Design Flexibility in Massachusetts

MassHighway Project Development and Design Guide

Minnesota DOT

Flexible Design for 21st Century Challenges: Balancing Competing Objectives & Optimizing Return on Investments

February 23, 2009
Massachusetts Context
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Design Guide
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Guiding Principles

- Provide for the **safety and mobility** of all users
- Incorporate the principles of **Context Sensitive Design** throughout the planning, design, and construction processes
- Provide a clear **Project Development Process**
Basic Design Controls

**Traditional AASHTO**
- Functional Classification
- Design Vehicles
- Traffic Characteristics
- Design Speed
- Highway Capacity
- Access Control

**New MassHighway**
- Roadway Context
- Roadway Users
- Transportation Demand
- Measures of Effectiveness
- Design Speed
Area Types

9 Area Types defined to compliment Roadway Types to aid with **Context** Sensitive Design
Roadway Users
Measures of Effectiveness

**Transportation Measures**
(for all users)
- Condition of facilities
- Safety and comfort
- Mode choice
- Network connectivity
- User population
- Traditional LOS
  - Travel time
  - Congestion
  - Specific measures elsewhere

**Other Measures**
- Environment preservation
- Cultural resource preservation
- Community enhancement
- Economic development
- Aesthetics
- Environmental justice/equity
- Impact mitigation
  - Noise
  - Air Quality
  - Wildlife Habitat
Flexible Multimodal Accommodation Framework

- **Type 1:** Independent Accommodation
- **Type 2:** Partial Bicycle/MV Sharing
- **Type 3:** Bicycle/MV Sharing
- **Type 4:** Pedestrian/Bicycle Sharing
- **Type 5:** Shared by All Users
Examples of Flexibility in the Design Guide
## Design Speeds

### Exhibit 3-7
Design Speed Ranges (Miles per Hour)

<table>
<thead>
<tr>
<th>Area Type</th>
<th>Freeway</th>
<th>Arterials</th>
<th>Collectors</th>
<th>Local Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Major*</td>
<td>Minor</td>
<td>Major</td>
</tr>
<tr>
<td>Rural Natural</td>
<td>50 to 75</td>
<td>40 to 60*</td>
<td>35 to 60</td>
<td>30 to 60</td>
</tr>
<tr>
<td>Rural Developed</td>
<td>50 to 75</td>
<td>40 to 60*</td>
<td>35 to 60</td>
<td>30 to 60</td>
</tr>
<tr>
<td>Rural Village</td>
<td>N/A</td>
<td>30 to 45</td>
<td>30 to 40</td>
<td>25 to 40</td>
</tr>
<tr>
<td>Suburban Low Intensity</td>
<td>50 to 75</td>
<td>30 to 60*</td>
<td>30 to 55</td>
<td>30 to 55</td>
</tr>
<tr>
<td>Suburban High Intensity</td>
<td>50 to 75</td>
<td>30 to 50*</td>
<td>30 to 50</td>
<td>25 to 50</td>
</tr>
<tr>
<td>Suburban Town Center</td>
<td>N/A</td>
<td>25 to 40</td>
<td>25 to 40</td>
<td>25 to 40</td>
</tr>
<tr>
<td>Urban</td>
<td>50 to 75</td>
<td>25 to 50</td>
<td>25 to 40</td>
<td>25 to 40</td>
</tr>
</tbody>
</table>

N/A  Not Applicable
*A higher design speed may be appropriate for arterials with full access control*

Source: Adapted from A Policy on Geometric Design of Highways and Streets, AASHTO, 2004 – Chapter 3 Elements of Design
Comparison of Design Speeds

<table>
<thead>
<tr>
<th>Roadway Type (Based on 1997)</th>
<th>1997 Manual</th>
<th>2006 Guidebook</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Arterial (Level Terrain)</td>
<td>60 to 75 mph</td>
<td>40 to 60 mph</td>
</tr>
<tr>
<td>Urban Arterial</td>
<td>30 to 60 mph</td>
<td>25 to 50 mph</td>
</tr>
<tr>
<td>Rural Collector (Level Terrain)</td>
<td>60 mph</td>
<td>30 to 60 mph</td>
</tr>
<tr>
<td>Urban Collector</td>
<td>30 mph (minimum)</td>
<td>25 to 40 mph</td>
</tr>
</tbody>
</table>

- Additional flexibility provided in the Guidebook by further definition of Roadway and Area Types to reduce the ambiguity of “urban vs. rural” and terrain type
Ranges of Acceptable Lane and Shoulder Widths

Exhibit 6-12
Widths of Usable Shoulders (in Feet)

<table>
<thead>
<tr>
<th>Area Type</th>
<th>Freeways</th>
<th>Arterials**</th>
<th>Collectors**</th>
<th>Local Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Natural</td>
<td>10 to 12</td>
<td>4 to 12</td>
<td>4 to 10</td>
<td>2 to 8</td>
</tr>
<tr>
<td>Rural Developed</td>
<td>10 to 12</td>
<td>4 to 12</td>
<td>4 to 10</td>
<td>2 to 8</td>
</tr>
<tr>
<td>Rural Village</td>
<td>N/A</td>
<td>4 to 12</td>
<td>4 to 10</td>
<td>2 to 8</td>
</tr>
<tr>
<td>Suburban Low Density</td>
<td>10 to 12</td>
<td>4 to 12</td>
<td>4 to 10</td>
<td>2 to 8</td>
</tr>
<tr>
<td>Suburban High Density</td>
<td>10 to 12</td>
<td>4 to 12</td>
<td>4 to 10</td>
<td>2 to 8</td>
</tr>
<tr>
<td>Suburban Village/Town Center</td>
<td>N/A</td>
<td>4 to 12</td>
<td>4 to 10</td>
<td>2 to 8</td>
</tr>
<tr>
<td>Urban</td>
<td>10 to 12</td>
<td>4 to 12</td>
<td>4 to 10</td>
<td>2 to 8</td>
</tr>
</tbody>
</table>

* Last shoulders are required on Freeways and other divided roadways. See the AASHTO Green Book for last shoulder guidance.
** Shoulder widths less than the values shown above may be used if a design exception is obtained (See Chapter 2 for a description of the design exception procedure). Situations where narrower shoulders may be considered are described below.

Exhibit 6-14
Range of Travel Lane Widths (in Feet)

<table>
<thead>
<tr>
<th>Area Type</th>
<th>Freeways</th>
<th>Arterials**</th>
<th>Collectors**</th>
<th>Local Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Natural</td>
<td>12</td>
<td>11 to 12</td>
<td>10 to 12</td>
<td>9 to 12</td>
</tr>
<tr>
<td>Rural Developed</td>
<td>12</td>
<td>11 to 12</td>
<td>10 to 12</td>
<td>9 to 12</td>
</tr>
<tr>
<td>Rural Village</td>
<td>N/A</td>
<td>11 to 12</td>
<td>10 to 12</td>
<td>9 to 12</td>
</tr>
<tr>
<td>Suburban Low Density</td>
<td>12</td>
<td>11 to 12</td>
<td>10 to 12</td>
<td>9 to 12</td>
</tr>
<tr>
<td>Suburban High Density</td>
<td>12</td>
<td>11 to 12</td>
<td>10 to 12</td>
<td>9 to 12</td>
</tr>
<tr>
<td>Suburban Village/Town Center</td>
<td>N/A</td>
<td>11 to 12</td>
<td>10 to 12</td>
<td>9 to 12</td>
</tr>
<tr>
<td>Urban</td>
<td>12</td>
<td>11 to 12</td>
<td>10 to 12</td>
<td>9 to 12</td>
</tr>
</tbody>
</table>

* Lane widths shown here are those recommended. See Chapter 2 for a description of the design exception procedure. Situations where narrower lanes may be considered are described below.
** Minimum lane widths are required for design speeds of 60-65 mph at or above.
*** N/A Not Applicable
Addenda provided some flexibility at the low end of the speed and volume range - minimum width of 30 feet for arterials (<55 mph and <400 vpd), and 20 feet for collector roads (<35 mph and <400 vpd), but these conditions rarely exist.
## Intersections
### Multimodal LOS Balance

### Exhibit 6-11
Level-of-Service Targets

<table>
<thead>
<tr>
<th></th>
<th>Pedestrian</th>
<th>Bicycle</th>
<th>Motor Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Center</td>
<td>A-C</td>
<td>C-E</td>
<td>D-F or NA</td>
</tr>
<tr>
<td>Urban Residential</td>
<td>A-C</td>
<td>B-D</td>
<td>C-E</td>
</tr>
<tr>
<td>Suburban Commercial</td>
<td>C-E</td>
<td>C-E</td>
<td>C-F or NA</td>
</tr>
<tr>
<td>Suburban Residential</td>
<td>B-B</td>
<td>A-C</td>
<td>C-D</td>
</tr>
<tr>
<td>Small Town, Village Center</td>
<td>A-C</td>
<td>A-C</td>
<td>C-D</td>
</tr>
<tr>
<td>Small Town, Village Residential</td>
<td>A-C</td>
<td>A-C</td>
<td>B-C</td>
</tr>
<tr>
<td>Rural Settlement (Crossroads, Residential)</td>
<td>A-B</td>
<td>A-C</td>
<td>A-C</td>
</tr>
<tr>
<td>Rural Open Space</td>
<td>A-B</td>
<td>A-C</td>
<td>A-C</td>
</tr>
</tbody>
</table>

NA: Level-of-service criteria may not apply in dense urban or suburban commercial centers.
Design Exceptions
Results
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