Overview

1. Why a new Guidebook now?
2. Who will use this?
3. What is the general approach
4. Examples of recommended design standards
5. Cross Sections
6. Implementation
Why Now?

1. Road design for whom?
2. Change in vehicle types
3. What is a win-win approach?
4. Length of time to change rules and regulations
Why a new Guide now?

- Massachusetts guide for Neighborhood Roads to create model guidelines and match local settings.
- This is called “context sensitive” design.
- Other road design manuals don’t get at local streets very well.
Who might use the Guidebook?

There are many “actors” in Transportation Design

- Engineers and designers (private and public sectors)
- Applicants who are building new infrastructure as part of their projects;
- Planning Directors/Planners;
- Planning Boards, Board of Selectmen, Fire and Emergency Service providers;
- Regional Planning Associations – link to state funding and state projects;
- Abutters;
- Land use and environmental advocates; and
- Finally – build roads that benefit the USERS
What kind of Guidebook?

Project Goals

- Reduce environmental impacts of roadway development, operation and maintenance;
- Encourage Context Sensitive Solutions (CSS) in residential roadway design;
- Provide specific guidelines and references for municipal application;
- Promote innovative techniques for stormwater management; and
- Reduce maintenance costs of roadways and stormwater systems.
What kind of Guidebook?

Project Goals (contin.)

- Encourage consistency in approach and rationale in residential roadway design across Massachusetts;
- Promote inter-connectivity of roads;
- Promote pedestrian and non-motorized access;
- Promote universal accessibility; and
- Provide guidance for the design of neighborhood scale residential roads.
Shared knowledge base

- Emphasize context specific design, but encourage local jurisdictions to start from joint approach to road design
- Provide local government staff with information so that local regulations can be updated based on:
  - Other jurisdictions experience and models
  - Proven scientific research
  - Balanced approach
- Encourage local government staff and boards to work together to design new road standards
Connected street system where possible

- Allow large emergency equipment access to all homes
- Insure appropriate speed and volume on all streets
- Design roads with width to allow motorists to pull over and be passed by emergency responders; and
- Give responders enough room for “incident deployment” (generally 16-20 feet).
“Local requirements should be used to determine the cross-section required for these roadways. On some low-volume local roads in residential areas, shared streets that do not allow motor vehicles to pass simultaneously are acceptable.”

Source: Mass Highway 2006 Highway Design Manual (p. 5-35)
Guidebook: Principles & Approach

- Reach broad environmental goals
  - Improve water quality by reducing impervious surfaces and stormwater runoff (LID)
  - Encourage alternative means of travel. A connected street network, accommodations for bikes and pedestrians, and contextual road design can decrease Vehicle Miles Traveled (VMT) by encouraging walking and reducing the length of vehicle trips.
Helpful Tools

- Guiding Principles for when and how to choose design alternatives
- Illustrations and findings from other jurisdictions
- Summary of scientific research
- Examples and case studies
- Extensive resource guide for additional information
  - Glossary of defined terms
## Residential Road Design Standards

<table>
<thead>
<tr>
<th>Design Speed</th>
<th>Cul-de-sac Design</th>
<th>Utilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Offsets</td>
<td>Turnaround Dimensions and Design</td>
<td>Residential “Loading Areas”</td>
</tr>
<tr>
<td>Minimum Centerline Offsets</td>
<td>Common Driveway Guidelines</td>
<td>Road Lighting</td>
</tr>
<tr>
<td>Tangents between Reverse Curves</td>
<td>Grade</td>
<td>Street Trees</td>
</tr>
<tr>
<td>Sidewalks and Pedestrian Easements</td>
<td>Design Vehicle</td>
<td>Road Location</td>
</tr>
<tr>
<td>Turning Radii at Intersections</td>
<td>Low Impact Development (LID) and Stormwater Management</td>
<td>Traffic Calming Measures</td>
</tr>
</tbody>
</table>
Guiding Principles

- Reduce speeds on neighborhood roads.
- When Design Speed is lower, roads may be designed with tighter curves, shorter Stopping Sight Distances (SSD), and narrower widths.
- SSD is the distance traveled while the driver understands it is necessary to stop, applies the brake, and comes to a stop.

Supporting Information

- The posted speed limit is different from Design Speed. Massachusetts General Laws (MGL) Ch. 90 s. 17 & 18 set speed limits for thickly settled areas.
- Speed Limits for existing roads may not be reduced without support from engineering studies.
- However, neither of these sections specifically addresses establishment of speed limits for new roads.
- Design and sign speeds of less than 25 miles per hour for new local roads that are based on design speeds of 15 to 20 miles per hour.

<table>
<thead>
<tr>
<th>Type of Road</th>
<th>Design Speed</th>
<th>Stopping Sight Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alley or Lane</td>
<td>15 mph</td>
<td>80 feet</td>
</tr>
<tr>
<td>Narrow Road</td>
<td>20 mph</td>
<td>115 feet</td>
</tr>
<tr>
<td>Low volume, adjacent open space, topographic constraints</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium Road</td>
<td>20 mph</td>
<td>115 feet</td>
</tr>
<tr>
<td>Higher volume</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wide Road</td>
<td>25-30 mph</td>
<td>155 feet</td>
</tr>
<tr>
<td>Highest volume, more connectivity and adjacent distractions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Road Design Elements

3.7 Sidewalks and Pedestrian Easements

Guiding Principles

• Location of existing adjacent sidewalks;
• Grade and slope of roadway (avoid sidewalks on the bottom of slope to reduce puddles);
• Location of existing vegetation and above-ground utilities that will remain in place.

Supporting Information

• The Massachusetts Architectural Access Board (MA-AAB).
• The federal Americans with Disability Act (ADA) is a companion to the MA-AAB.
• AASHTO has a Guide for the Planning, Design and Operation of Pedestrian Facilities.
• Section 5.3 in MassDOT.

Source: Neighborhood Street Design Guidelines, Oregon Transportation and Growth Management Program.
Road Design Elements

3.7 Sidewalks and Pedestrian Easements

**Suggested Guidelines (partial)**

1. Sidewalks must be ADA and MA AAB compliant. Figure 11 illustrates common dimensions for wheelchairs and bicycles.
   a) Sidewalk width – 4 feet minimum (5 feet preferable).
   b) Cross slope - 1.8% typical (2% max)
   c) Slope of ramps - 7.5% typical (8% max.)
   d) Landings - 5’ x 5’ pad with a slope ≤ 1.8% typical (2% max.);
   e) Must have a physically detectable warning panel (refer to MassDOT drawing number E107.6.5)
   e) Carry sidewalk grade through residential driveway (refer to MassDOT drawing number E107.7.0)

2. Encourage a grass plot between roadway and sidewalk


Source: Neighborhood Street Design Guidelines, Oregon Transportation and Growth Management Program.
Road Design Elements

3.8 Turning Radii at Intersections

Guiding Principles

• Narrower, low speed and volume roads can have tighter curb radii both for pavement widths and right-of-way widths.
• Creates slower traffic movements and narrower pedestrian crossings.
• A larger curb radius, such as 30 feet or more, is easier for large vehicles to enter the road, but means a longer walk for pedestrians.

Suggested Guidelines

1. Curb radii: 20 feet minimum (may be up to 35 feet for narrower intersecting roads);
2. Right of way (ROW) radii: 30 feet minimum (accommodate pavement radii and 5 foot sidewalk);
3. If parking is allowed on the street, establish limits on parking near corners to provide additional room for large vehicles.
Road Design Elements

3.9 Cul de Sac Design

Guiding Principles

- The connected road network is of primary importance to a functioning and efficient road network.
- Limiting through connections increases trip length and discourages walking or biking unless there are pedestrian easements.
- Cul-de-sacs should be avoided and connected roads established where possible. In all cases, turnarounds must accommodate local public safety vehicles.

Suggested Guidelines

1. Cul-de-sacs should be discouraged unless site specific conditions such as existing development, environmental constraint (slope, wetland, riparian body, etc.) or other constraint (railroad right-of-way, and lot configuration), create practical needs for their use.

2. Encourage loop roads instead of cul-de-sacs.

Source: MAPC, Low Impact Development Principles, Techniques and Implementation,
**Suggested Guidelines (contin.)**

4. Incorporate LID measures such as vegetated islands.

5. Create pedestrian easements to allow non motor vehicle connection between dead end roads.

6. Maximum length: Consider public water and other firefighting/emergency response requirements. Measure the maximum length from the existing road entrance so if an existing dead end street is being extended the maximum length applies to the entire road.

7. Hammerhead turnaround should be permitted (30' minimum curb radii; 45' minimum center lane radii, head adequate for three point turn maximum, and accommodate local fire fighting vehicle).

Source: City of Fort Worth, Street Development standards
3.11 Common Driveways

**Guiding Principles**
- Common driveways allow access to more than one dwelling unit from a public road.
- Common driveways may be narrower and steeper than public roadways and may be preferable to minor roadways in situations where significant landscape features can be preserved.
- Many regulations encourage common driveways in lieu of more roadway designs that result in significant land clearing and construction effort.

**Supporting Information**
MassDOT section 15.2.3 and 527 CMR 10.03, requires a minimum of 18 feet clear width.

**Suggested Guidelines**
- Ask your fire chief, will s/he accept a common driveway less than 18 feet wide? Are there special circumstances that apply to a particular development that make a narrower driveway the better alternative?
- Use a common driveway for a maximum of two to six single family homes or choose a maximum number of lots, or maximum total square footage of dwelling area.
- Pavement width: 16 to 18 feet (must have a minimum of 18 feet clear per 527 CMR 10.03).
- Gravel pavement is acceptable.
- Grade: 12 percent (can increase to 15 percent depending on existing topography). Maintain 100’ SSD.
- Centerline Alignment: 50 feet minimum center line radius (maintain 80 foot SSD).
- Drainage: LID swales recommended as described in Section 3.14.
Guiding Principles

• Traffic calming may be a part of the mitigation measures that can be applied to existing roads near new development.
• Traffic calming is an important part of retrofitting existing neighborhoods to keep the atmosphere human scaled as opposed to vehicle scaled.
• There are no “standards” for this section. Traffic calming should be reviewed on a case by case basis.

Supporting Information

• Vehicle speed is more critical than volume in terms of safety and should be addressed first where there are constraints.

• Neighborhood involvement is important to successful implementation. Rationale for traffic-calming and management measures should be explained clearly to community residents and installation of these treatments should incorporate public input.

(Source: City of Seattle)
Suggested Guidelines

1. Traffic-calming and management measures should fit into, and preferably enhance, the street environment.

2. Traffic-calming designs should be predictable and easy to understand by drivers and other users.

3. Devices that meet multiple goals are usually more acceptable. For example, a raised crosswalk may be more understandable to motorists than a speed hump. The former has a clear goal, whereas the latter may be perceived as a nuisance.

4. Treatments need to be well designed and based on current available information on their applications and effects. Information on U.S. experiences with various traffic-calming measures can be found in ITE.

5. Devices should accommodate emergency vehicles. Emergency response times shall be considered.
6. Traffic-calming areas or facilities should be adequately signed, marked, and lit to be visible to motorists.

7. Treatments need to be spaced appropriately to have the desired effect on speed — too far apart and they will have a limited effect, too close and they will be an unnecessary cost and annoyance. Devices usually need to be spaced about 300 to 500 feet apart. If they are spaced too far apart, motorists may speed up between them. This is particularly the case where the devices are added onto the street (e.g., speed humps).

Legend: Appropriate for Consideration (●) May be Applicable (●●)


<table>
<thead>
<tr>
<th>Traffic Calming Device</th>
<th>Typical Use</th>
<th>Residential Roads (non-arterial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curb bulbs</td>
<td>Pedestrian Crossing Conditions</td>
<td>●</td>
</tr>
<tr>
<td>On-street parking</td>
<td>Conditions Along Roads</td>
<td>●</td>
</tr>
<tr>
<td>(parallel and angle)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Streetscape</td>
<td>Conditions Along Roads</td>
<td>●</td>
</tr>
<tr>
<td>improvements (street</td>
<td></td>
<td></td>
</tr>
<tr>
<td>trees, lighting,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>street furniture,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>special paving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>treatments)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs</td>
<td>Managing Traffic</td>
<td>●</td>
</tr>
<tr>
<td>Speed cushions</td>
<td>Managing Traffic</td>
<td>●●</td>
</tr>
<tr>
<td>(for 25 mph or below)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gateway treatments</td>
<td>Pedestrian Crossing Conditions</td>
<td>●</td>
</tr>
<tr>
<td>Neighborhood speed</td>
<td>Managing Traffic</td>
<td>●</td>
</tr>
<tr>
<td>watch program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited access</td>
<td>Managing Traffic</td>
<td>●</td>
</tr>
<tr>
<td>All-way stop</td>
<td>Managing Traffic</td>
<td>●</td>
</tr>
<tr>
<td>Chicanes</td>
<td>Managing Traffic</td>
<td>●</td>
</tr>
<tr>
<td>Chokers</td>
<td>Managing Traffic</td>
<td>●</td>
</tr>
<tr>
<td>Diverters</td>
<td>Managing Traffic</td>
<td>●</td>
</tr>
<tr>
<td>Partial road closure</td>
<td>Managing Traffic</td>
<td>●</td>
</tr>
<tr>
<td>Pedestrian districts</td>
<td>Pedestrian Crossing Conditions</td>
<td>●</td>
</tr>
<tr>
<td>(woonerfs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed humps</td>
<td>Managing Traffic</td>
<td>●</td>
</tr>
<tr>
<td>Traffic circles</td>
<td>Managing Traffic</td>
<td>●</td>
</tr>
</tbody>
</table>
Guiding Principles
Street trees and vegetated areas should be part of all neighborhood roads. Encourage the retention of existing vegetation if they allow it to count towards the required site landscaping percentages. Trees and vegetation absorb carbon dioxide and help to improve air quality.

Supporting Information
- Studies have shown the following air quality benefits of urban trees:
  - A 60 percent reduction in road level particulates on tree-lined roads vs. roads with no trees
  - Reduction in nitrogen dioxide, sulfur dioxide, carbon monoxide, cadmium, chromium, nickel and lead levels
  - A 50 percent reduction in noise.
- Source: Dr. Kim D. Coder, “Identified Benefits of Community Trees and Forests.”
- See also MassDOT Chapter 13.

**Suggested Guidelines**

1. **Tree Spacing**: Trees should be installed every 40 feet along both sides. Spacing can be increased where trees are retained within the ROW and within the roadside area (generally 20 feet adjacent to ROW limits). Retained vegetation should count towards landscaping and street tree requirements.

2. **Tree Location**: Trees should be installed within the ROW or within the roadside area. If street trees are not within the ROW, then they should be within an easement that allows for municipal tree trimming.

3. **Tree Variety**: A variety of native deciduous or coniferous (locality driven) plants should be used. Invasive species that are listed on the [Massachusetts Invasive Plant List](https://www.marylandinvasivespecies.net/invasive-preservation/pdf/Plant-List.pdf) should be prohibited.

4. **Tree Size**: Trees should be properly sized and stabilized by guyed wires to ensure vigor.

5. **Vegetation in stormwater bio swales** and shrubs in cul-de-sac islands should count towards the street tree requirement.

6. **Consider using a tree box** also called a tree filter box (Figure 20) where site constraints would affect tree growth or there is concern about root damage to subdivision improvements such as sidewalks.
Construction Standards

1. Depth standards
2. Sidewalks
3. Alternative & Permeable pavement
4. Erosion Control Plans
5. Operations and Maintenance of Low Impact Development
## Summary of Road Types

**Table 5: General Parameters for Residential Road Design**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Single Use Residential Wide</th>
<th>Single Use Residential Medium</th>
<th>Single Use Residential Narrow</th>
<th>Single Use Residential Alley</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traveled Way</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical ADT</td>
<td>4,999 &lt; 1,500</td>
<td>1,499 &lt; 400</td>
<td>399 &lt; 0</td>
<td>100 &lt; 0</td>
</tr>
<tr>
<td>Design speed</td>
<td>25-30 mph</td>
<td>20 mph</td>
<td>20 mph</td>
<td>15 mph</td>
</tr>
<tr>
<td>Operating Speed</td>
<td>20-25 mph</td>
<td>20 mph</td>
<td>15-20 mph</td>
<td>15-20 mph</td>
</tr>
<tr>
<td>Number of Through Lanes</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Lane Width</td>
<td>10-12 feet</td>
<td>10-12 feet</td>
<td>10 feet</td>
<td>9-10 feet</td>
</tr>
<tr>
<td>Shoulder</td>
<td>2 feet</td>
<td>2 feet</td>
<td>2 feet</td>
<td>2 feet</td>
</tr>
<tr>
<td>Bike Lanes</td>
<td>Shared road Or 6 feet wide</td>
<td>Shared road</td>
<td>Shared road</td>
<td>Shared road</td>
</tr>
<tr>
<td>Utility Easement Width</td>
<td>---</td>
<td>----</td>
<td>10 feet</td>
<td>10 feet</td>
</tr>
<tr>
<td>Range of ROW Width</td>
<td>40-50 feet</td>
<td>36-40 feet</td>
<td>33-36 feet</td>
<td>20 feet</td>
</tr>
<tr>
<td><strong>Roadside</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desirable Roadside Width</td>
<td>5.5-12 feet</td>
<td>5.5-10 feet</td>
<td>5.5 feet</td>
<td>None</td>
</tr>
<tr>
<td>(pedestrian, swale, and planting strip)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grass Plot/Planting Strip</td>
<td>0-6 feet</td>
<td>0-6 feet</td>
<td>0-6 feet</td>
<td>None</td>
</tr>
<tr>
<td>Minimum Sidewalk Width</td>
<td>4 feet one side ok</td>
<td>4 feet / Shared road</td>
<td>Shared road</td>
<td>Shared road</td>
</tr>
<tr>
<td>Street Lighting</td>
<td>At intersections and pedestrian scale lighting at residential driveways.</td>
<td>At intersections and pedestrian scale lighting at residential driveways.</td>
<td>At intersections and pedestrian scale lighting at residential driveways.</td>
<td>At intersection with road</td>
</tr>
<tr>
<td><strong>Intersections</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic control</td>
<td>Stop signs, 4-way yield</td>
<td>4-way yield</td>
<td>4-way yield</td>
<td>Yield exiting alley</td>
</tr>
<tr>
<td>Curb Radii</td>
<td>15-25 feet</td>
<td>15-25 feet</td>
<td>15-20 feet</td>
<td>15 feet</td>
</tr>
</tbody>
</table>

*Source: Format is adapted from the ITE CSS Table 11.3 General Parameters for Vehicle Mobility Priority Collectors, the guidelines are derived by the authors.*
Wide Road

NOTES:
1. LEFT SIDE DEPICTS 3" REVEAL BERM (CAPE COD OR MASSDOT TYPE A). RIGHT SIDE DEPICTS 6" REVEAL CURB (MASSDOT TYPE 3 OR VERTICAL CURB).
2. 2' WIDE SHOULDER AND DRAINAGE SWALE MAY BE USED IN LIEU OF CURB OR BERM. IN SUCH INSTANCES, UNDERGROUND UTILITIES MAY REQUIRE EASEMENT BEYOND RIGHT-OF-WAY.
3. SIDEWALK(S) MAY BE LOCATED ON EITHER SIDE OF RIGHT-OF-WAY. 6" REVEAL CURB REQUIRED WHERE SIDEWALK IS LOCATED ADJACENT TO TRAVELED WAY.
4. GRAVEL BASE TO BE MASSDOT M1.03.0 TYPE B OR M1.03.1. DEPTH TO BE 12" (MIN.) FOR GOOD SUBSOIL CONDITIONS AND 18" (MIN.) FOR POOR SUBSOIL CONDITIONS.

50' RIGHT-OF-WAY WIDE ROAD SECTION
Medium Road

NOTES:
1. LEFT SIDE DEPICTS 3" REVEAL BERM (CAPE COD OR MASSDOT TYPE A). RIGHT SIDE DEPICTS 6" REVEAL CURB (MASSDOT TYPE 3 OR VERTICAL GRANITE).
2. 2' WIDE SHOULDER AND DRAINAGE SWALE MAY BE USED IN LIEU OF CURB OR BERM. IN SUCH Instances, UNDERGROUND UTILITIES MAY REQUIRE EASEMENT BEYOND RIGHT-OF-WAY.
3. SIDEWALK(S) MAY BE LOCATED ON EITHER SIDE OF RIGHT-OF-WAY.
4. 6" REVEAL CURB REQUIRED WHERE SIDEWALK IS LOCATED ADJACENT TO TRAVELED WAY.
5. GRAVEL BASE TO BE MASSDOT M1.03.0 TYPE B OR M1.03.1. DEPTH TO BE 8" (MIN) FOR GOOD SUBSOIL CONDITIONS AND 12" (MIN) FOR POOR SUBSOIL CONDITIONS.
Bio Swale. A man made vegetated swale designed to capture, infiltrate, and clean stormwater. These drainage features usually runs parallel to the road.

Implementation: from Guidebook to Reality

Changes in regulation can change this

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