Technical Memorandum

To: **Electronic Distribution Recipients**

From: **Michael G. Beer, P.E.** Electronic signature on file
Acting Assistant Commissioner, Engineering Services

Subject: Design Speed Guidance for State Highways

Expiration and Purpose

This Technical Memorandum supersedes TM17-13-TS-06 and extends the expiration date of Technical Memorandum 12-13-TS-07 to December 31, 2023 unless superseded prior to that date.

The purpose of this Technical Memorandum is to update the MnDOT Design Speed criteria. This update will provide for more design flexibility when choosing a highway or corridor design speed.

Guidelines

Refer to Attachment TM 12-13-TS-07

Questions

Any questions regarding the technical provisions of this Technical Memorandum can be addressed to the following:

Douglas Carter, P.E., State Geometrics Engineer, MnDOT, **at (651) 366-4623**

Any questions regarding publication of this Technical Memorandum should be referred to the Design Standards Unit, DesignStandards.DOT@state.mn.us. A link to all active and historical Technical Memoranda can be found at http://techmemos.dot.state.mn.us/techmemo.aspx.

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Attachments:

TM 12-13-TS-07

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MINNESOTA DEPARTMENT OF TRANSPORTATION
Engineering Services Division
Technical Memorandum No. 12-13-TS-07
December 5, 2012

To: Electronic Distribution Recipients

From: Jon M. Chiglo, P.E.
Division Director, Engineering Services

Subject: Design Speed Guidance for State Highways

Expiration

This is a new Technical Memorandum and will remain in effect until December 5, 2017 unless superseded or published in the MnDOT Road Design Manual prior to that date.

Implementation

The design guidance contained in this Technical Memorandum is effective immediately for projects in the early stages of the preliminary design phase, and may be incorporated into projects in a more advanced design phase.

It is required that the final selection of the project design speeds be thoroughly documented in the district project design memo.

Introduction

Many state transportation departments have been turning to flexible design as a solution to resolving various transportation challenges. The benefits of flexible design allow for a greater sensitivity to the design needs of multiple travel modes, the local community, and the surrounding environment. This design approach also provides an opportunity to increase safety on a system-wide basis by stretching available funding to improve safety over a larger exposure area. MnDOT has been moving forward with its own flexible design initiative and this Technical Memorandum is one in a series that are being published to help support the statewide effort.

MnDOT Design Speed standards were reviewed with respect to current AASHTO standards and guidance, as well as the Department's experience related to successful projects where the principles of context-sensitive solutions are practiced. The new design criteria presented within this Technical Memoranda represents a conceptual change in how design speed choices are made. The designer is given more leeway in selecting the most appropriate standard by incorporating a multitude of design considerations. Because of this flexibility, thorough decision documentation will be required.

Purpose

The purpose of this Technical Memorandum is to update the MnDOT Design Speed criteria. This update will provide for more design flexibility when choosing a highway or corridor design speed.

Guidelines

The design speed, perhaps more so than any other design control on a highway, will have a major impact on all facets of the geometric design and other design elements. The project segment's appropriate design speed depends upon the functional classification and use, average daily traffic (ADT), anticipated and desirable operating speed, terrain, non-motorized use, and adjacent land use of the highway.

Design speed is a principal design control that effects the selection of many of the project standards and design element criteria used in a roadway project. The design speed choice can have a great impact on other cross-sectional elements (e.g. lane width, shoulder width, bike lanes, bus shoulders, etc.). Selection of design speed also sets limits for curvature, sight distance, clear zone, and other geometric and cross-sectional features.

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Using a higher design speed can contribute to higher vehicle operating speeds. Designers must evaluate the advantages of higher operation speeds against lost design flexibility. The most appropriate design speed may be a lower value that recognizes the importance of attaining maximum design flexibility and a context sensitive roadway that fits community needs and environmental constraints. Design speed values above the minimums are usually most appropriate and desirable, but the designer should not be averse to adopting lower values where significant constraints or opportunities exist. The designer must carefully document all the considerations and analyses important to determining the most appropriate design speed. The designer must weigh the benefits of a desired degree of safety, access, mobility, design consistency, and efficiency against the community, environmental, right of way, mode impacts, and cost impacts.

Design speeds usually fall between 30 mph and 75 mph (50 km/h and 120 km/h), at 5 mph (10 km/h) increments.

- **High-speed facilities will now be defined as 50 mph (80 km/h) or higher.**
- **Low-speed facilities will now be defined as 45 mph (70 km/h) or lower.**

The roadway user expectation must be considered when selecting the design speed. For example, drivers expect to be able to drive at certain maximum speeds based on the functional classification and rural or urban character of the highway. The design speed should fit the travel desires and habits of the majority of roadway users.

The AASHTO publication, *A Policy on Geometric Design of Highways and Streets*, has a thorough discussion on design speed and the above considerations.

Table 1 provides the allowable ranges of design speeds for varying conditions. For design work, it is typically desirable to choose a design speed that complements the highway type, setting, functional classification, traffic volume, and terrain.

Table 1 DESIGN SPEED (Dual Unit)

<table>
<tr><th colspan="4">Conditions</th><th colspan="3">Design Speed, mph (km/h)</th></tr>
<tr><th colspan="4"></th><th colspan="3">ADT</th></tr>
<tr><th>Type of Highway</th><th>Setting</th><th>Functional Class</th><th>Terrain</th><th><1500</th><th>1500-3000</th><th>>3000</th></tr>
<tr><td rowspan="13">2-Lane Highway</td><td rowspan="9">Rural</td><td rowspan="3">Principal Arterial</td><td>Level</td><td colspan="3">60-75 (100-120)</td></tr>
<tr><td>Rolling</td><td colspan="3">55-70 (90-110)</td></tr>
<tr><td>Mountainous</td><td>40-60 (60-100)</td><td colspan="2">50-60 (80-100)</td></tr>
<tr><td rowspan="3">Minor Arterial</td><td>Level</td><td colspan="3">60-70 (100-110)</td></tr>
<tr><td>Rolling</td><td colspan="3">50-70 (80-110)</td></tr>
<tr><td>Mountainous</td><td colspan="2">40-60 (60-100)</td><td>50-60 (80-100)</td></tr>
<tr><td rowspan="3">Collector</td><td>Level</td><td>50-60 (80-100)</td><td colspan="2">60 (100)</td></tr>
<tr><td>Rolling</td><td>40-60 (60-100)</td><td colspan="2">50-60 (80-100)</td></tr>
<tr><td>Mountainous</td><td>30-60 (50-100)</td><td colspan="2">40-60 (60-100)</td></tr>
<tr><td rowspan="2">Urban High- Speed</td><td>Arterial</td><td rowspan="2">All</td><td rowspan="2" colspan="3">50-70 (80-110)</td></tr>
<tr><td>Collector</td></tr>
<tr><td rowspan="2">Urban Low- Speed</td><td>Arterial</td><td rowspan="2">All</td><td rowspan="2" colspan="3">30-45 (50-70)</td></tr>
<tr><td>Collector</td></tr>
<tr><td rowspan="4">Freeway</td><td rowspan="3">Rural</td><td rowspan="3">Arterial</td><td>Level</td><td colspan="3">70-75 (110-120)</td></tr>
<tr><td>Rolling</td><td colspan="3">70 (110)</td></tr>
<tr><td>Mountainous</td><td colspan="3">50-70 (80-110)</td></tr>
<tr><td>Urban</td><td>Arterial</td><td>All</td><td colspan="3">50-70 (80-110)</td></tr>
<tr><td rowspan="6">Multi-Lane Highway</td><td rowspan="3">Rural</td><td rowspan="3">Arterial</td><td>Level</td><td colspan="3">60-75 (100-120)</td></tr>
<tr><td>Rolling</td><td colspan="3">60-70 (100-110)</td></tr>
<tr><td>Mountainous</td><td colspan="3">50-70 (80-110)</td></tr>
<tr><td>Urban High-Speed</td><td>Arterial</td><td>All</td><td colspan="3">50-70 (80-110)</td></tr>
<tr><td rowspan="2">Urban Low-Speed</td><td>Arterial</td><td rowspan="2">All</td><td rowspan="2" colspan="3">30-45 (50-70)</td></tr>
<tr><td>Collector</td></tr>
</table>

General Design Considerations
Design speeds at or below the lower end of the given mph range in Table 1 should be considered on corridors that serve more of an access, tourist or aesthetic related function than a mobility function. These corridors might be "Rustic" Roads, "Scenic Byways," sections of urban corridors with high pedestrian activity or in the vicinity of schools, or other roadways located in unique environmentally or socially sensitive areas. Using lower design speeds can help to provide additional flexibility in the design of horizontal, vertical and cross sectional elements.

The basis for selecting a design speed must be fully documented in the project design file. This documentation shall include a discussion of the road characteristics that relate to operating speeds plus the overall characteristics of the roadway corridor and land use. The documentation should also include any existing advisory or regulatory speed signing in place, and a discussion about practical operating speeds on the affected and abutting segments of road.

Specific Design Considerations
The following factors should also be considered when selecting a design speed;

1. **Interrelationships with other cross sectional elements**
   Although design speed selection is largely related to traveled-way demand and functional classification, the judgment is incomplete without considering the overall cross section, competing functions, and adjacent design elements in light of total function and safety.

2. **Space constraints**
   Rural, suburban and urban settings can present constrained environments. Space limitation and the need to apportion it among competing functions can sometimes be an overriding factor in design speed selection. The operational and safety consequences associated with various values of each cross sectional element must be evaluated for each function/user to assess tradeoffs and arrive at an equitable balance.

3. **Context**
   MnDOT's overarching design policy is to balance the objectives of mobility and safety for all travel modes with preservation and enhancement of aesthetic, scenic, historic, cultural, environmental and community values. When designing a road or street, understanding these and other aspects of a facility's context is necessary to make design judgments that are sensitive to its built and natural environments.

4. **Maintenance**
   Design speed choices can have a great impact on other cross-sectional elements (e.g. lane width, shoulder width, bike lanes, bus shoulders, etc.). These choices all impact the ease of maintainability. The responsible operations and maintenance organization must be consulted with and have the ability to provide input.

Questions
Any questions regarding the technical provisions of this Technical Memorandum can be addressed to any one of the following:

- **Michael Elle at (651) 366-4622, Project Manager, 13cc Design Flexibility Initiative Engineer**
- **Jim Rosenow at (651) 366-4673, Design Standards Engineer, Acting.**
- **Darwin Yasis at (651) 366-4623, State Geometrics Engineer.**

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