
# DM-2 Multimodal Traffic Calming Chapter

Source: Kittelson & Associates, Inc.

## TRANSPORTATION ENGINEERING AND SAFETY CONFERENCE

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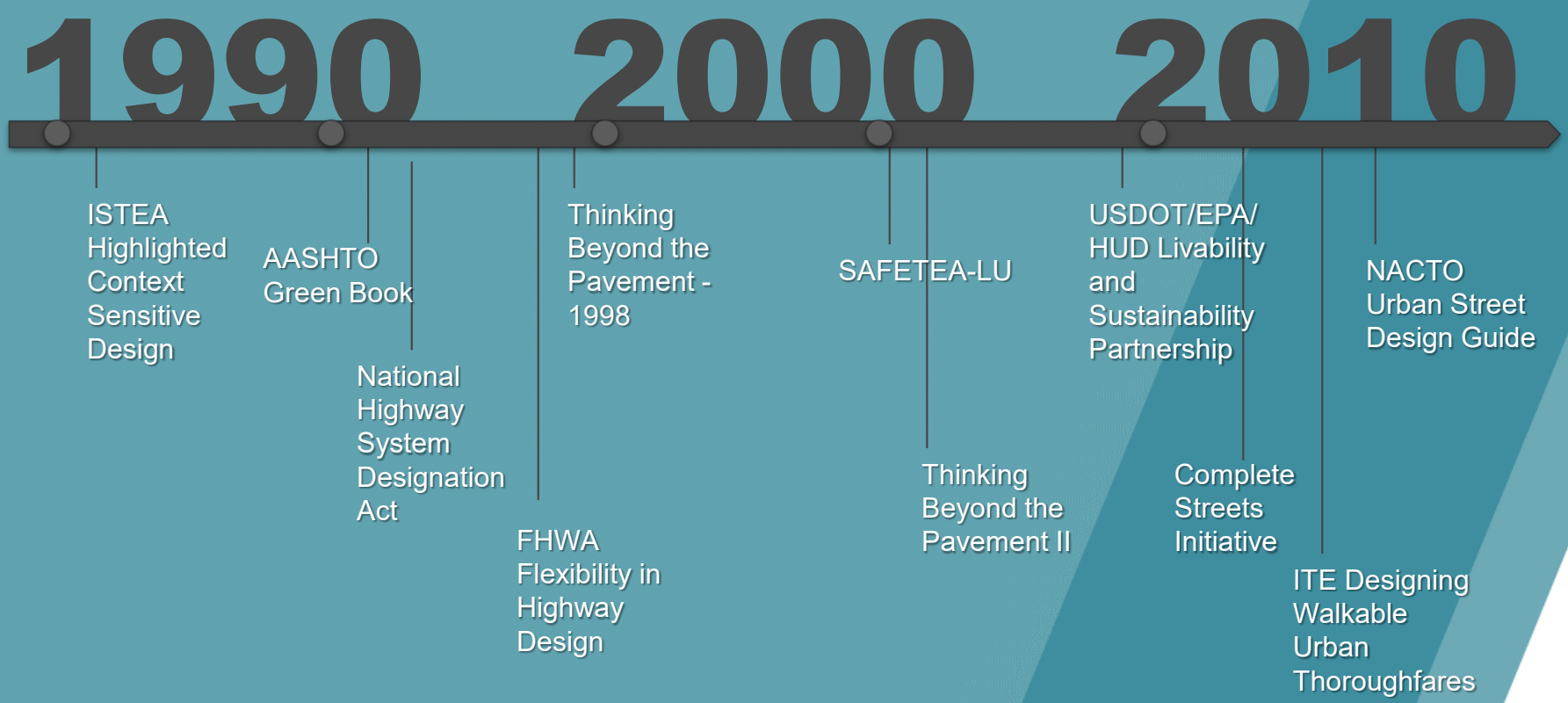
KITTELSON & ASSOCIATES

# Agenda

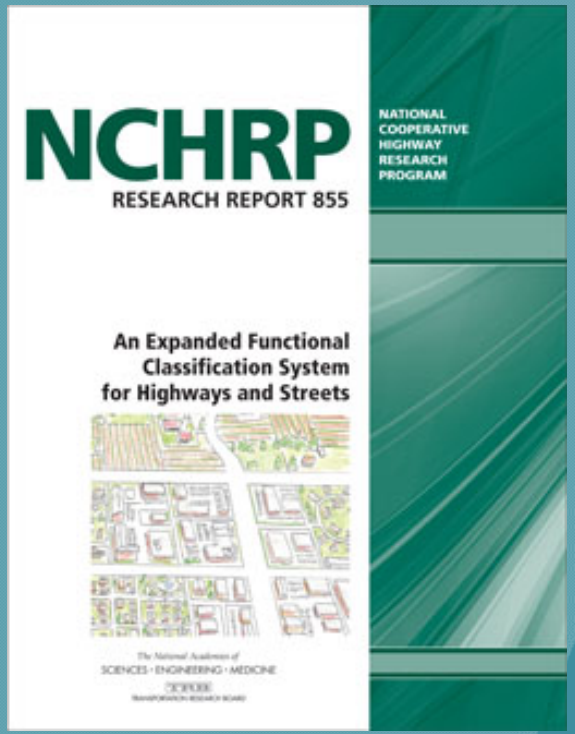
- Background/ Traffic Calming Trends
- Design Manual 2 Updates
- Traffic Calming Chapter
  1. Project Overview
  2. Chapter Outline
  3. Decision Matrix
  4. Toolbox Example
  5. TE Form
  6. Implementation Flow Chart

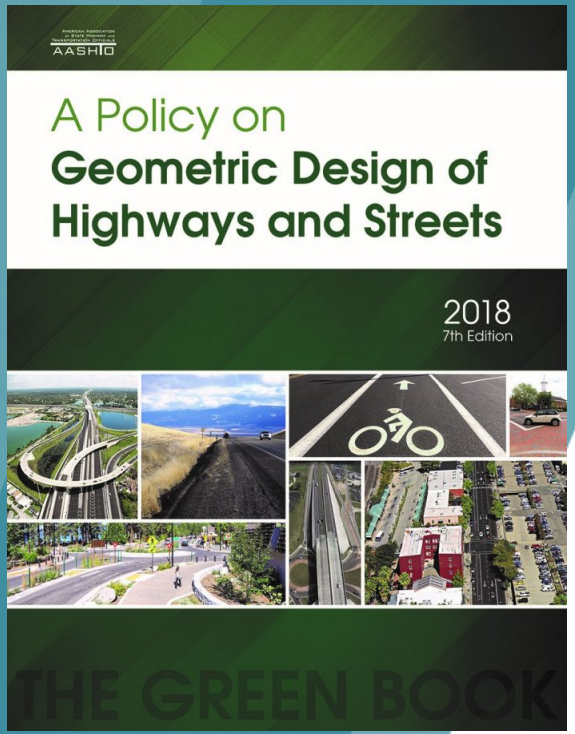
# Background


1990
2000
2010
ISTEA Highlighted Context Sensitive Design
AASHTO Green Book
National Highway System Designation Act
FHWA Flexibility in Highway Design
Thinking Beyond the Pavement - 1998
SAFETEA-LU
Thinking Beyond the Pavement II
USDOT/EPA/ HUD Livability and Sustainability Partnership
Complete Streets Initiative
ITE Designing Walkable Urban Thoroughfares
NACTO Urban Street Design Guide

# Background


NCHRP
REPORT 785
NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM
Performance-Based Analysis of Geometric Design of Highways and Streets
TRANSPORTATION RESEARCH BOARD


NCHRP
RESEARCH REPORT 855
NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM
An Expanded Functional Classification System for Highways and Streets
SCIENCES · ENGINEERING · MEDICINE


AASHTO
A Policy on
Geometric Design of Highways and Streets
2018
7th Edition
THE GREEN BOOK

# Traffic Calming Trends

- Moving away from 85th percentile speed as primary/only warrant
- Prioritizing areas with vulnerable populations
- Evaluating traffic calming treatments for more than speed management
- Accommodating needs of emergency vehicles and buses

# Design Manual 2 Updates

- Design for context and flexibility
- Identify relationship to roadway functional classification and users
- Transportation System Goals
  - Enable safe, convenient, and comfortable travel for all users
  - Improve network connectivity for all modes and address gaps
  - Focus on providing access to key destinations
  - Align project designs with goals articulated in state, regional, and local plans

# Design Manual 2 Updates

| Chapter | | |
|---|---|---|
| | Preface | Design Guidance |
| 1 | Context-Based Design | |
| 2 | Design Controls | |
| 3 | New Construction and Reconstruction Projects | Project Type Specifics |
| 4 | 3R and Pavement Preservation Projects | |
| 5 | Bridge Projects | |
| 6 | Interchanges | Design Details |
| 7 | Intersections and Driveways | |
| 8 | Road Diet | |
| 9 | Maintenance and Protection of Traffic | |
| 10 | Drainage | |
| 11 | Erosion and Sedimentation Control | |
| 12 | Guide Rail, Median Barrier, and Roadside Safety Devices | |

| Chapter | | |
|---|---|---|
| 13 | Pedestrian Facilities | Modal Considerations |
| 14 | Bicycle Facilities | |
| 15 | Transit Facilities | |
| 16 | Freight Facilities | |
| 17 | Plain People Community Considerations | |
| 18 | Traffic Calming | Additional Topics |
| 19 | Parking | |
| 20 | Lighting | |
| 21 | Wildlife Crossings | |
| 22 | Landscape Planting | |
| 23 | Emergency Escape Ramps | |
| 24 | Rest Areas and Welcome Centers | |

# Traffic Calming Chapter

1. **Project Overview**
2. Chapter Outline
3. Decision Matrix
4. Toolbox Example
5. TE Form
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# Project Overview

- Chapter Objectives
  - Can be applied across the Commonwealth
  - Context-Based
    - Rural, Rural Town, Suburban, Urban, and Urban Core
  - Intentionally flexible with appropriate guidance
  - Streamline the implementation process

# Project Overview

- Outreach
  - District 6-0 / City of Philadelphia / DVRPC
  - District 11-0 / Pittsburgh / SPC
  - Additional outreach prior to CT
- Chapter Materials
  - Decision Matrix (2)
  - Toolbox of Measures
  - Traffic Engineering Form
  - Implementation Flow Chart

# Traffic Calming Chapter

1. Project Overview
2. **Chapter Outline**
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# Chapter Outline

1. Introduction
2. Traffic Calming Applicability
3. Multimodal Traffic Calming Considerations
4. Traffic Calming Measures and Design Guidelines
5. Use of Signs and Pavement Markings
6. Traffic Calming Study and Approval Process

# Traffic Calming Chapter

1. Project Overview
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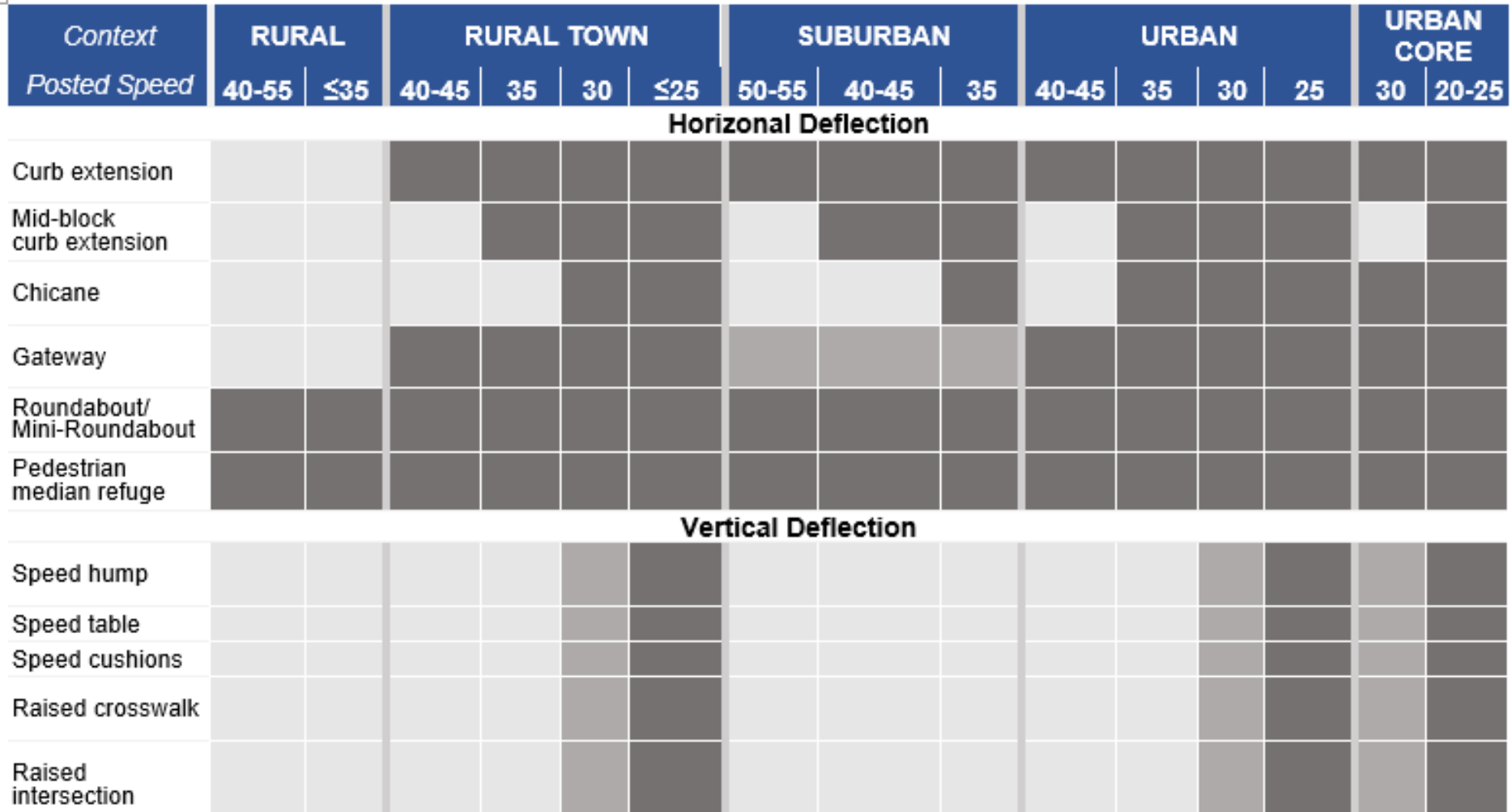
# Decision Matrix

| INTENDED OUTCOME OF TRAFFIC CALMING IMPLEMENTATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Traffic Calming Solution* | *Reduce Vehicular Operating Speeds* | *Reduce Vehicular Crash Severity and Frequency* | *Increase Safety of Vulnerable Users* | | | | | | | *Enhance Multimodal Connectivity and Access* |
| | | | *Reduce Crossing Distance* | *Decrease Pedestrian Exposure* | *Increase Pedestrian Safety and Comfort* | *Reduce Conflict Points* | *Improved Visibility of Pedestrians* | *Improve Line of Sight for Pedestrians* | | |
| **Horizonal Deflection** | | | | | | | | | | |
| Curb extension | | | ■ | ■ | ■ | | ■ | ■ | | ■ |
| Mid-block curb extension | | | | | | | | | | |
| Chicane | ■ | | | | | | | | | |
| Gateway | ■ | | | | ■ | | | | | |
| Roundabout | ■ | ■ | | | | ■ | | | | |
| Pedestrian median refuge | | | ■ | ■ | ■ | ■ | ■ | ■ | | |
| **Vertical Deflection** | | | | | | | | | | |
| Speed hump | ■ | ■ | | | ■ | | | | | |
| Speed table | ■ | ■ | | | ■ | | | | | |
| Speed cushions | ■ | ■ | | | ■ | | | | | |
| Raised crosswalk | ■ | ■ | | | ■ | | ■ | ■ | | |
| Raised intersection | ■ | | ■ | | ■ | | ■ | ■ | | |

# Decision Matrix

| INTENDED OUTCOME OF TRAFFIC CALMING IMP | | | | | | |
|---|---|---|---|---|---|---|
| | | | *Increase Safety of Vuln* | | | |
| *Traffic Calming Solution* | *Reduce Vehicular Operating Speeds* | *Reduce Vehicular Crash Severity and Frequency* | *Reduce Crossing Distance* | *Decrease Pedestrian Exposure* | *Increase Pedestrian Safety and Comfort* | *Redu Conf Poin* |
| | | | **Horizonal Deflection** | | | |
| Curb extension | | | ■ | ■ | ■ | |
| Mid-block curb extension | | | | | | |
| Chicane | ■ | | | | | |
| Gateway | ■ | | | | ■ | |
| Roundabout | ■ | ■ | | | | ■ |
| Pedestrian median refuge | | | ■ | ■ | ■ | ■ |

# Decision Matrix



# Decision Matrix

| *Context* / *Posted Speed* | URBAN 40-45 | URBAN 35 | URBAN 30 | URBAN 25 | URBAN CORE 30 | URBAN CORE 20-25 |
|---|---|---|---|---|---|---|
| Curb extension | | | | | | |
| Mid-block curb extension | | | | | | |
| Chicane | | | | | | |
| Gateway | | | | | | |
| Roundabout/ Mini-Roundabout | | | | | | |
| Pedestrian | | | | | | |

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# Toolbox

- **Horizontal Deflection**
  - Curb Extension
  - Chicane
  - Gateway
  - Roundabout
  - Pedestrian Median Refuge
- **Vertical Deflection**
  - Speed Hump
  - Speed Cushion
  - Speed Table
  - Raised Crosswalk
  - Raised Intersection
- **Physical Obstruction**
  - Diagonal Diverter
  - Right-in/Right-out island
  - Raised Median through intersection
- **Signing and Pavement Markings**
  - Travel Lane Width
  - Bicycle Facilities
  - Lane and Parking Configuration Changes
  - Lane Reduction/Road Diet
- **Other**
  - Traffic Signal Timing/Phasing
  - Automated Enforcement
  - Leading Pedestrian Intervals
  - Intersection Control Spacing

# Toolbox

- *Description and Purpose*
- *Typical Application*
- *Example Photographs*
- *Advantages and Disadvantages*
- *Effectiveness*
- *Design Criteria*
- *Design Details*
- *Design Considerations/Context*
- *Additional Guidance and Research*

# Toolbox Example



### *6.2.2.2. Raised Crosswalk*

## DESCRIPTION AND PURPOSE

Raised crosswalks are a vertical traffic calming treatment similar to speed tables but applied at pedestrian crossing locations. Raised crosswalks elevate a crosswalk from street level to sidewalk level, and thereby improving visibility and awareness of pedestrians, reducing vehicle speeds, and improving pedestrian comfort and safety. Typical approach ramps are 5-7 feet with a top flattened width of 10 feet and a total length of 20-24 feet. Raised crosswalks combine the benefits of a speed hump with enhanced visibility for pedestrian crossings.

## TYPICAL APPLICATION

| | |
|---|---|
| **TRAFFIC VOLUMES** | Applicable on roadways with less than 10,000 ADT. |
| **SPEED:** | Acceptable on roadways with posted speed limits of 30 mph or less. Not appropriate where 85$^{th}$ percentile speeds are 45 mph or more. Should be located where the desired speed is 20-25 mph. |
| **STREET FUNCTIONAL CLASSIFICATION** | Appropriate on local streets except in rural contexts. May be appropriate on collector and arterial streets depending on context, including pedestrian activity, mixed land uses, building proximity to streets, and vehicle speeds and volumes. Additional analysis and |

# Toolbox Example

## ADVANTAGES AND DISADVANTAGES

| ADVANTAGES | |
|---|---|
| **May reduce vehicle travel speeds** | • Vertical deflection slows vehicles midblock or at intersections.<br>• Raised crosswalks installed in a series have proven the most effective at speed reduction. |
| **Manages Traffic Volumes** | • Can reduce cut-through traffic. |
| **Improve Pedestrian Safety** | • Reduces vehicle-pedestrian conflicts by providing better visibility for pedestrians and clearly demarcating crossing areas.<br>• Improves ADA accessibility by providing a level crosswalk.<br>• Proven to increase vehicles yielding for pedestrian crossings. |
| **May prevent or reduce illegal parking** | • Can prevent motorists from parking too close to an intersection or crosswalk. |
| **Limited Impact to Bicyclists** | • Raised crosswalks should not impact bicycle safety.<br>• A maximum street grade of 5% may be considered on high trafficked bicycle routes. |
| **Improves Motorist Yielding** | • Raised crosswalks have proven effective in improving motorist yield rates for crossing pedestrians. |

# Toolbox Example

| DISADVANTAGES | |
|---|---|
| **On-Street Parking Impacts** | • May result in the loss of one on-street parking at midblock locations. Unlikely to impact parking at intersections due to roadway design standards. |
| **Emergency response issues** | • Could cause delay for emergency vehicles if not designed appropriately.<br>• Raised crosswalks have shown less speed delay than traditional speed humps. |
| **Maintenance** | • May require more maintenance than traditional crosswalks. |
| **Drainage Impacts** | • Presence of existing drainage features could increase the cost of implementation due to drainage impacts. |
| **Snow removal** | • May impact snow removal efforts.<br>• Icing may be a problem if snow is not adequately removed. |
| **Noise** | • Potential noise impacts from vehicles braking and accelerating. |

# Toolbox Example

## DESIGN

| COUNTERMEASURE DESIGN FEATURES | TYPICAL DESIGN CRITERIA |
|---|---|
| **DIMENSIONS** | • Raised crosswalk should be three to six inches above street level.<br>• Approach ramps should be five to seven feet in width.<br>• Top crosswalk should have a minimum width of 10 feet.<br>• Total length of 20-24 feet. |
| **SPACING** | • Raised crosswalk spacing of 250-600 feet is recommended.<br>• Raised crosswalks should be located so vehicles cannot approach from high speeds. They may be located near other raised traffic calming devices, near stop-controlled intersections, or small-radius curves.<br>• Typically spaced five feet away from driveways. |
| **PAVEMENT MARKING** | • Raised crosswalk should be marked with paint and/or pavement markings that denote an elevated surface.<br>• Change in material or texture can be used to alert drivers and pedestrians of a crossing. |

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# TE Form

Sections to Note:

- Existing Facility Description
- Outreach Efforts
- Site Data – Documents context of site and justification/considerations for chosen traffic calming feature
- Recommendations Section

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# Implementation Flow Chart

1. Identify Issues
2. Determine Intended Outcomes
3. Preliminary Screening
4. Review Toolbox Criteria
5. Complete Engineering Form

# Questions?

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