pedestrian/bike improvement
- Railroad warning devices
- Rest area projects (provided they don't affect mainline or mainline exit or entrance ramps)
- Right of way
- Salvage yard screening
- Signing
- Traffic Management System
- Warning flashers
- Weigh stations (provided they don't affect mainline or mainline exit or entrance ramps

Design Exception Flowchart