Design Speed and Beyond

Concepts, Principles, and Practices

Engineering for Speed Management: A new challenge for designers

2013–2014 MnDOT Context Sensitive Solutions events

Webinar

December 18, 2013
Welcome and Introduction

• Online participants are encouraged to add to the discussion by using the interactive chat.

• Submit comments and questions via chat at any time during the webinar by clicking on the gold box in the upper left corner of your screen. This will take you to the chat page.

• Sign in by creating a Chatroll account, or sign in using your Facebook or Twitter account.

• Next webinar: “So You Want to Build a Cross Section”, February 18, 2014, 2–4pm Central. For more information visit www.cts.umn.edu/contextsensitive/workshops/.
Today’s Panel

Nathan Drews, MnDOT Traffic Safety
Derek Leuer, MnDOT Traffic Safety
Jack Broz, Avenue Design Partners
Jim Rosenow, MnDOT Flexible Design
What you’re about to see and hear is not entirely reflected in current Minnesota Department of Transportation design policy...yet.
Opening Thought

massDOT, Highway Division:

“Design speed is a choice.”
Opening Discussion
What are we talking about?
Which speed do we mean?

- Speeding
- Design Speed
- Posted Speed
- Enforced Speed
- Operating Speed
- Running Speed
- 85th Percentile

- Target Operating Speed
- High Speed
- Low Speed
- Minnesota Statutory Speed
- Minnesota Statutory Speed with on-street Bicycling
Questions

- Is speeding a problem on any projects?
- Is speeding identified in the project’s problem statement?
- Does Speed = Safety?
Question

- How can we manage traffic speeds during the off-peak periods?
  - Peak Period design results in roads that are overbuilt for the remainder of the day, week and year. Multi-modal needs for corridors require an off-peak management of speeds.
Mobility vs. Speed

- **Speed**: Measurement of how fast you are moving

- **Mobility**: Measuring if you are moving
  - **Travel**: Movement from point A to point B, (such as a trip to work)
  - **Circulating**: Movement around a community (stopping for gas, banking and groceries)
  - **Access**: Movement into a destination (You park, get off the bus or park your bicycle and walk into your destination)
Market Street: San Francisco, 1906
Speed this and speed that

Speed Engineering
What the Law Requires

Statutes 169.14

Driver’s Duty

Prima Facie
‣ Special Provisions

Engineering and Traffic Investigation
Engineering and Traffic Investigation

Operating Speed

Roadway Design (Not Design Speed)
  › Crash Experience

Authorization by the Commissioner
Speed Terms

Operating Speed – The speed where 85% of traffic is driving at or below

Posted Speed – The maximum lawful speed of the road (enforceable)

Design Speed – The speed for selecting engineering elements and components

Target Speed – The operating speed that is desired

Speeding – A behavior that is difficult (or impossible) to control with engineering design
Statutory speeds (MSA 169.14, Subd. 2):

1. Where no special hazard exists, the following speeds shall be lawful…
   a. 30 mph in an urban district
   b. 65 mph on non-Interstate freeways and expressways
   c. 55 mph in locations other than those specified in this section
   d. 70 mph on rural Interstate highways
   e. 65 mph on Interstate highways within 50,000–population cities
   f. 10 mph in alleys
   g. 25 mph on residential roadways if adopted by the jurisdiction
   h. 35 mph in a rural residential district if adopted by the jurisdiction
“Alteration of the statutory speed limits to fit existing traffic and physical conditions of the highway constitutes the basic principle of speed zoning. The objective of correct speed zoning is to influence as many drivers as possible to operate at or near the same speed, thus reducing conflicts created by wide differentials in speed.”
Operating Speed

85th Percentile and 10 MPH Pace Pack
Operating Speed and Traffic Safety

Speed vs. Safety

[Diagram showing the relationship between crash frequency and speed variation from mean speed.]
Operating Speed and Traffic Safety

Speed vs. Safety

MN Urban Roadway Access Density vs. Posted Speed Limits

- 47.1 at 30 mph
- 41.6 at 35 mph
- 35.5 at 40 mph
- 17.2 at 45 mph
- 11.4 at 50 mph
- 6.9 at 55 mph

STATEWIDE AVERAGE = 34.3

Speed Limit on Urban Conventional Roadways (UC) (Includes 2, 4, and 6 Lane Roads)

- 90 segments 20 miles: 2760 accesses
- 18 segments 25 miles: 331 accesses
- 29 segments 24 miles: 1535 accesses
- 23 segments 23 miles: 208 accesses
- 16 segments 13 miles: 150 accesses
- 16 segments 12 miles: 32 accesses

MN Urban Roadway Crash Rates vs. Posted Speed Limits

- 6.96 at 30 mph
- 3.94 at 35 mph
- 4.30 at 40 mph
- 3.37 at 45 mph
- 2.38 at 50 mph
- 2.32 at 55 mph

STATEWIDE AVERAGE = 4.0

Speed Limit on Urban Conventional Roadways (UC) (Includes 2, 4, and 6 Lane Roads)

- 99 segments 29 miles: 3759 crashes
- 18 segments 24 miles: 496 crashes
- 29 segments 24 miles: 1479 crashes
- 23 segments 23 miles: 403 crashes
- 16 segments 13 miles: 495 crashes
- 16 segments 12 miles: 395 crashes
### Posted versus Operating Speed

<table>
<thead>
<tr>
<th>Study Location</th>
<th>Before</th>
<th>After</th>
<th>Sign Change (MPH)</th>
<th>85% MPH Before</th>
<th>Traffic Change (MPH)</th>
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<tr>
<td>MN 65</td>
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<tr>
<td>US 169 (Extra Enforcement)</td>
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<td>41</td>
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<td>Anoka CSAH 1</td>
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<td>40</td>
<td>-5</td>
<td>48</td>
<td>+2</td>
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<tr>
<td>Anoka CSAH 24</td>
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<td>45</td>
<td>+15</td>
<td>49</td>
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<tr>
<td>Anoka CR 51</td>
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<td>+5</td>
<td>45</td>
<td>+1</td>
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</table>

<table>
<thead>
<tr>
<th>Study Location</th>
<th>Before</th>
<th>After</th>
<th>Sign Change (MPH)</th>
<th>85% MPH Before</th>
<th>Traffic Change (MPH)</th>
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</thead>
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<td>50</td>
<td>40</td>
<td>-10</td>
<td>52</td>
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<td>Nobles Ave</td>
<td>30</td>
<td>35</td>
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<td>+3</td>
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<td>62nd Ave N</td>
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<td>30</td>
<td>-5</td>
<td>37</td>
<td>0</td>
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<tr>
<td>Miss. St</td>
<td>30</td>
<td>35</td>
<td>+5</td>
<td>39</td>
<td>+1</td>
</tr>
<tr>
<td>Vicksburg Ln (Extra Enforcement)</td>
<td>50</td>
<td>45</td>
<td>-5</td>
<td>52</td>
<td>-1</td>
</tr>
</tbody>
</table>
“Grading Your Project”

As a State, and as a Nation, the way we have generally designed roadway facilities to influence driver speed and behavior to act as we intend has not been entirely successful.
Roundtable
Design element attributes

Horizontal Curvature

Maximum side friction factor

- Provides ample margin of safety against skidding
### Stopping Sight Distance

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentile</th>
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</thead>
<tbody>
<tr>
<td>Perception-reaction time</td>
<td>90&lt;sup&gt;th&lt;/sup&gt; to 95&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Deceleration rate</td>
<td>90&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Eye height</td>
<td>90&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Taillight height</td>
<td>90&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

**Multiplicative total** = 99.99%
Design element attributes

Stopping Sight Distance

Figure 4. Conceptual Relationship Between Available Sight Distance and Safety at Crest Vertical Curves
Roundtable
Let’s get real

Relationship of design speed to reality
Research on Design Speed Issues

- Sought correlation between Design Speed, Operating Speed and Posted Speed
- Provides equations to assist in predicting operating speeds
- Makes recommendations for best practice for selecting Design Speed
Figure 6. 85th percentile speed versus posted speed for NCHRP, Texas, and FHWA data.

Source: NCHRP Report 504
### Suburban/ Urban Speeds

Table 24  Percentile speed that equals posted speed by area type and posted speed

<table>
<thead>
<tr>
<th>Area Type</th>
<th>Speed Limit (mph)</th>
<th>Percentile at or below Given Speed*</th>
<th>Number of Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Speed Limit</td>
<td>Speed Limit Plus 5 mph</td>
<td>Speed Limit Plus 10 mph</td>
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<tr>
<td>Suburban/ Urban</td>
<td>25</td>
<td>42</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>28</td>
<td>64</td>
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<td></td>
<td>35</td>
<td>22</td>
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<td></td>
<td>50</td>
<td>43</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>55</td>
<td>48</td>
<td>80</td>
</tr>
</tbody>
</table>

Source: NCHRP Report 504

**How do you select Design Speed?**
Vehicle Speeds and Pedestrians

Figure 1. Vehicle Impact Speed and Pedestrian Injury Severity (from DETR)

- 40 mph: 20% Fatal, 40% Injured, 40% Uninjured
- 30 mph: 30% Fatal, 30% Injured, 40% Uninjured
- 20 mph: 50% Fatal, 30% Injured, 20% Uninjured

Figure 2. Fatal Injury Rates by Vehicle Speed, by Pedestrian Ages (Florida, 1993-1996, pedestrians in single-vehicle crashes)

- 14 or less
- 15 - 19
- 20 - 44
- 45 - 64
- 65 or more

Florida, 1993–1996; pedestrians in single-vehicle crashes

UK: Department of Environment, Transport, and the Regions, (DETR)
Figure 6. 85th percentile speed versus posted speed for NCHRP, Texas, and FHWA data. 

Source: NCHRP Report 504
Ingersoll Avenue: After Restriping
## Ingersoll Avenue: Speed and Travel Times (WB)

<table>
<thead>
<tr>
<th>Time</th>
<th>Condition</th>
<th>Avg. Speed</th>
<th>Delay</th>
<th>Travel Time</th>
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</thead>
<tbody>
<tr>
<td>AM</td>
<td>Before</td>
<td>25.4</td>
<td>36</td>
<td>213</td>
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<tr>
<td></td>
<td>After</td>
<td>24.8</td>
<td>41</td>
<td>220</td>
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<td></td>
<td>Change</td>
<td>-2%</td>
<td>14%</td>
<td>3%</td>
</tr>
<tr>
<td>Noon</td>
<td>Before</td>
<td>22.9</td>
<td>56</td>
<td>238</td>
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<tr>
<td></td>
<td>After</td>
<td>22.9</td>
<td>57</td>
<td>236</td>
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<td></td>
<td>Change</td>
<td>0%</td>
<td>2%</td>
<td>-1%</td>
</tr>
<tr>
<td>PM</td>
<td>Before</td>
<td>23.8</td>
<td>49</td>
<td>227</td>
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<tr>
<td></td>
<td>After</td>
<td>21.9</td>
<td>69</td>
<td>247</td>
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<tr>
<td></td>
<td>Change</td>
<td>-8%</td>
<td>41%</td>
<td>9%</td>
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</table>
# Ingersoll Avenue: Crash History

**Ingersoll Avenue - ML King to Polk Blvd**

<table>
<thead>
<tr>
<th>Time Period</th>
<th>May-August Crashes</th>
<th>Total Annual Crashes*</th>
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<tbody>
<tr>
<td><strong>Total Crashes</strong></td>
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<tr>
<td>2005-2009 Average</td>
<td>21</td>
<td>49</td>
</tr>
<tr>
<td>2010</td>
<td>9</td>
<td>21*</td>
</tr>
<tr>
<td><strong>No. Injuries</strong></td>
<td></td>
<td></td>
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<tr>
<td>2005-2009 Average</td>
<td>10</td>
<td>22</td>
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<tr>
<td>2010</td>
<td>4</td>
<td>9*</td>
</tr>
</tbody>
</table>

* Calculated number based on 2005-2009 percentages
Example: Excelsior Blvd.

- 11 foot lanes – no shoulders
- 35 mph
- Turn lanes store 2 vehicles
- Tapers 10:1 on turn lanes; 5:1 for parking bays
- Crash reduction over 55%
Example: Excelsior Blvd.

- CSD elements that needed to be strengthened:
  - “that the travel lanes are wider than necessary on Excelsior Blvd contributing to higher travel speeds than desirable or posted (posted at 35 mph) ... while speeds were technically slowed in the study location and to the east (speeds and travel-way width increased to the west), the overall street is designed for a higher speed operation than is necessary”.

From ITE publication
*Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*
Case Study: US 151, WI

Saturday morning
35 mph Posted Speed
25 mph travel speed
3.7 mile trip length
6 out of these 8 vehicles will travel together for over 3 miles.
Case Study: US 151, Madison WI
Case Study: US 151, WI
What does the Green Book (or the RDM) say?

…and how did we get to where we are now?
Assumed Design Speed (Barnett 1936):

“The maximum reasonably uniform speed which would be adopted by the faster driving group of vehicle operators, once clear of urban areas”
Design Speed (AASHO 1938):

“The maximum approximately uniform speed which probably will be adopted by the faster group of drivers but not, necessarily, by the small percentage of reckless ones.”
The Assumed Design Speed selected for a highway is determined by consideration of the topography of the area traversed, economic justification based on traffic volume, cost of right-of-way and other factors, traffic characteristics, and other pertinent factors such as aesthetic considerations.
Evolution of Design Speed

AASHO (1954, 1965):

“The speed determined for design and correlation of the physical features of a highway that influence vehicle operation. It is the maximum safe speed that can be maintained over a specified section of highway when conditions are so favorable that the design features of the highway govern.”
Evolution of Design Speed

AASHO (1954, 1965):

“The assumed speed should be a logical one with respect to the character of terrain and the type of highway. Every effort should be made to use as high a design speed as practicable…”
Evolution of Design Speed

AASHO (1965):

“The increase in speeds on highways during the last 15 years is a result of improvement in both the vehicles and the highways. The speed assumed for design should fit the desires and travel habits of nearly all drivers.”
AASHO (1965):

“It can be expected that average speeds on main highways will continue to increase gradually.”

“…a top speed of 70 mph currently would fit a very high percentile speed.”
AASHO (1965):

“Drivers do not adjust their speeds to the importance of the highway but to the physical limitations...”
Evolution of Design Speed

AASHO (1973):

“The maximum safe speed…” “Urban arterials should be designed with all elements in balance…”

“Every effort should be made to provide above-minimum design values, but in view of the numerous controls in urban areas…”

“The maximum safe speed…” “The assumed design speed should be a logical one with respect to the topography, the adjacent land use, and the functional classification of highway.”
Evolution of Design Speed

Separate chapters for each functional classification with respective design speed guidance therein.
Current Interstate Era

Pre-WWII


Evolution of Design Speed

AASHTO (2001–present) and MUTCD (2000–present):

“Design Speed is a selected speed used to determine the various geometric design features of the roadway.”
Evolution of Design Speed

Current design speed definition –

› Proposed in NCHRP Report 400 (1997)
› Term “safe” was removed to avoid the perception that speeds greater than the design speed were unsafe
› Recognized that operating speed can be – and commonly is – greater than the design speed
Current Interstate Era

AASHTO (present):
“The longer the trip, the greater is the driver’s desire to use higher speeds.”
AASHTO (2011):

“The assumed design speed should be a logical one…”

“...every effort should be made to provide as high a design speed as practical to attain a desired degree of safety, mobility and efficiency…”
In the AASHTO Green Book discussion on Design Speed selection, how many times is posted speed brought up as a factor to be considered?
Evolution – The Local Angle

Minnesota T.H. 73
Rural collector
“As high a design speed as practicable should be used…”

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Design Speed (mph)</th>
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<tr>
<td></td>
<td>Desirable</td>
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<td>Full Control of Access:</td>
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<tr>
<td>Urban Freeways</td>
<td>70</td>
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<tr>
<td>Rural Freeways</td>
<td>80</td>
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<tr>
<td>Partial Control of Access:</td>
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<tr>
<td>Urban Expressways</td>
<td>60</td>
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<td>Rural Expressways</td>
<td>70</td>
</tr>
<tr>
<td>Unlimited Access:</td>
<td></td>
</tr>
<tr>
<td>Rural - Flat Terrain</td>
<td>70</td>
</tr>
<tr>
<td>Rural - Rolling Terrain</td>
<td>70</td>
</tr>
<tr>
<td>Rural - Rough Terrain</td>
<td>60</td>
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<tr>
<td>Urban</td>
<td>50</td>
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Table A 5-291.181
Evolution – The Local Angle

Road Design Manual – 1982 rewrite

<table>
<thead>
<tr>
<th>CONDITIONS</th>
<th>DESIGN SPEED (MPH)</th>
<th>DESIRABLE</th>
<th>MINIMUM</th>
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<td><strong>FULL CONTROL OF ACCESS:</strong></td>
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<td>RURAL FREeways</td>
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<td>65</td>
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<tr>
<td><strong>PARTIAL CONTROL OF ACCESS:</strong></td>
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<td><strong>UNLIMITED ACCESS:</strong></td>
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<tr>
<td>RURAL – FLAT TERRAIN</td>
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<td>URBAN</td>
<td>50</td>
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### Evolution – The Local Angle

Road Design Manual – 1990’s version

<table>
<thead>
<tr>
<th>Conditions</th>
<th>2-Lane Highways</th>
<th>Freeway</th>
<th>Multi-Lane High Speed</th>
<th>Multi-Lane Low Speed</th>
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<td>Urban</td>
<td>Rural</td>
<td>Urban</td>
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<td>Arterial</td>
<td>Arterial</td>
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<tr>
<td></td>
<td>Rolling</td>
<td></td>
<td>Rolling</td>
<td></td>
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<tr>
<td></td>
<td>Mountains</td>
<td></td>
<td>Mountains</td>
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</tr>
<tr>
<td>Design Speeds</td>
<td>Flat</td>
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<td>Flat</td>
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<tr>
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<td>Rolling</td>
<td></td>
<td>Rolling</td>
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<td>120 - 100</td>
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<td>Design Speeds</td>
<td>100 - 80</td>
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<td>100 - 80</td>
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<td>Design Speeds</td>
<td>70 - 59</td>
<td></td>
<td>70 - 59</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Design Speeds normally should be higher than the minimum speeds shown. Design Speeds must be equal to or exceed the posted speeds.
The most appropriate design speed may be a lower value that recognizes the importance of attaining maximum design flexibility and a context sensitive roadway…

…it is typically desirable to choose a design speed that equals or exceeds the anticipated posted speed…
Evolution – The Local Angle

Technical Memorandum No. 12–13–TS–07

December 5, 2012

- 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.

- Revised to conform to AASHTO
- Relaxes design treatments (superelevation, cross section, bridge rail)
- Diminishes influence toward excessive speed
What’s past is prologue…
“Selection of a design speed influences the physical geometrics of the roadway. Similarly, the physical geometrics of the roadway are important determinants of the operating speeds that will result on the facility.”
“...the design speed should only be based on the speed limit if the speed limit is consistent with existing operating speeds or physical constraints of the built environment.”
In the AASHTO Green Book discussion on Design Speed selection, how many times is posted speed brought up as a factor to be considered?

Once – as one of several factors to consider when designing arterial streets.
Nuts and Bolts
…or:

“How I Learned to Stop Over-designing and Start Right-sizing, and it Begins With Design Speed.”
## The Framework

### Road Design Manual Table 2-5.06A

<table>
<thead>
<tr>
<th>Type of Highway</th>
<th>Setting</th>
<th>Functional Class</th>
<th>Terrain</th>
<th>Design Speed, km/h (mph)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Principal Arterial</td>
<td>Level</td>
<td>100-120 (60-75)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Rolling</td>
<td>90-110 (55-70)</td>
</tr>
<tr>
<td></td>
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Leading Edge of Thinking

NCHRP Project 15–25: Alternatives to Design Speed for Selection of Roadway Design Criteria

Speed ➔ Design

or

Design ➔ Speed
Leading Edge of Thinking

NCHRP Project 15–25: Alternatives to Design Speed for Selection of Roadway Design Criteria

German “Design Class” Concept

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<th>Category group</th>
<th>motorways</th>
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RAA  RAL  RASnt
 Leading Edge of Thinking

NCHRP Project 15–25: Alternatives to Design Speed for Selection of Roadway Design Criteria

German “Design Class” Concept

<table>
<thead>
<tr>
<th>Design Class</th>
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</table>
Leading Edge of Thinking

Project 15–25 has rolled into Project 15–47: Developing an Improved Highway Geometric Design Process

…but not before concluding:

› Design speed can be foregone in low and transitional speed circumstances (20–45 mph)
  ◦ Would still need some design controls (minimum radius, K-value, intersection sight distance, etc.)
› Design speed still useful for high speed design
› **Precise design speed values overrated as a control**
Back to the Future

Design data in the Green Book and RDM are provided in 5 mph increments, but...

Old Road Design Manual (pre 1990’s):
“Design speeds usually fall between 30 and 70 mph at 10 mph increments. Occasionally, it is warranted to use 5 mph increments.”

AASHTO Green/Blue Books (1984 and previous):
“...it has been found desirable...to use increments of 10 mph. Smaller increments show little distinction in design elements between one design speed and the next...”
Rural Highways

The Standard

30 to 75 mph

(...depending on functional class, terrain, setting and traffic volume.)
Rural Highways

Perspective

Minor arterial
50 mph design speed
## Rural Highways

### Perspective

#### Table 2-4.05A

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<th>CONDITIONS</th>
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Design criteria at the time
Rural Highways

Perspective

70 mph design speed
Rural Highways

Perspective
Rural Highways

Guiding Principles

- User expectation / transportation function
- Practicality
- Economy
- Sustainability
- Environmental stewardship
Rural Highways

Rules of Thumb

- 40 mph (Collector)
- 50 mph (Arterial)
- 60 mph (Expressway)
- 70 mph (Freeway)
Rural Highways

Merely rules of thumb, but they can be expected to apply routinely.

Subject to:

- Context
- Sub-class (e.g. minor vs principal arterial)
- Terrain
- Demand
- Driver expectation
Urban Freeways

The Standard

50 to 70 mph
Urban Freeways

Perspective

Robert Moses, 1964:
“You can draw any kind of picture you like…but when you operate in an overbuilt metropolis, you have to hack your way with a meat ax.”
Urban Freeways

Perspective

Cross Bronx Expressway
Perspective

From “Interregional Highways” (1943)

The design speed “shall be as high as practicable, consistent with the topography, proximity of urban improvements, and expected traffic volume.” With those limits, a design speed higher than 50 miles per hour “will usually be impracticable.”
Urban Freeways

Perspective

I–94 in North Minneapolis

60 & 70 mph DS’s
Urban Freeways

Perspective

I–35E Parkway in St. Paul

50 mph DS
Urban Freeways

Guiding Principles

- Practicality
- Economy
- Feasibility
- Social and environmental impact
Freeways

Rules of Thumb

Urban: 50 mph
Suburban: 60 mph
Rural: 70 mph
Urban Non-Freeways

The Standard

30 to 70 mph
Urban Non-Freeways

Perspective

- High-speed urban facilities are relatively rare
Urban Non–Freeways

Legend
- >= 50 mph Speed Limit
- <= 45 mph Speed Limit
Urban Non–Freeways

Perspective

- High–speed urban facilities are relatively rare
  - Where they do occur, a context–oriented approach is appropriate
- Low–speed streets are the great majority of cases
Low-speed Urban Streets

Guiding Principles

- Speed control / safety for all users
- Economy
- Feasibility
- Versatility
- Social and environmental impact
Low-speed Urban Streets

Rules of Thumb

Residential: 20 mph
Collectors/Arterials:
  Low-speed: 30 mph
  Transitional speed: 40 mph
Closing Discussion

Engineering for speed management and safety
Engineering for Speed Management

- Design of self-enforcing roads
- Speed Study for setting speed limits
Question

- Can the Design Speed be lower than target operating speed or posted speed?

Example:
- Minor Arterial – CSAH
- Context: City’s “Main Street”
- 85th Percentile: 42 mph
- Posted: 35 mph
- Reconstruction
- Multimodal design
- Target Operating Speed: 35 mph
- Design Speed: ? (30–40 mph per state aid rule 8820.9936)
Classification required by Federal law

General Categories:
- Arterial
- Collector
- Local
Conventional Approach

\[ \text{SPEED LIMIT} \quad 55 \quad + \quad ? \quad = \quad \text{D.S.} \]
NCHRP Report 504, 2003

- Minimal relationship between Design Speed and Operating Speed

- **Strong relationship to lower 85\textsuperscript{th} percentile speeds**
  - Increased access density
  - Increased pedestrian activity
  - Absence of pavement markings
  - Medians
  - On-street parking
Concept of Desired/Target Speed

Target Operating Speed

- “…desirable speed at which vehicles should operate on a thoroughfare in a specific context.” (ITE)

- “…the desired operating speed along a roadway. An appropriate target speed should be determined early in the project development process.” (FHWA)
Need for Flexibility:

- Community’s Guiding Principles
  - Multimodal Design
  - Connectivity and Public Realm
  - Local Economy
  - Design for People
  - Community Character and Identity
  - Sustainable Solutions
  - Healthy and Active Lifestyles
  - Unique Location

- Environmental Stewardship

- Financial Sustainability
Question...

Where is the flexibility in selecting a design speed?
Self–Enforcing/Self–Explaining Roads

- Important Design Focus Areas
  - Rural Areas
    - Many types/functions of 2–lane rural roads
    - Make the effort to “get to know” the subject road
  - Transitions
    - Undeveloped to Developed
    - Developed to Urban Core
  - Curves
    - First curves after long tangents
    - Comparably more restrictive curves
Design Speed of 40 mph was...

- 10 mph less than the existing (previous) posted speed
- 10 mph less than the low end of the “allowable” (standard) range
The outcome was:

- 70% crash reduction
- Satisfaction of local and regulatory concerns
- Economical and context sensitive project
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nathan.drews@state.mn.us
james.rosenow@state.mn.us
Thank You

Next webinar:

“So You Want to Build a Cross Section”
February 18, 2014
2–4 p.m. Central

For more information visit:
www.cts.umn.edu/contextsensitive/workshops/