PARISH OF ASCENSION
DEPARTMENT OF
TRANSPORTATION & ENGINEERING

# RESIDENTIAL AND PARISH WIDE TRAFFIC CALMING POLICIES AND PROCEDURES MANUAL


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**FINAL DRAFT**

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## 1.0 Purpose

The purpose of this manual is to provide Ascension Parish residents, community leaders, and Officials pertinent information and standardized administrative procedures for the evaluation and implementation of Traffic Calming Measures. While traffic calming measures are typically utilized to retrofit existing roadways and streets, the guidelines in this Manual can also be applied to qualifying new roadway facilities.

## 2.0 Introduction

The Federal Highway Administration has identified that Speed management is a significant challenge for most communities in the United States. This is particularly true for small, rural communities where the main roadway through the town serves a dual role. Outside the town, the roadway provides high-speed travel over long distances; within the built-up area, however, the same roadway accommodates local access, pedestrians of all ages, on-street parking, bicycles, and the many other features unique to the character of a community. This convergence of roadway purposes presents both an enforcement challenge for the community and a potential safety problem for the public.

Addressing the issue through law enforcement alone often leads to temporary compliance at a significant cost. A more permanent way to reinforce the need to reduce speed is to change the look and feel of the road by installing traffic calming treatments that communicate to drivers that the function of the roadway is changing. Traffic calming has been evaluated and used extensively within low-speed urban areas in the United States but less so in rural areas where driver expectations and traffic characteristics are different.

As Ascension Parish continues to grow and urbanize, the conflicts and challenges noted above have become more prevalent which has led to the need for the development of Traffic Calming policies and procedures. Traffic calming measures are typically limited to local roads with speed limits of 35 mph or less, however to a lesser degree some measures have been utilized on collector roads. This manual is intended to provide guidance regarding the selection of potential traffic calming measures for implementation on local residential streets and where applicable on Parish Routes. This manual is not intended to replace or supersede existing design policies and procedures, or supersede any current Federal, State, or local requirements.

The Federal Highway Administration (FHWA) and the Institute of Transportation Engineers (ITE) have recently collaborated to produce a Traffic Calming ePrimer. This ePrimer documents the results of several decades of traffic calming experience in the U.S. and provides the basis of many of the procedures being presented.

“Traffic calming measures are mainly used to address speeding and high cut-through traffic volumes on neighborhood streets. These issues can create an atmosphere in which non-motorists are intimidated, or even endangered, by motorized traffic. Additionally, high cut-through volumes become an increased concern when larger commercial vehicles are involved. Along with the additional amount of traffic generated within the neighborhood, cut-through motorists are often perceived as driving faster than local motorists. By addressing high speeds and cut-through volumes, traffic calming can increase both the real and perceived safety of pedestrians and bicyclists and improve the quality of life within the neighborhood. The evolution of traffic calming into complete streets also recognizes that traffic calming measures can include devices that enhance safety and mobility for bicyclists and pedestrians such as sidewalks, bike lanes and other non-motorized mode enhancements.” (Pennsylvania DOT Traffic Calming Handbook)

The ITE publication *Traffic Calming: State of the Practice* defines traffic calming as "the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users" in the interest of street safety, livability, and other public purposes. Traffic calming includes physical and visual measures, as well as enforcement and educational activities.

Traffic calming can help to increase the quality of life in urban, suburban, and rural areas by reducing automobile speeds and traffic volumes on neighborhood streets. FHWA states "The importance of reducing vehicle speeds cannot be overstated in an area where there is potential for conflict between a pedestrian and a motor vehicle. The slower the speed of the motor vehicle, the greater the chances are for survival for the pedestrian. If struck by a motor vehicle travelling at a speed of 20 miles per hour or less, a pedestrian is typically not permanently injured. If struck by a motor vehicle travelling at a speed of 36 miles per hour or more, a pedestrian is usually fatally injured (see Figure 2.1).

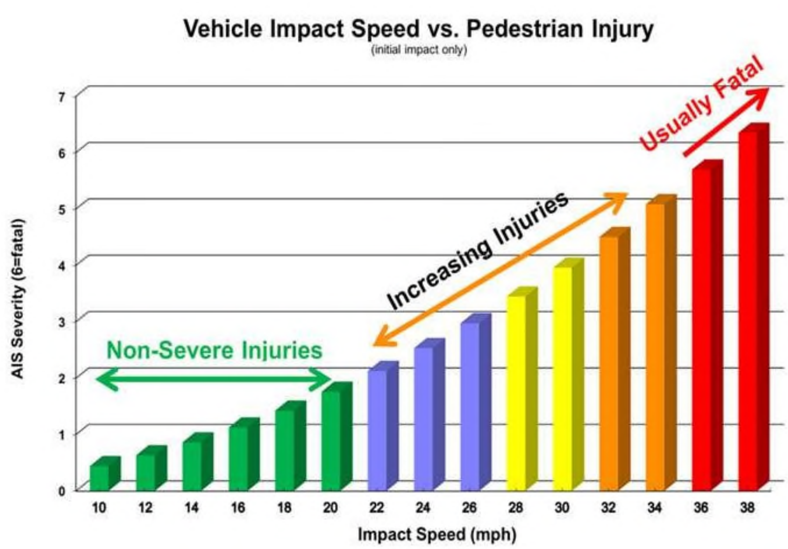



**Figure 2.1. Speed/Pedestrian Injury Severity Correlation**
(Source: FHWA Module 2-C. E. "Rick" Chellman)

Traffic issues can typically be defined as either Life Safety or Quality of Life. While traffic calming measure can be utilized to address life safety they are typically classified as quality of life. "Traffic calming involves trade-offs; finding a balance between the need to provide an efficient transportation network and maintaining a livable and safe environment for bicyclists, pedestrians, and other street or street- adjacent users. The challenge of traffic calming is selecting the appropriate measures and locations to reach that balance.

Often in neighborhood traffic calming, meeting the desires of the neighborhood residents is a challenge. Residents may want slower vehicle travel speeds through their neighborhoods, but mobility desires can be at odds with that goal. A traffic calming measure seen as necessary by some may be seen as a nuisance by others". (FHWA Mod 2)

The first step towards traffic calming is to contact the Ascension Parish Government. For traffic calming issues regarding the need for traffic studies, traffic safety, education, or engineering, contact the Department of Transportation & Engineering Call Center at (225) 450-1200. However, for traffic enforcement and life safety issues please contact the Ascension Parish Sheriff's Office at (225) 621-8300.

## 3.0 Traffic Calming Measures

"The role of physical measures in traffic calming has been emphasized because they are "self-policing". This means that traffic calming measures, such as speed humps and traffic circles, have the ability to slow motor vehicles in the absence of enforcement. On the other hand, traffic control devices, such as, weight limits and one-way streets; depend upon the level of police enforcement and the willingness of motorists to comply with the posted restrictions to be effective. Therefore, the use of traffic calming measures can often lead to a more certain accomplishment of the neighborhood's goals.

Traffic calming devices should not be confused with traffic control devices, which are outlined in the new Manual on Uniform Traffic Control Devices (MUTCD). Traffic control devices are all signs, signals, pavement markings, and other devices placed along roadways to guide and regulate the action of motorists on public roads. Traffic calming devices are used to strike a balance between vehicular traffic and everyone else who uses the streets through measures that are self-enforcing." (Pennsylvania DOT Traffic Calming Handbook)

Traffic calming measures are grouped within four categories: horizontal deflection, vertical deflection, street width reduction, and routing restriction. The category descriptions and some of the measures they include are presented below.

A **horizontal deflection** hinders the ability of a motorist to drive in a straight line by creating a horizontal shift in the roadway. This shift forces a motorist to slow the vehicle in order to comfortably navigate the measure. Types of horizontal deflections include:

- Lateral shift
- Chicane
- Realigned intersection
- Traffic circle, as illustrated in Figure 2.1
- Small modern roundabout and mini-roundabout
- Roundabout

**Figure 3.1. Horizontal Deflection Measure - Traffic Circle**
(Source: FHWA Module 1)

A **vertical deflection** creates a change in the height of the roadway that forces a motorist to slow down in order to maintain an acceptable level of comfort. Types of vertical deflections include:

- Speed cushion, as illustrated in Figure 3.2
- Speed table
- Offset speed table
- Raised crosswalk
- Raised intersection

**Figure 3.2. Vertical Deflection Measure – Speed Cushion**
(Source: FHWA Module 1-Jeff Gulden)

A **street width reduction** narrows the width of a vehicle travel lane. As a result, a motorist slows the vehicle in order to maintain an acceptable level of comfort and safety. The measure can also reduce the distance a pedestrian walks to cross a street, reducing exposure to pedestrian/vehicle conflicts. Types of street width reductions included:

- Corner extension (i.e., a curb extension at an intersection)
- Choker (i.e., a midblock curb extension)
- Median island, as illustrated in Figure 2.3
- On-street parking
- Road diet

**Figure 3.3. Street Width Reduction Measure - Median Island**
(Source: FHWA Module 1-Ken Sides)

A **routing restriction** prevents particular vehicle movements at an intersection and is intended to eliminate some portions of cut-through traffic. Types of routing restrictions include:

- Diagonal diverter
- Full closure
- Half closure, as illustrated in Figure 2.4
- Median barrier
- Forced turn island


**Figure 3.4. Routing Restriction Measure - Half Closure**
(Source: FHWA Module 1-Jeff Gulden)

The measures presented above are commonly used with the express purpose of supporting the livability and vitality of a residential or commercial area through an improvement in non-motorist safety, mobility, and comfort. Only measures that are self-enforcing and for which long-standing benefits have been measured are included for the lower speed residential streets. Where posted speed limits exceed 35mph many of the traditional traffic calming physical measures are not practical so signing, striping, and enforcement measure must be utilized.

In addition to the physical measures defined above an important element of Traffic Calming includes both Education and Enforcement. Educational elements are to remind speeding drivers of the negative effects and dangers of their actions especially as it relates to children. Communities requesting the implementation of traffic calming measures should include education campaigns including the use of brochures and neighborhood newsletters. These should include information on speeding fines, impacts in school zones, pedestrian and bicycle safety tips, and information obtained from the traffic studies such as traffic volumes and prevailing speeds in relation to posted speed limits.

Enforcement measures can include increased law enforcement presence, radar trailers, portable message signs, and detection cameras. While these measures can be effective, they provide temporary benefits while in place. Unfortunately, it is not practical to maintain the extended law enforcement presence that would be needed to permanently lower speeds.

# 4.0 Traffic Calming Tool Kit

## 4.1 Basic Elements

Guidance defines Basic Traffic Calming Elements as those traffic control devices and programs implemented on a day-to-day basis to regulate, warn, guide, inform, enforce and educate motorists, bicyclists and pedestrians. They include standard striping and signing elements as found in the Manual on Uniform Traffic Control Devices, local and state design standards, and minor roadway design elements to improve visibility and safety, enforcement by police, and safety education programs. Basic elements are used primarily in those areas where traffic impacts have been found not to be excessive or serious, but where traffic control and/or education has been determined to be appropriate.

Some common basic elements include:

| | |
|---|---|
| High Visibility Crosswalks | Traffic Signal Timing |
| Minor Bulb-Outs | Striping Changes |
| Warning Signs | Curb Markings |
| Stop Signs | Truck Restrictions |
| High Visibility Signs | Signed Turn Restrictions |
| Radar Trailer/ Radar Signs | Lighting Improvements |
| Police Enforcement | |

While these basic elements are commonly utilized traffic calming installations throughout the US, the FHWA has not included them in their ePrimer for reasons including: these basic elements would not be considered physical measures that are "self-policing". Many of these are standard traffic control measures typically used for improving traffic flow and has a secondary benefit for non-motorist safety. These measures typically produce only a temporary or short-lived benefit, requires enforcement, and has minimal or no measurable effect on vehicle speed or non-motorist safety.

## 4.2 Physical Measures

The traffic calming physical measures have been defined in section 2.2 above. The FHWA ePrimer Module 3 has compiled general facts and information regarding the most popular traffic calming measures and their potential applicability. The following table and ITE Fact Sheets provide:

1. A description of the measure and its general purpose,
2. An overview of the setting where each measure is appropriate,
3. A summary that highlights the key effects and issues associated with the measure that are essential to address, and
4. A sampling of additional key design considerations for the measure.

Table 4.1 presents a simplified summary of the potential applicability of each individual traffic calming measure and the likelihood of its acceptability for a particular setting. This table can be used as an initial screening tool to identify whether a particular traffic calming measure has a likely fatal flaw in terms of its overall applicability and acceptability. A more comprehensive assessment of measure applicability is presented below in the ITE fact sheets and in Appendix D and E.

**Table 4.1 Likelihood of Acceptable Traffic Calming Measures**

| | | Functional Classification | | | Street Function | |
|---|---|---|---|---|---|---|
| Traffic Calming Measure | Segment or Intersection | Thoroughfare or Major | Collector or Residential Collector | Local or Local Residential | Emergency Access | Transit Route |
| **Horizontal Deflection** | | | | | | |
| Lateral Shift | Segment | 3 | 5 | 5 | 5 | 5 |
| Chicane | Segment | 1 | 5 | 5 | 3 | 3 |
| Realigned Intersection | Intersection | 1 | 5 | 5 | 5 | 5 |
| Traffic Circle | Intersection | 1 | 3 | 5 | 3 | 3 |
| Mini-Roundabout | Intersection | 3 | 3 | 5 | 5 | 5 |
| Roundabout | Intersection | 5 | 3 | 1 | 5 | 5 |
| **Vertical Deflection** | | | | | | |
| Speed Cushion | Segment | 1 | 5 | 5 | 5 | 5 |
| Speed Table | Segment | 3 | 5 | 5 | 1 | 3 |
| Offset Speed Table | Segment | 3 | 5 | 5 | 5 | 3 |
| Raised Crosswalk | Both | 3 | 5 | 5 | 1 | 3 |
| Raised Intersection | Intersection | 3 | 5 | 5 | 3 | 3 |
| **Street Width Reduction** | | | | | | |
| Corner Extension | Intersection | 5 | 5 | 5 | 5 | 5 |
| Choker | Segment | 5 | 5 | 5 | 5 | 5 |
| Median Island | Both | 5 | 5 | 5 | 5 | 5 |
| On-Stree Parking | Segment | 5 | 5 | 5 | 5 | 5 |
| Road Diet | Both | 5 | 5 | 3 | 5 | 5 |
| **Routing Restriction** | | | | | | |
| Diagonal Diverter | Intersection | 1 | 3 | 3 | 1 | 3 |
| Half Closure | Intersection | 1 | 5 | 5 | 3 | 3 |
| Median Barrier | Intersection | 3 | 5 | 5 | 1 | 3 |
| Forced Turn Island | Intersection | 3 | 5 | 5 | 3 | 3 |

| Legend: | | |
|---|---|---|
| | 5 | Traffic Calming Measure May Be Appropriate |
| | 3 | Caution Traffic Calming Measure May Be Inappropriate |
| | 1 | Traffic Calming Measure is Likely Inappropriate |

# Traffic Calming Fact Sheets

May 2018 Update

## Introduction

**Purpose:**

The purpose of these fact sheets is to provide transportation practitioners, public agencies, and the general public general facts and information regarding the most popular traffic calming measures used today. ITE and the Federal Highway Administration (FHWA) recently produced a Traffic Calming ePrimer (web link shown below), which documents the results of several decades of traffic calming experience in the United States, presenting a thorough review of current traffic calming practices. These fact sheets summarize information presented in the ePrimer.

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Traffic Calming Measures Included:**

A **horizontal deflection** hinders the ability of a motorist to drive in a straight path by creating a horizontal shift in the roadway. This shift reduces the ability of a motorist to maintain speed while comfortably navigating the measure.

- Lateral shift
- Chicane
- Realigned Intersection
- Traffic Circle
- Small Modern Roundabout/Mini-Roundabout
- Roundabout

A **vertical deflection** creates a change in the height of the roadway that typically forces a motorist to slow down to maintain an acceptable level of comfort.

- Speed Hump
- Speed Cushion
- Speed Table
- Raised Crosswalk
- Raised Intersection

A **street width reduction** narrows the width of a vehicle travel lane or roadway, so a motorist likely needs to slow the vehicle to maintain an acceptable level of comfort and safety. The measure can also reduce the distance required for pedestrian crossings, reducing exposure to vehicular conflicts.

- Corner Extension/Bulb-Out
- Choker
- Median Island
- On-Street Parking
- Road Diet

A **routing restriction** prevents particular vehicle movements at an intersection and is intended to eliminate some portions of cut-through traffic.

- Diagonal Diverter
- Closure
- Median Barrier/Forced Turn Island

**Measures Not Included:**

A variety of other measures have been part of traffic calming efforts in jurisdictions throughout the United States. These measures are not included in these fact sheets for a variety of reasons, including:

- The measure is a standard traffic control measure typically used for improving traffic flow and has a secondary benefit for non-motorist safety
- The measure produces only a temporary benefit
- The measure requires additional enforcement beyond typical activities
- The measure has minimal or no measurable effect on vehicle speed or non-motorist safety

The excluded measures include:

- Signs
- Pavement Markings
- Gateways
- Corner Radius Reductions
- Textured Pavements and/or Rumble Strips
- Streetscaping/Landscaping

Although these fact sheets focus on mostly physical measures to calm traffic, non-physical measures can also be effective as part of traffic calming efforts. For example, education and enforcement efforts have long been used as part of neighborhood traffic calming programs and should continue to be considered as either supplements to self-enforcing physical means or as precursors to physical measures.

# 4.3 Horizontal Deflections

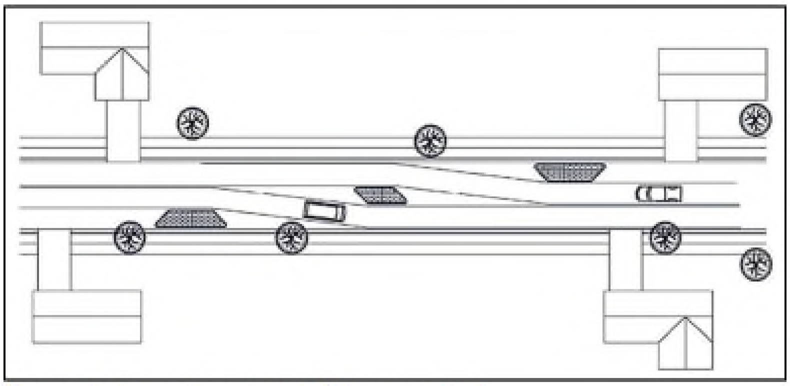
# Lateral Shift

**Description:**

- Realignment of an otherwise straight street that causes travel lanes to shift in at least one direction
- A chicane is a variation of a lateral shift that shifts alignments more than once

**Applications:**

- Appropriate for local, collector, or arterial roadways
- Appropriate for one-lane one-way and two-lane two-way streets
- Appropriate on roads with or without dedicated bicycle facilities
- Maximum appropriate speed limit is typically 35 mph
- Appropriate along bus transit routes


(Source: Delaware Department of Transportation)


(Source: Google Street View)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Typically separates opposing traffic through the shift with the aid of a raised median
- Applicable only to mid-block locations
- Can be installed on either open- or closed-section (i.e. curb and gutter) roads
- Location near streetlights preferred
- May require drainage feature relocation
- Should not require utility relocation

**Potential Impacts:**

- Without islands, motorists could cross the centerline to drive the straightest path possible
- No impact on access
- May require removal of some on-street parking
- Limited data available on impacts on speed, volume diversions, and crash risk
- Provides opportunities for landscaping
- Can provide locations for pedestrian crosswalks

**Emergency Response Issues:**

- Appropriate along primary emergency vehicle routes or on streets with access to hospitals/emergency medical services, provided vehicles can straddle the street centerline

**Typical Cost (2017 dollars):**

- Reported costs range between $8,000 and $25,000

# Traffic Calming Fact Sheets

May 2018 Update

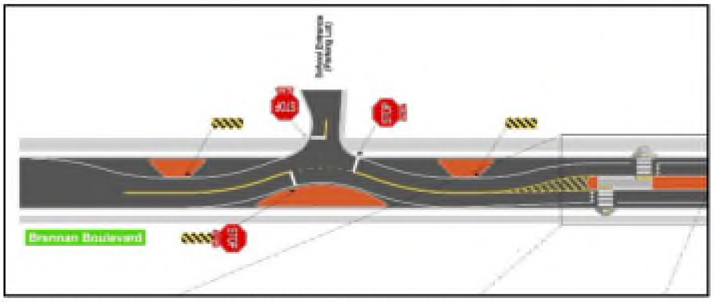
## Chicane

**Description:**

- A series of alternating curves or lane shifts that force a motorist to steer back and forth instead of traveling a straight path
- Also called deviations, serpentines, reversing curves, or twists

**Applications:**

- Appropriate for mid-block locations but can be an entire block if it is relatively short
- Most effective with equivalent low volumes on both approaches
- Appropriate speed limit is typically 35 mph or less
- Typically, a series of at least three landscaped curb extensions
- Can use alternating on-street parking from one side of a street to the other
- Applicable on one-lane one-way and two-lane two-way roadways
- Can be used with either open or closed (i.e. curb and gutter) cross-section
- Can be used with or without a bicycle facility




(Source: Delaware Department of Transportation)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Chicanes may still permit speeding by drivers cutting straight paths across the center line
- Minimize relocation of drainage features
- May force bicyclists to share travel lanes with motor vehicles
- Maintain sufficient width for ease of emergency vehicles and truck throughput

**Potential Impacts:**

- No effect on access, although heavy trucks may experience challenges when negotiating
- Limited data available on impacts to speed and crash risk
- Street sweeping may need to be done manually
- Minimal anticipated volume diversion from street
- May require removal of some on-street parking
- Provides opportunity for landscaping
- Unlikely to require utility relocation
- Not a preferred crosswalk location
- Bus passengers may experience discomfort due to quick successive lateral movements

**Emergency Response Issues:**

- Appropriate along primary emergency vehicle routes

**Typical Cost (2017 dollars):**

- Reported costs range between $8,000 and $25,000

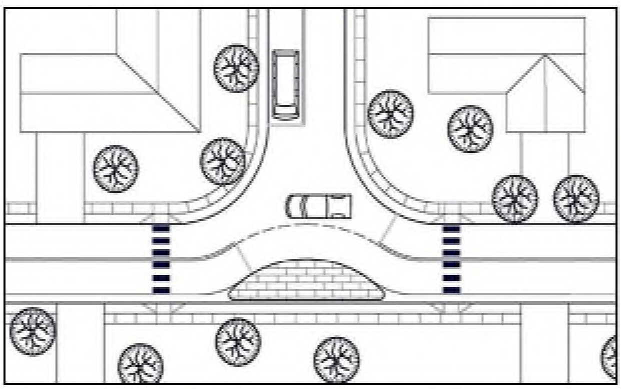
# Realigned Intersection

**Description:**

- Reconfiguration of an intersection with perpendicular angles to have skewed approaches or travel paths through the intersection
- Also called modified intersection

**Applications:**

- Appropriate for collector or local streets
- Most applicable at T-intersections
- Can be used where on-street parking exists
- Applicable on one-way and two-way roadways
- Most commonly installed on closed-section roads (i.e. curb and gutter)
- Can be applied with and without a dedicated bicycle facility
- Can be applied with or without on-street parking


(Source: Delaware Department of Transportation)

(Source: Delaware DOT)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Need to avoid relocating drainage features such as catch basins, concrete channels, valley gutters, inlets, and trench drains
- Bicyclists and motorists may have separate lanes or may share lanes at intersections
- Be cognizant of pedestrian crossing needs (e.g., ADA, wheelchair ramps at T-intersections)
- Default design vehicle SU-30
- Typical maximum speed limit of 25 mph
- May be appropriate for buses if adequate turning radii can be provided

**Potential Impacts:**

- Limited-to-no impact on access
- Minimal anticipated diversion of traffic
- Can result in speed reductions between 5 and 13 mph within intersection limits
- Provides opportunity for landscaping
- Can improve pedestrian safety
- Consider additional intersection lighting

**Emergency Response Issues:**

- Appropriate along an emergency vehicle route or on a street with access to hospital/emergency medical services
- Little impact on response time

**Typical Cost (2017 dollars):**

- Costs range between $15,000 and $60,000

# Traffic Calming Fact Sheets
May 2018 Update

A Community of Transportation Professionals

## Traffic Circle

**Description:**
- Raised islands placed in unsignalized intersections around which traffic circulates
- Approaching motorists yield to motorists already in the intersection
- Require drivers to slow to a speed that allows them to comfortably maneuver around them
- Approaches not designed to modern roundabout principals - no deflection

**Applications:**
- Appropriate at intersections of local streets
- One lane each direction entering intersection
- Not typically used at intersections with high volumes of large trucks or buses turning left
- appropriate for both one-way and two-way streets in urban and suburban settings


(Source: Scott Batson)


(Source: Scott Batson)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**
- Typically circular in shape but may be an oval shape
- Usually have landscaped center islands
- Recommend YIELD signs on all approaches
- Preferable for roadways to be closed-section (i.e. curb and gutter)
- Can be applied to roads with on-street parking
- Can be applied to roads both with and without dedicated bicycle facilities; bike lanes not striped in circulatory roadway
- Key design features include: offset distance (distance between projection of street curb and center island), lane width of circulatory roadway, circle diameter, and height of mountable apron for large vehicles

**Potential Impacts:**
- Minimal anticipated traffic diversion
- Bicyclist and motorists will share lanes at intersections because of narrowed roadway
- Large vehicles/buses usually not able to circulate around center island for left turns
- Landscaping needs to be designed to allow adequate sight distance, per AASHTO
- Minimize routing of vehicles through unmarked crosswalks on side-streets
- May require additional street lighting

**Emergency Response Issues:**
- Emergency vehicles maneuver intersections at slow speeds
- Constrained turning radii typically necessitates a left turn in front of the circle for large vehicles

**Typical Cost (2017 dollars):**
- Typical cost is $15,000, with a range between $10,000 and $25,000

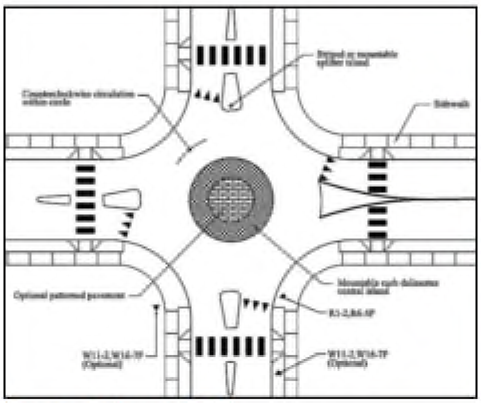
# Mini Roundabout

**Description:**

- Raised islands, placed in unsignalized intersections, around which traffic circulates
- Motorists yield to motorists already in the intersection
- Require drivers to slow to a speed that allows them to comfortably maneuver around them
- Center island of mini roundabout is fully traversable, splitter islands may be fully traversable

**Applications:**

- Intersections of local and/or collector streets
- One lane each direction entering intersection
- Not typically used at intersections with high volume of large trucks or buses turning left
- Appropriate for low-speed settings



(Source: Delaware DOT)


(Source: Gary Schatz)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation:**

- See NCHRP Report 672 for design details
- Typically circular in shape, but may be an oval shape
- Controlled by YIELD signs on all approaches with pedestrian crosswalks, if included, one car-length upstream of YIELD bar
- Preferable for roadway to have urban cross section (i.e., curb and gutter)
- Can be applied to road with on-street parking
- Can be applied to roads both with and without a bicycle facility. Bicycle facilities, if provided, must be separated from the circulatory roadway with physical barriers; cyclists using the circulatory roadway must merge with vehicles. Bicycle facilities are prohibited in the circulatory roadway to prevent right-hook crashes.
- Key design features are the fastest paths and path alignment.

**Potential Impacts:**

- Slight speed reduction
- Little diversion of traffic
- Bicycle and motorist will share lanes at intersections because of narrowed roadway
- Large vehicles/buses usually drive over the center island for left turns

**Emergency Response:**

- Emergency vehicles maneuver using the center island at slow speeds

**Typical Cost**

- Cost is similar to bulb-outs because pedestrian ramps and outside curb lines usually have to be relocated

# Roundabout

**Description:**
- Raised islands placed in unsignalized intersections around which traffic circulates
- Approaching motorists yield to motorists already in the intersection
- Requires drivers to slow to a speed that allows them to comfortably maneuver around them
- Different from traffic circles or mini-roundabouts; possible substitute for traffic signal control

**Applications:**
- Intersections of arterial and/or collector streets
- One or more entering lanes
- Can be used at intersections with high volumes of large trucks and buses, depending on design


(Source: Grant Kaye)


(Source: PennDOT Local Technical Assistance Program)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation:**
- See NCHRP Report 672 for design details
- Design vehicle is determined specifically for each site ranging from emergency vehicles to over size/overweight vehicles
- Typically circular in shape but may be an oval shape
- Key physical elements are center islands, truck aprons, and splitter islands
- Controlled by YIELD signs on all approaches with pedestrian crosswalks, if included, one car-length upstream of YIELD bar
- Key design features include: fastest paths, swept paths, and path alignment
- Large vehicles circulating around the center island for all movements may traverse the apron
- Landscaping needs to be designed to allow adequate sight distance per NCHRP 672
- Preferable to have a closed-section road (i.e. curb and gutter)
- Bicycle facilities, if provided, must be separate from the circulatory roadway with physical barriers; cyclists using the circulatory roadway must merge with vehicles. Bicycle facilities are prohibited in the circulatory roadway to prevent right-hook crashes.

**Potential Impacts:**
- Limited impact on access, except for access points immediately adjacent to intersection
- Limited impact on roadways with on-street parking
- May draw additional traffic but with reduced delays and queues

**Emergency Response:**
- Appropriate for emergency vehicle routes or streets that provide access to hospitals
- Emergency vehicles may traverse the apron

**Typical Cost**
- Cost varies widely by site, but is usually comparable to a traffic signal

# 4.4 Vertical Deflections

# Speed Cushion

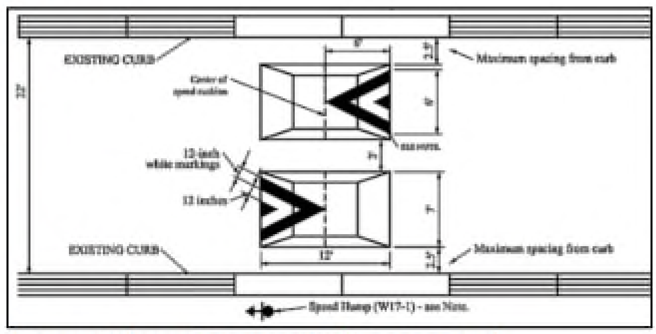
**Description:**

- Two or more raised areas placed laterally across a roadway with gaps between raised areas
- Height and length similar to a speed hump; spacing of gaps allow emergency vehicles to pass through at higher speeds
- Often placed in a series (typically spaced 260 to 500 feet apart)
- Sometimes called speed lump, speed slot, and speed pillow

**Applications:**

- Appropriate on local and collector streets
- Appropriate at mid-block locations only
- Not appropriate on grades greater than 8 percent

(Source: James Barrera, Horrocks, New Mexico)



(Source: Delaware Department of Transportation)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Two or more cushions at each location
- Typically 12 to 14 feet in length and 7 feet in width
- Cushion heights range between 3 and 4 inches, with trend toward 3 - 3 ½ inches maximum
- Speed cushion shapes include parabolic, circular, and sinusoidal
- Material can be asphalt or rubber
- Often have associated signing (advance-warning sign before first cushion at each cushion)
- Typically have pavement markings (zigzag, shark's tooth, chevron, zebra)
- Some have speed advisories

**Potential Impacts:**

- Limited-to-no impact on non-emergency access
- Speeds determined by height and spacing; speed reductions between cushions have been observed averaging 20 and 25 percent
- Speeds typically increase by 0.5 mph midway between cushions for each 100 feet of separation
- Studies indicate that average traffic volumes have reduced by 20 percent depending on alternative routes available
- Average collision rates have been reduced by 13 percent on treated streets

**Emergency Response Issues:**

- Speed cushions have minimal impact on emergency response times, with less than a 1 second delay experienced by most emergency vehicles

**Typical Cost (2017 dollars):**

- Cost ranges between $3,000 and $4,000 for a set of rubber cushions

# Traffic Calming Fact Sheets

May 2018 Update

A Community of Transportation Professionals

## Speed Table/Raised Crosswalks

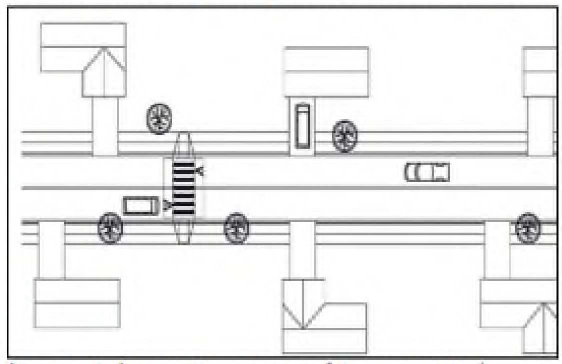
**Description:**

- Long, raised speed humps with a flat section in the middle and ramps on the ends; sometimes constructed with brick or other textured materials on the flat section
- If placed at a pedestrian crossing, it is referred to as a raised crosswalk
- If placed only in one direction on a road, it is called an offset speed table

**Applications:**

- Appropriate for local and collector streets; mid-block or at intersections, with/without crosswalks
- Can be used on a one-lane one-way or two-lane two-way street
- Not appropriate for roads with 85th percentile speeds of 45 mph or more
- Typically long enough for the entire wheelbase of a passenger car to rest on top or within limits of ramps
- Work well in combination with textured crosswalks, curb extensions, and curb radius reductions
- Can be applied both with and without sidewalks or dedicated bicycle facilities
- Typically installed along closed-section roads (i.e. curb and gutter) but feasible on open section

(Source: Google Maps, Boulder, Colorado)



(Source: Delaware Department of Transportation)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- ITE recommended practice – "Guidelines for the Design and Application of Speed Humps"
- Most common height is between 3 and 4 inches (reported as high as 6 inches)
- Ramps are typically 6 feet long (reported up to 10 feet long) and are either parabolic or linear
- Careful design is needed for drainage
- Posted speed typically 30 mph or less

**Potential Impacts:**

- No impact on non-emergency access
- Speeds reductions typically less than for speed humps (typical traversing speeds between 25 and 27 miles per hour)
- Speeds typically decline approximately 0.5 to 1 mph midway between tables for each 100 feet beyond the 200-foot approach and exit points of consecutive speed tables
- Average traffic volumes diversions of 20 percent when a series of speed tables are implemented
- Average crash rate reduction of 45 percent on treated streets
- Increase pedestrian visibility and likelihood of driver yield compliance
- Generally not appropriate for BRT bus routes

**Emergency Response Issues:**

- Typically preferred by fire departments over speed humps, but not appropriate for primary emergency vehicle routes; typically less than 3 seconds of delay per table for fire trucks

**Typical Cost (2017 dollars):**

- Cost ranges between $2,500 and $8,000 for asphalt tables; higher for brickwork, stamped asphalt, concrete ramps, and other enhancements sometimes used at pedestrian crossings

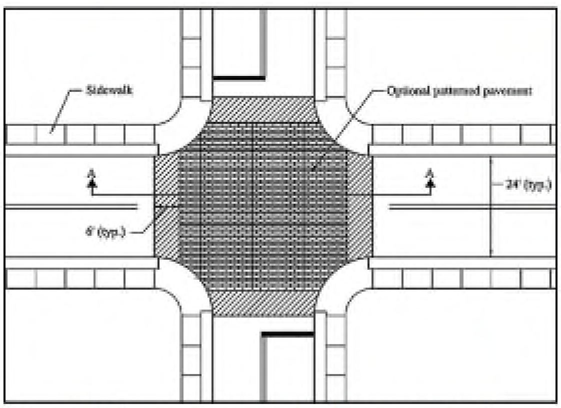
# Raised Intersection

**Description:**

- Flat raised areas covering entire intersections, with ramps on all approaches and often with brick or other textured materials on the flat section and ramps
- Sometimes referred to as raised junctions, intersection humps, or plateaus

**Applications:**

- Intersections of collector, local, and residential streets
- Typically installed at signalized or all-way stop controlled intersections with high pedestrian crossing demand
- Works well with curb extensions and textured crosswalks
- Often part of an area-wide traffic calming scheme involving both intersecting streets in densely-developed urban areas



(Source: Delaware Department of Transportation)


(Source: Chuck Huffine, Phoenix AZ)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Used at intersections with a maximum speed limit of 35 mph
- Typically rise to sidewalk level; appropriate if crosswalks exist on all four legs
- Appropriate if a dedicated bicycle facility passes through the intersection
- Detectable warnings and/or color contrasts must be incorporated to differentiate the roadway and the sidewalk
- May require bollards to define edge of roadway
- Storm drainage/underground utility modifications are likely necessary
- Minimum pavement slope of 1 percent to facilitate drainage

**Potential Impacts:**

- Reduction in through movement speeds likely at intersection
- Reduction in mid-block speeds typically less than 10 percent
- No impact on access
- Can make entire intersections more pedestrian-friendly
- No data available on volume diversion or safety impacts

**Emergency Response Issues:**

- Slows emergency vehicles
- Appropriate for primary emergency vehicle routes and streets with access to a hospital or emergency medical services

**Typical Cost (2017 dollars):**

- Costs range between $15,000 and $60,000

# 4.5 Street Width Reduction

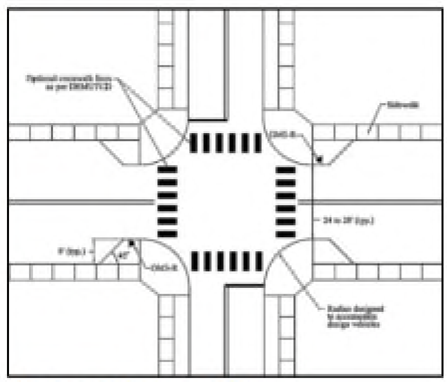
# Traffic Calming Fact Sheets
May 2018 Update

## Corner Extension/Bulb-Out

**Description:**
- Horizontal extension of the sidewalk into the street, resulting in a narrower roadway section
- If located at a mid-block location, it is typically called a choker

**Applications:**
- When combined with on-street parking, a corner extension can create protected parking bays
- Effective method for narrowing pedestrian crossing distances and increase pedestrian visibility
- Appropriate for arterials, collectors, or local streets
- Can be used on one-way and two-way streets
- Installed only on closed-section roads (i.e. curb and gutter)
- Appropriate for any speed, provided an adequate shy distance is provided between the extension and the travel lane
- Adequate turning radii must be provided to use on bus routes


(Source: James Barrera, Horrocks, New Mexico)


(Source: Delaware DOT)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**
- Effects on vehicle speeds are limited due to lack of deflection
- Must check drainage due to possible gutter realignment
- Major utility relocation may be required, especially drainage inlets
- Typical width between 6 and 8 feet
- Typical offset from travel lane at least 1.5 feet
- Should not extend into bicycle lanes

**Potential Impacts:**
- Effects on vehicle speeds are limited due to lack of deflection
- Can achieve greater speed reduction if combined with vertical deflection
- Smaller curb radii can slow turning vehicles
- Shorter pedestrian crossing distances can improve pedestrian safety
- More pedestrian waiting areas may become available
- May require some parking removal adjacent to intersections

**Emergency Response Issues:**
- Retains sufficient width for ease of emergency-vehicle access
- Shortened curb radii may require large turning vehicles to cross centerlines

**Typical Cost (2017 dollars):**
- Cost between $1,500 and $20,000, depending on length and width of barriers

# Choker

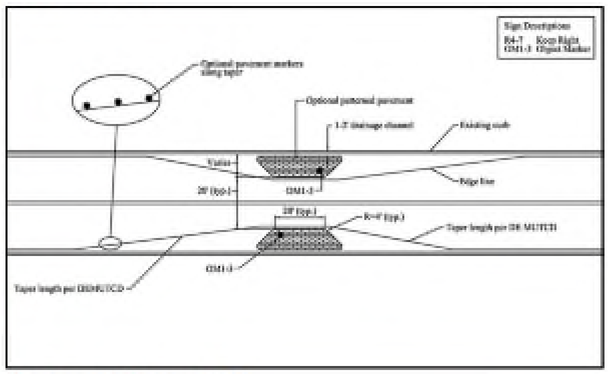
**Description:**

- Curb extension is a lateral horizontal extension of the sidewalk into the street, resulting in a narrower roadway section
- If located at an intersection, it is called a corner extension or a bulb-out
- If located midblock, it is referred to as a choker
- Narrowing of a roadway through the use of curb extensions or roadside islands

**Applications:**

- Can be created by a pair of curb extensions, often landscaped
- Encourages lower travel speeds by reducing motorist margin of error
- One-lane choker forces two-way traffic to take turns going through the pinch point
- If the pinch point is angled relative to the roadway, it is called an angled choker
- Can be located at any spacing desired
- May be suitable for a mid-block crosswalk
- Appropriate for arterials, collectors, or local streets

(Source: City of An Arbor, Michigan)



(Source: Delaware DOT)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Only applicable for mid-block locations
- Can be used on a one-lane one-way and two-lane two-way street
- Most easily installed on a closed-section road (i.e. curb and gutter)
- Applicable with or without dedicated bicycle facilities
- Applicable on streets with, and can protect, on-street parking
- Appropriate for any speed limit
- Appropriate along bus routes
- Typical width of 6 to 8 feet; offset from through traffic by approximately 1.5 feet
- Locations near streetlights are preferable
- Length of choker island should be at least 20 feet

**Potential Impacts:**

- Encourages lower speeds by funneling it through the pinch point
- Can result in shorter pedestrian crossing distances if a mid-block crossing is provided
- May force bicyclists and motor vehicles to share the travel lane
- May require some parking removal
- May require relocation of drainage features and utilities

**Emergency Response Issues:**

- Retains sufficient width for ease of use for emergency vehicles

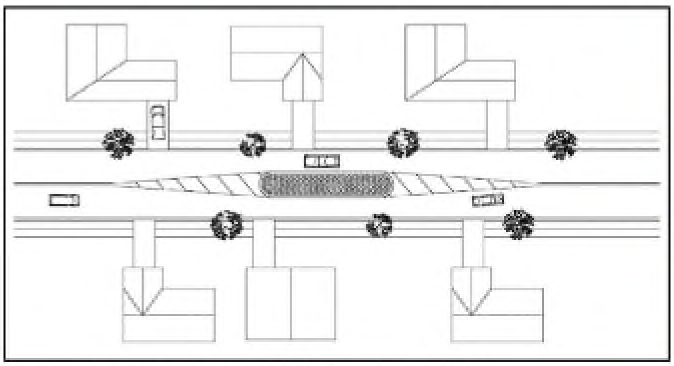
**Typical Cost (2017 dollars):**

- Between $1,500 and $20,000, depending on length and width of barriers

# Median Island

**Description:**
- Raised island located along the street centerline that narrows the travel lanes at that location
- Also called median diverter, intersection barrier, intersection diverter, and island diverter

**Applications:**
- For use on arterial, collector, or local roads
- Can often double as a pedestrian/bicycle refuge islands if a cut in the island is provided along a marked crosswalk, bike facility, or shared-use trail crossing
- If placed through an intersection, considered a median barrier


(Source: Delaware Department of Transportation)


(Source: James Barrera, Horrocks, New Mexico)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**
- Potential legal issues associated with blocking a public street (e.g., business or emergency access)
- Barriers may consist of landscaped islands, mountable facilities, walls, gates, side-by-side bollards, or any other obstruction that leave an opening smaller than the width of a passenger car
- Can be placed mid-block or on the approach to an intersection
- Typically installed on a closed-section roadway (i.e. curb and gutter)
- Can be applied on roads with or without sidewalks and/or dedicated bicycle facilities
- Maximum appropriate speed limits vary by locale
- Typically not appropriate near sites that attract large combination trucks

**Potential Impacts:**
- May impact access to properties adjacent to islands
- No significant impact on vehicle speeds beyond the island
- Little impact on traffic volume diversion
- Safety can be improved without substantially increasing delay
- Shortens pedestrian crossing distances
- Bicyclists may have to share vehicular travel lanes near the island
- May require removal of some on-street parking
- May require relocation of drainage features and utilities

**Emergency Response Issues:**
- Appropriate along primary emergency vehicle roads or street that provides access to hospitals/emergency medical services

**Typical Cost (2017 dollars):**
- Cost between $1,500 and $10,000, depending on length and width of island

# On-Street Parking

**Description:**

- Allocation of paved space to parking
- Narrows road travel lanes and increases side friction to traffic flow
- Can apply on one or both sides of roadway
- Can be either parallel or angled, but parallel is generally preferred for maximized speed reduction

**Applications:**

- High likelihood of acceptability for nearly all roadway functional classifications and street functions
- More appropriate in urban or suburban settings
- Can be combined with other traffic calming measures
- Can apply alternating sides of street for chicane effect
- Can combine with curb extensions for protected parking, including landscaping for beautification
- Can apply using time-of-day restrictions to maximize throughput during peak periods
- Can be used on one-way or two-way streets
- Preferable to have a closed-section road (i.e. curb and gutter)
- Appropriate along bus transit routes

(Source: PennDOT Local Technical Assistance Program)

(Source: Google Earth, Fort Collins, CO)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Appropriate distance needed between travel lane and parking lane
- Impact is directly affected by demand; must have parked vehicles present to be effective
- If used for chicane effect, must verify parking demand to ensure that majority of spaces are occupied when effect is desired most during the day; can use parallel, angled, or combination
- Should not be considered near traffic circles nor roundabouts
- Should not be applied along median island curbs
- For lower-demand locations, can counteract negligible impact with curb extensions or other road-narrowing features

**Potential Impacts:**

- Can be blocked in by snow during plowing operations; required vehicle removal
- May limit road user visibility and sight distance at driveways/alleys/intersections
- Can put bicyclists at risk of colliding with car doors
- May be impacted if other traffic calming measures are considered or implemented
- Provides buffer between moving vehicles and pedestrian facilities

**Emergency Response Issues:**

- Preferred by emergency responders to most other traffic calming measures
- Requires consideration of design of parking lanes near hydrants and other emergency features

# Road Diet

**Description:**

- Revision of lane use or widths to result in one travel lane per direction with minimum practical width, with goal of reducing cross-section; common application involves conversion of four-lane Two-way road to three-lane road – two through lanes and center two-way left-turn lane (TWLTL)
- Can also involve narrowing of existing travel lanes
- Alternate cross-section uses can include dedicated bicycle facilities, left-turn lanes, on-street parking, raised medians, pedestrian refuge islands, sidewalks, etc.

**Applications:**

- High likelihood of acceptability for nearly all roadway functional classifications
- Can be applied in urban, suburban, or rural settings
- Appropriate for most common urban speed limits
- Can be applied at/near intersections or along road segments
- Appropriate along bus routes


(Source: Chuck Huffine, Phoenix, AZ)


(Source: Chuck Huffine, Denver, CO)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Must consider transitions from adjacent roadway sections and through intersections
- AADT can be considered but is not the primary volume factor that needs to be evaluated

**Potential Impacts:**

- Usually reduces number of available travel lanes – impacts demand that can be accommodated; typical acceptable threshold of 1000 vehicles per direction during peak hour
- Reduction of through lanes tends to reduce speeds
- Can improve pedestrian crossing ease and safety
- Can improve bicycle accessibility if travel lanes can be used for shoulders/bike lanes instead

**Emergency Response Issues:**

- Generally accepted from emergency services; leaves available space for through flow of emergency vehicles

**Typical Cost (2017 dollars):**

- $6000 or less, depending on physical geometric changes and length of application
- The biggest impact to cost involves signal modifications, if applicable; other primary costs include pavement marking and signing revisions
- Costs can be much higher if outside portion of pavement is converted to other non-motorized uses (dedicated bicycle facilities, sidewalks, grass buffers)

# 4.6 Routing Restrictions

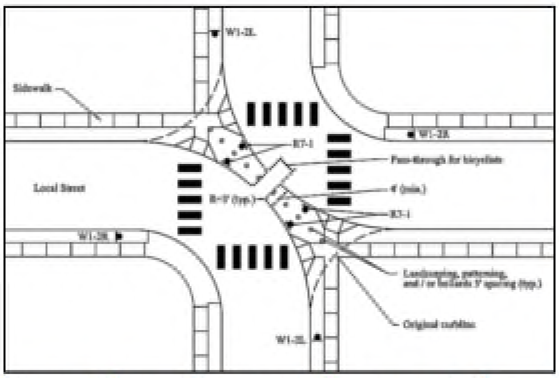
# Diagonal Diverter

**Description:**

- Barriers placed diagonally across four-legged intersections, blocking through movements
- Sometimes called full diverters or diagonal road closures

**Applications:**

- Typically applied only after other measures are deemed ineffective or inappropriate
- Provisions are available to make diverters passable for pedestrians and bicyclists
- Often used in sets to make travel through neighborhoods more circuitous



(Source: Delaware Department of Transportation)

(Source: PennDOT Local Technical Assistance Program)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Possible legal issues associated with closing public streets (e.g., business and/or emergency access)
- Can only be placed at intersections
- Can be used on both one-way and two-way streets
- Typically found on closed-section roads (i.e. curb and gutter)
- Typical maximum appropriate speed limit is 25 mph
- Maintain drainage as necessary to mitigate potential flooding
- Corner radii should be designed to allow full-lane width for passing motor vehicle traffic
- SU-30 default design vehicle
- Appropriate signing and pavement markings needed on approaches
- Openings for pedestrians and bicyclists should allow movement between all intersection legs
- Barriers may consist of landscaped islands, walls, gates, side-by-side bollards, or any other obstruction that leave an opening smaller than the width of a typical passenger car

**Potential Impacts:**

- Concern regarding impacts to emergency response, street network connectivity, and capacity
- Should consider traffic diversion patterns and associated impacts
- No significant impacts on vehicle speeds beyond the approach to the diverter
- Not appropriate for bus transit routes
- Improved pedestrian and bicycle safety

**Emergency Response Issues:**

- Should not be used on roads that provide access to hospitals or primary emergency services
- Restricts emergency vehicle access through intersections
- Can be designed to allow emergency vehicle access with removable, or breakaway delineators or bollards, gates, mountable curbs, etc.

**Typical Cost (2017 dollars):**

- Typical cost of $6,000 for diverter with limited drainage modifications

# Closure

**Description:**

- **Half closures** are barriers that block travel in one direction (creates a one-way street) for a short distance on otherwise two-way streets; sometimes called partial closures or one-way closures
- **Full-street closures** are barriers placed across a street to completely close the street to through-traffic, usually leaving open space for pedestrians and bicyclists; they are sometimes called cul-de-sacs, dead-ends, or mini-parks

**Applications:**

- Appropriate for local streets (half and full), at intersection (half and full), or mid-block (full closure only)
- Typically applied only after other measures have failed or are deemed inappropriate or ineffective
- Typically found on closed-section roadways (i.e. curb and gutter)
- Can be applied with and without dedicated bicycle facilities and on roads with on-street parking
- Often used in sets to make travel through neighborhoods more circuitous
- Not appropriate along bus transit routes
- Can be used to assist crime prevention

(Source: James R. Barrera, Horrocks, New Mexico)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Potential legal concerns
- Can be placed at intersections or mid-block locations
- Barriers may consist of landscaped islands, walls, gates, side-by-side bollards, or other obstructions that result in openings smaller than the width of a typical passenger car
- Appropriate signing needed at entrances to full-closure street blocks
- May require modifications to maintain surface drainage capacity
- Should consider traffic diversion patterns and associated impacts
- Possible to make diverters passable for pedestrians and bicyclists

**Potential Impacts:**

- Concerns regarding street network connectivity and capacity
- May result in traffic diverting to other local streets (should be used in groups/clusters)
- No significant impact on vehicle speeds beyond the closed block
- Can improve pedestrian crossing safety

**Emergency Response Issues:**

- Full or half closures can increase response times and should not be used on roads/streets that provide access to hospitals or emergency medical services; half closures allow for a higher degree of emergency vehicle access than full closures
- Both closure types can be designed to allow emergency vehicle access with removable, or breakaway delineators or bollards, gates, mountable curbs, etc.

**Typical Cost (2017 dollars):**

- **Full Closure** - <$10,000 for simple closures, to $100,000 for complex closures with drainage mods.
- **Half Closure** - $3,000 for simple closure, to $40,000 for complex closures with drainage mods.

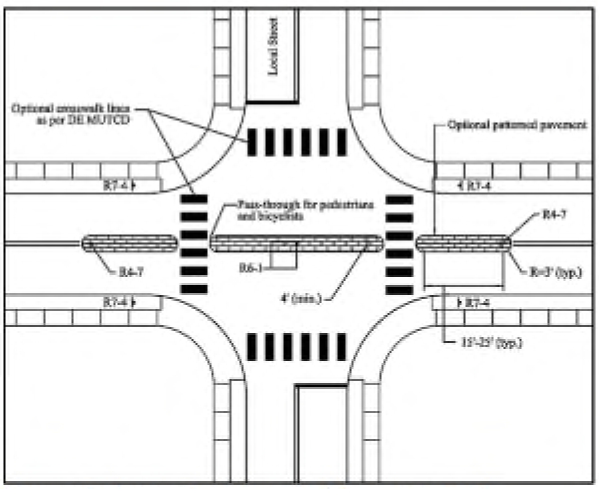
# Median Barrier/Forced Turn Island

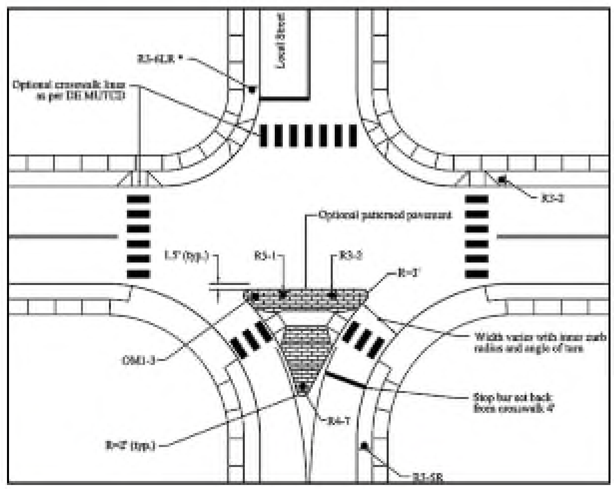
**Description:**

- Raised islands along the centerline of a street and continuing through an intersection that block the left-turn movement from all intersection approaches and the through movement from the cross street; also called median diverter, intersection barrier, intersection diverter, and island diverter
- Raised island that forces a right turn is called a forced turn island

**Applications:**

- For use on arterial or collector roadways to restrict access to minor roads or local streets and/or to narrow lane widths
- Typically applied only after other measures have failed or been deemed inappropriate/ineffective
- Barriers are made passable for pedestrians and bicyclists
- Often used in sets to make travel to/through neighborhoods more circuitous




(Source: Delaware Department of Transportation)

***ITE/FHWA Traffic Calming EPrimer:*** https://safety.fhwa.dot.gov/speedmgt/traffic_calm.cfm

**Design/Installation Issues:**

- Potential legal issues associated with blocking a public street (e.g., business/emergency access)
- Placed on major roads on approaches to and across intersections with minor roads
- Should extend beyond the intersection to discourage improper/illegal turn movements
- Barriers may consist of landscaped islands, mountable features, walls, gates, side-by-side bollards, or any other obstruction that leave an opening smaller than the width of a passenger car

**Potential Impacts:**

- May divert traffic volumes to other parallel and/or crossing streets
- May require removal or shortening of on-street parking zones on approaches/departures
- May impact access to properties adjacent to intersection
- No significant impacts on vehicle speeds beyond the approaches to intersection

**Emergency Response Issues:**

- Restricts emergency vehicle access using minor street
- Can be designed to allow emergency vehicle access

**Typical Cost (2017 dollars):**

- Cost between $1,500 and $20,000, depending on length and width of barriers

## 5.0 Traffic Calming Implementation Process

The Ascension Parish Traffic Calming Program is a phased process as summarized below:

- Public Action/Participation: Request for study (Form Ac.TCM.01)
- Parish Assessment/Screening of Request to determine eligibility
- Problem Identification and preliminary plan development
    - Initial problem identification
    - Baseline data collection and analysis
    - Determination of affected/study area
- Preliminary plan development and Work Group Participation
    - Establishment of Working Group
    - Identification of suitable Traffic Calming Measures
    - Working Group acceptance of Preliminary Plan
    - Open House meeting and survey for acceptance of Preliminary Plan
- Traffic Calming Plan Refinement
    - Final Plan development
    - Establishment of Probable Construction Cost
    - Petition for Final Plan Acceptance (Form Ac.TCM.02)
- Traffic Calming Plan Ranking and Funding Consideration (Form Ac.TCM.03)
    - Eligible Projects that have an accepted Final Plan shall be ranked for funding consideration

In addition to the considerations for the implementation of Traffic Calming Measures on existing roadways these traffic calming policies and procedures can be considered for inclusion into the street provisions of the Uniform Development Codes for Ascension Parish.

## 6.0 Traffic Calming Project Initiation

A Traffic calming project can be initiated by a formal request from; neighborhood associations, directly affected individuals, local government engineering staff, or elected officials. Form Ac.TCM.01 must be utilized to initiate these requests. For identified Homeowners Associations or Civic Associations Form Ac.TCM.01 must be accompanied with an approved request for action from the Association Board. For individuals the request must include an initial Traffic Calming Study Petition Form Ac.TCM.02 from a minimum of 10 residents of separate households along the area of study (i.e. only one signature per household).

This request must clearly identify the problem location and limits, specific concerns (speeding, cut-through traffic, truck and commercial traffic, pedestrian safety, roadway safety, or other issues). A clear understanding of the issue is important to assist the Parish in the development of overall study area.

Upon receipt of a properly completed formal request, the Parish will perform an initial screening to determine if the request meets the minimum warrants to be considered for Traffic Calming Measures. For a request to be considered, the functional classification and posted speed thresholds noted below must be met. In addition, a minimum of two additional warrants must also be considered and met:

- Functional Classification with posted speeds of 35mph or less
    - Local residential street
    - Minor Collector Street with predominantly residential land use

- Minimum bidirectional average daily traffic volumes of 1,000 vehicles/day or peak hour volumes in excess of 100 vehicles per day for the roadway under consideration
- For speeding concerns, the $85^{th}$ percentile measured speed is at least 7 mph over the posted speed
- Cut-through traffic volumes exceeds 25% of the total volume on the street
    - The street is not the primary access to commercial or industrial sites
    - The street is not a primary emergency response route
- Schools, parks or other pedestrian generators along the study route
- A minimum of 3 correctable crashed along the study route over the last 3 years.

For requests that have met the minimum eligibility requirements the Parish shall initiate additional baseline investigations that may be needed to adequately investigate the identified problem and support project ratings to be utilized for potential funding consideration and priority rankings.

# 7.0 Traffic Calming Plan Development

Once a request has been deemed eligible for traffic calming consideration, the Parish shall begin the process to establish the impact area and determine suitable traffic calming measures. The Parish would consider the area that could potentially be affected by the implementation of these measures. This will include all streets for which traffic calming is proposed, all streets that are only accessible via these streets, and all streets that are likely to absorb significant levels of traffic diverted as part of traffic calming measures. The findings from this evaluation will set the impact area that will later be petitioned for potential Traffic Calming Plan acceptance.

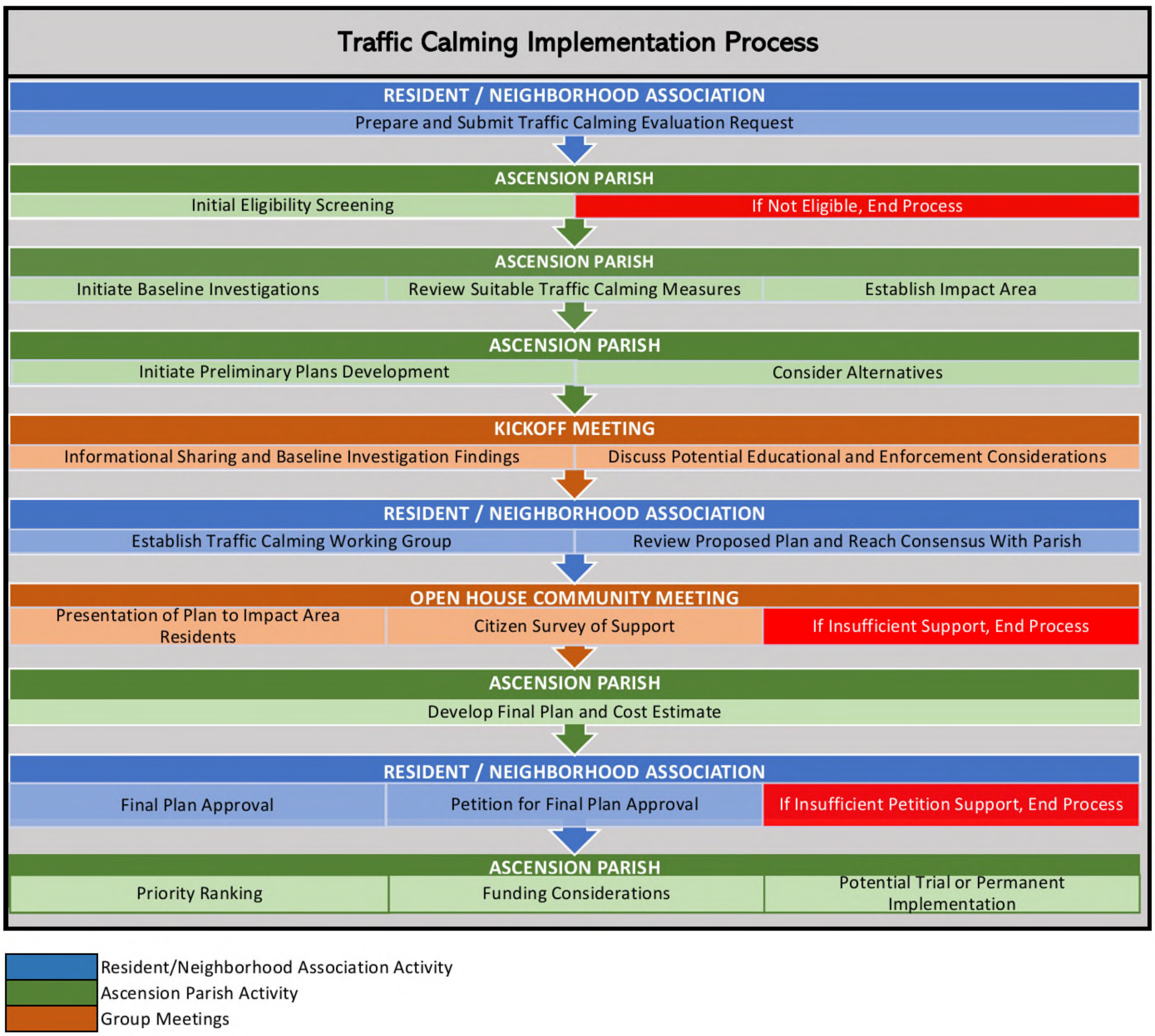
As part of the preliminary plan development process the Parish will set a meeting to discuss the proposed project with the neighborhood to share information and discuss potential educational and enforcement considerations. Out of this meeting a Working Group will be established to review various traffic calming measures that may be suitable to address the concerns. Once the necessary traffic data has been compiled and the existing site conditions established, a listing of various traffic calming measures either individually or as part of a complimentary set of measures will be compiled that best address the identified problems. These proposed measures must demonstrate that they are designed to address the documented problems and are appropriate for the location where they may be proposed to be installed.

Once the Preliminary Plan has been developed, and a consensus reached between the Parish and the Working Group, an "Open House" meeting with the residents of the impact area will be scheduled. These residents either live or work adjacent to the proposed traffic calming measures and they are the ones that will be both beneficially and negatively impacted by the proposed measures. It is important that this meeting be utilized to obtain comments from these residents since they are critical to the success of the project.

At this meeting the Parish will explain the traffic calming process, present the findings of the data analysis, describe the appropriate traffic calming measure/measures that have been identified, identify potential options that could be considered, and discuss the likelihood of the success of the project actions. Schedules for any plan modifications and subsequent meetings that may be required, shall be established and the path forward to final plan approval addressed. At this time a survey of the residents of the impacted area will also be conducted and <u>a minimum of 33% of those surveyed must support moving forward</u> with the development of the Final Traffic Calming Plan for the process to continue.

Provided that the approval to move forward with the Final Traffic Calming Plan has been established, applicable comments received during the "Open House" will be incorporated and the Plan refined. Once the refinement process has been completed the Parish will develop an estimate of Probable Cost. The applicants must then initiate the final plan acceptance petition of the impacted area. This Final Plan approval petition process provides the affected neighborhood residents the opportunity to approve the details of the recommended traffic calming measures. For Final Traffic Calming Plan approval, a minimum of 50% of all petitions (Form Ac.TCM.02) of the households and businesses within the designated impact area must be returned with at least 67% of those providing positive support. Should the necessary local public support not be met, modifications to the plan can be considered or the plan will be dropped from consideration. Figure 7.1 summarizes the process described above.

Figure 7.1



## 8.0 Traffic Calming Plan Priority Ranking and Potential Implementation

Sufficient funding may not be available to address all Traffic Calming needs within the Parish. Projects that have been determined to be eligible for Traffic Calming Measures and that have garnered the appropriate level of support from the designated impact area, will be prioritized for funding consideration. The priority ranking process has been developed to rank projects considering the safety risk and impact generators (Table 8.1 and Form Ac.TCM.03). Primary risk factors are excessive traffic speed and volumes and how they affect the corridor safety. Factors that are compounded by the excessive speed and volume include: pedestrian generators, school zones, and the lack of sidewalks. Other safety concerns that come into play include but are not limited to sight distance issues, pavement conditions, roadway geometry, and driveway density. These elements will be rolled into a crash/accident factor in the rating process.

Table 8.1
Project Ranking and Scoring

| Criteria / Warrant | Points | Points Basis |
|---|---|---|
| Traffic Volume | 0-30 | 1 pt. will be assigned for the Average Daily Traffic volume divided by 100 (max 30 pts) |
| Speed | 0-30 | 2 pts. will be assigned for each mph that the 85th Percentile speed exceeds the posted speed (max 30 pts) |
| Accidents | 0-10 | 1 pt. will be assigned for each preventable collision/accident that has occurred over the last 3 yrs. (max 10pts) |
| School Zones | 0-10 | 10 pts. if school/schools abut or marked school crossings are in place within the limits of the study street |
| Pedestrian Generators | 0-10 | 5 pts. will be assigned for each facility (parks, community centers, libraries, transit stops, commercial uses... That will generate a significant number of pedestrians (10 pts max) |
| Sidewalks | 0-10 | 10 pts. will be assigned if no sidewalks are present, 5pts if sidewalks on one side of the roadway only |
| Max Pt. Total | 100 | |

Once a request for the evaluation of a Traffic Calming Plan has completed the planning process and has been ranked, it can be programmed for the final Implementation Phase. Project implementation is highly dependent upon both the availability of funding and community resources including manpower, materials and equipment. Therefore, the specific task that must be addressed to move a project forward including:

- Project Funding
- Final Construction Plan Development (i.e. may require engineered plans and bid packages)
- Construction (may include a Trial Implementation and Permanent Installation)
- Post Construction Monitoring and Evaluation

## 8.1 Funding

In order to implement a Traffic Calming Project funding sources must be secured for; final project design, construction bidding, construction, and post construction monitoring. At this time Ascension Parish does not have a designated funding source for Traffic Calming Projects and therefore each proposed project must compete with other types of capital improvements for potential funding appropriations. Potential funding sources for Traffic Calming Projects may include but are not limited to:

- Federal/State Funds
    - Transportation Alternatives Program
    - Local Roads Safety Program
    - Safe Routes to School/Public Places Program
- Ascension Parish Capital Improvement Appropriations
- Ascension Parish Traffic Impact Fee Appropriations
- Developer Contributions
- Private Community/Business Contributions
- Public/Private Partnerships
- Residential Assessments

Depending on the construction elements proposed, there may be an opportunity for some traffic calming elements to be incorporated as part of a programmed road maintenance projects and/or included as part of larger improvement projects that may fall within the designated Impact Area.

The Federal/State funds listed above are Federally funded programs administered through LADOTD. These programs typically take applications on a bi-annual basis, have an 80%Federal/20% Local cost share match for construction, are highly competitive, and have limited resources.

## 8.2 Final Construction Plan Development

The level of the engineering design effort is dependent upon the complexity of the Traffic Calming Plan selected. In most cases horizontal deflections and routing restrictions shall require detailed engineered plans be developed and the project bid for construction. For vertical deflections and street width reductions there may be occasions whereby the design can be developed by Ascension Parish Transportation and Engineering staff.

## 8.3 Construction

For many comprehensive Traffic Calming Projects, a trail installation prior to any permanent installation should be considered. The trail installation will provide an opportunity to monitor the plan for its effectiveness and allow for minor adjustments to the configuration or location without incurring significant cost. Any temporary/trial measures installed should resemble the permanent measures as much as possible including the appropriate pavement markings, signs, and lighting.

The FHWA also recommends that a trial installation may be warranted under certain circumstances:

• if traffic diversions are difficult to predict as part of a complex area-wide plan, or

• if the traffic calming measure is novel or new and unfamiliar to the area

The trial period should last at least three to six months. For a measure that has the potential to significantly alter traffic patterns (like a half closure), a longer time period of six-to-twelve months could be appropriate.

Where feasible and available resources allow, the Parish will utilize their forces to install the Traffic Calming measures. However, for the more complex and comprehensive installations the Traffic Calming Project will have to be bid for construction.

The Parish will maintain the traffic control devices, signage, and striping. However, the maintenance of any landscaped areas that may have been incorporated into a Traffic Calming Plan shall be the responsibility of the neighborhood association or individuals who initiated the petition for the Traffic Calming Plan.

## 8.4 Post Construction Monitoring and Evaluation

Approximately six months after a Traffic Calming Plan has been implemented an evaluation will be conducted to determine whether the installed measures were successful in addressing the problems or issues that prompted the initial study request. Speed and volume are typically the primary metrics used to assess the effects of the measure. However, other appropriate measures identified in the baseline data collection and analysis phase of the Plan development will also be reviewed.

This data will help Ascension Parish learn from the project and acquire local data on the effects of the measures utilized. The evaluation could also lead to minor refinements or relocation of installed measures. If the monitoring identifies that significant problems are resulting from the installed plan, these findings will provide the Parish with the justification for modifications and/or removal.

# 9.0 Traffic Calming Plans on Parish Routes

The development of Traffic Calming Plans on Parish Routes with posted speeds of 35mph or less can be consistent with the measures defined above. However, for the higher speed routes with posted speeds in excess of 35mph the Traffic Calming measures are primarily limited to safety and speed control measures. The FHWA has broken the Safety Measures into four primary classifications with the specific measures indicated in Figure 9.1. This figure is taken from the 2018 FHWA Publication "Making Our Roads Safer One Countermeasure at a Time", with the complete document provided in Appendix C.

Figure 9.1

In 2012 FHWA Published "Speed Management-A Manual for Local Rural Road Owners". The following information has been taken from that document which identifies that several countermeasures have proven that they can be utilized to influence driver speed. In addition to the applicable traffic calming measures noted above for the lower speed roadways, these measures can be grouped into traffic control devices, and road and street design.

**Traffic control devices** to reduce speed includes such improvements as advisory speed signs, pavement markings, speed activated signs, and optical speed bars. The advisory speed signs may be used to supplement any warning sign to indicate the advisory speed for a condition as prescribed in the MUTCD.


Special pavement marking to encourage speed reduction for impending curve.

**Pavement markings signs** are supplemental advisory signs intended to emphasize speed limits or warn drivers of adverse conditions.


A solar-powered speed feedback sign.

**Speed activated and speed feedback signs** are electronic signs that connect to a device that measures the speed of approaching vehicles. Approach vehicles that exceed the posted speed limit will activate the electronic sign to provide a response such "SLOW" and/or display the vehicles approach speed.

**Optical speed bars** are used at spot locations or along corridors to reduce speeding. These are transverse pavement markings across the travel lane or along its edges placed with decreasing spacing in the direction of travel, which makes it appear to drivers that they are traveling faster than their true speed. These are placed in advance of speed transition zones or other critical locations. This treatment should be used sparingly since it will lose its effect and must be maintained to ensure its effectiveness.

Optical speed bars on a rural roadway placed in advance of a horizontal curve.

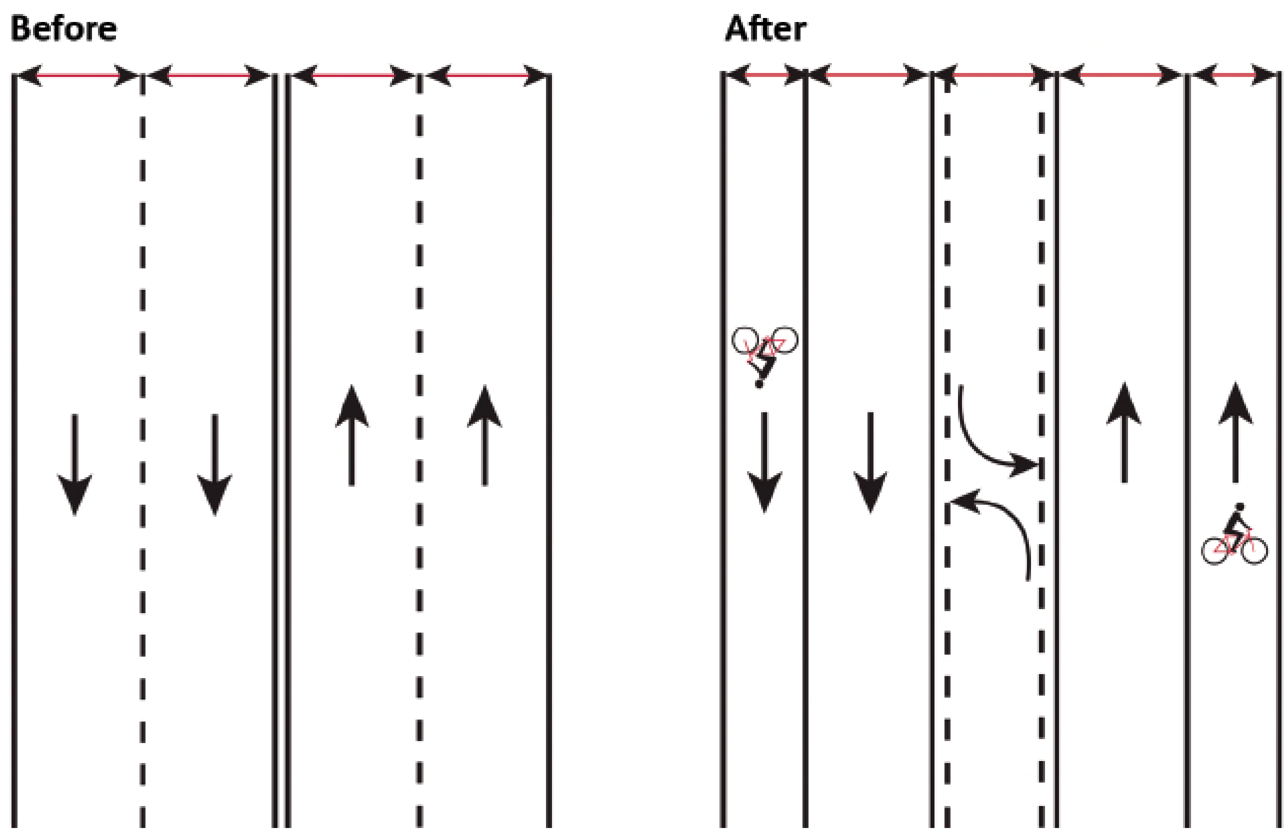
**Road and street design modifications** can induce speed reductions and provide other safety and operational benefits for all road users. These modifications can include lane width reductions, road diet, center islands or medians, and roundabouts.

**Lane width reductions** to as narrow as 10 feet can reduce speeds. This can be accomplished by restriping to narrower lanes without reducing the existing pavement width. The remaining pavement can be used for non-motorized uses, buffer areas between travel lanes and non-motorized uses, or space for on-street parking. In rural areas, reducing lane width on roadway segments should only be considered on lower-speed roadways through populated areas. At two way stop controlled, rural intersection on high-speed two-lane, two-way roadways lane narrowing through the application of rumble strips on the outside shoulders and in a painted yellow median island on major road approaches has been found to significantly reduce speeds and resulted in improved safety performance.

The lane width for motor vehicle travel in this community was reduced to provide exclusive space for cyclists.

**A road diet** is a conversion of an existing street cross section to create space for other uses (e.g. bicycle lanes, sidewalks, turn lanes, or on-street parking). Figure 9.2 is a before-and-after drawing of a typical road diet. The original road was four lanes with two lanes in each direction.

Figure 9.2 Road Diet Comparison




The same road width remains after the road diet, but the number of travel lanes for motor vehicles is reduced providing space for bicycle lanes in each direction. Road diets have the potential to reduce speeds due to the perceived narrowing of the roadway, with the extra pavement used for center turn lanes, parking, bicycle lanes, or other uses.

**Gateway Treatments** are additional countermeasures that can be used in rural areas to capture the attention of drivers and inform them that the nature of the roadway is changing, and as a result they should reduce their speed.

**A gateway** is a combination of traditional and nontraditional traffic control treatments such as enhanced signing, lane reductions, colored pavements, pavement markings, experimental striping, gateway structures, and traditional traffic calming techniques or identifiable features. A key consideration is the proper use of transitional speed limits and the Reduce Speed Limit Ahead warning signs as prescribed in the MUTCD.

A gateway treatment entering a rural community.

The gateway needs to be conspicuous to be effective. It is also important to ensure that devices used as part of a gateway treatment are crashworthy if placed within the clear zone and do not obstruct sight distance, as gateways placed in the roadway may become fixed object hazards.

**Enforcement** is critical in some locations to achieve compliance with posted speed limits. **Speed enforcement countermeasures** should primarily be at times and locations that can be directly tied to speeding-related crashes and areas of excessive speeding.

Traffic enforcement seeks to generate deterrent effects on speeding that are both specific and general. The specific deterrence is based on the idea that individual drivers who are caught and punished for speeding will be dissuaded from committing further speeding violations in the future. The general deterrence is based on the assumption that the process of apprehending individual violators can influence the behavior of a larger segment of the driving population.

There is an established linkage between speed education efforts and speed enforcement initiatives. Working together, these strategies amplify the impact of each element's contribution to traffic safety. NHTSA's high-visibility model recommends using a strategic combination of public information, education, and targeted speed enforcement at times and locations where excessive speeding and speeding-related crashes have been documented.

It is important that the engineering and law enforcement disciplines form a partnership to address speeding. Regular meetings between engineers and law enforcement officers responsible for traffic enforcement should be scheduled to discuss speeding concerns. Traffic engineers and law enforcement agencies must work closely together to identify roadway locations where engineering countermeasures alone will not address speeding, financial resources are not available to implement robust engineering measures, and speed enforcement strategies are needed.

In 2015 the State of Alabama in cooperation with the FHWA developed the "Alabama Speed Management Action Plan" with a primary purpose to help the State, in partnership with local agencies, reduce speeding-related fatal and injury-causing crashes. Section 3.2.1 from this document provides guidance as follows related to potential countermeasures for rural, non-freeway two-lane routes that may be considered.

*Alternate design and engineering countermeasures for rural two-lane routes and their intersections include, but are not limited to:*

- *Replace two-way, stop-controlled intersection with one-lane roundabout.*
- *Replace signal-controlled intersection with one-lane roundabout.*
- *Install lane-narrowing treatments (transverse in-lane rumble strips and painted median) on major road approaches to intersections with smaller, two-lane, stop-controlled roads. Narrowing treatment may be warranted on the larger roads to slow drivers on the main road, uncontrolled approaches, especially where speeding and sight distance issues may be present.*
- *Implement gateway treatments, lateral shift/chicane, lane narrowing, or raised traffic calming measures at high to lower-speed transition areas (such as near residential areas, schools).*
- *Consider other traffic calming measures such as speed tables at appropriate locations (rural villages, school zones).*
- *Implement the Safety edge treatment to mitigate, improve recovery of road departures.*
- *Implement other treatments intended to reduce or mitigate road departure, nighttime, or curve-related crashes such as rumble strips, improved curve or lane delineation, warning signs, and barriers as appropriate. Coordinate with the Alabama Roadway Departure Safety Implementation Plan to review speed limits for the corridor and/or sections to ensure limits are appropriate and assess the need for other safety treatments.*
- *Add paved shoulders, bike lanes, or separated paths to accommodate other (slower) users.*
- *Alternatively, incorporate spot treatments, such as the systematic addition of paved shoulder width and edge treatments on and near curves, to complement other systematic improvements that may be implemented through Alabama's Roadway Departure (crash reduction) Plan. Such an approach may be implemented more widely than corridor-long shoulder improvements and may have the added advantage of not leading to higher speeds that could occur if shoulders were widened for an entire corridor. However, crash modification factors and speed effects for this type of addition of shoulder width seem to be unavailable. Such treatments and other innovative treatments should be piloted on a smaller scale and evaluated before widespread implementation.*
- *Consider lowering speed limits and enhancing speed enforcement for routes with issues that cannot be sufficiently treated through a spot safety approach. Implement other countermeasures, such as improving shoulders and delineation without widening pavement, visually narrowing the road by eliminating the centerline (low-volume, low-speed roads), or other experimental treatments, that may help to slow speeds and reduce crashes. Work with FHWA for experimental approval.*

- *Enhance enforcement presence and driver perception of enforcement on rural two-lane highways. Target a larger number of rural routes that have higher than average frequencies of severe and speeding-related crashes for high-visibility enforcement by randomly allocating existing resources and publicizing the effort. The goal is to deter speeders, so using publicity or other means to enhance effectiveness is essential.*

In addition to the countermeasures discussed above two different FHWA Desktop Reference guides have been provided in the appendices:

- Appendix D: FHWA Desktop Reference-Engineering Speed Management Counter Measures Potential Effectiveness in Reducing Speed
- Appendix E: FHWA Desktop Reference-Engineering Speed Management Counter Measures Potential Effectiveness in Reducing Crashes

## 10.0 Referenced Resources

The information provided in this Traffic Calming Manual makes use of a variety of federal, state and local guidance documents, including:

FHWA and ITE Collaboration, *Traffic Calming ePrimer Module 1 Purpose and Organization of ePrimer*

FHWA and ITE Collaboration, *Traffic Calming ePrimer Module 2 Traffic Calming Basics*

FHWA and ITE Collaboration, *Traffic Calming ePrimer Module 3 Toolbox of Individual Traffic Calming Measures*

FHWA and ITE Collaboration, *Traffic Calming ePrimer Module 7 Traffic Calming Programs and Planning Process*

FHWA, *Making Our Roads Safer -One Counter Measure at A Time*

FHWA, *Speed Management-A Manual for Local Rural Road Owners*

FHWA, *Alabama Speed Management Action Plan, Problem Identification, Solutions, Implementation, Evaluation*

FHWA, *Manual on Uniform Traffic Control Devices* (MUTCD)

FHWA, *Engineering Speed Management Countermeasures: A Desktop Reference of Potential Effectiveness in Reducing Speed*

FHWA, *Engineering Speed Management Countermeasures: A Desktop Reference of Potential Effectiveness in Reducing Crashes*

ITE, *Traffic Calming-State of the Practice*

Delaware Department of Transportation, *Traffic Calming Design Manual (2012)*

Pennsylvania Department of Transportation, *Traffic Calming Handbook (2012)*

Virginia Department of Transportation*, Traffic Calming Guide for Local Residential Streets (Revised, 2008)*

City of Baton Rouge, LA, *Residential Traffic Calming Manual (2012)*

City of San Jose, CA, *Traffic Calming Toolkit (Revised 2014)*

# APPENDIX A

## Education Brochures
## and
## Safety Tips

**The following educational documents are for informational purposes and have been compiled from several recognized sources including: City of San Jose-Street Smarts Traffic Safety Education Program, LA DOTD Highway Safety, Louisiana Local Road Safety Program, FHWA-Local Road Safety Plans, and Virginia Beach DPW Traffic Engineering Division. Additional resources are available from each of these agencies utilizing the links provided below.**

**On-Line Resources**

- http://www.getstreetsmarts.org/

  City of San José created the STREET SMARTS Traffic Safety Education Program to address driver, pedestrian and bicyclist behavior.

  Founded in 2002, the nationally-recognized STREET SMARTS program has been working with schools, neighborhoods, seniors and other communities to improve safety on our streets. Every year, tens of thousands of kids learn how to be safer pedestrians and cyclists, while thousands of adults are making smarter choices on our roads.

- http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Multimodal/Highway_Safety/Pages/default.aspx

  LADOTD published the Louisiana Strategic Highway Safety Plan in July 2017

  **Mission:** Our mission is to continually improve the safety of users of Louisiana's highway system through implementation of the highway safety program.

  **Goal:** Our goal is to decrease the frequency, rate, severity of, and potential for crashes involving motor vehicles, bicyclists, and pedestrians on public roads in Louisiana through the implementation of the Strategic Highway Safety Plan involving engineering, enforcement, education, and emergency services.

  **Goal: Reduce Fatalities 50% By 2030**

- http://www.ltrc.lsu.edu/ltap/local-road-safety.html

  The Louisiana Local Technical Assistance Program (LTAP) works closely with Louisiana Department of Transportation and Development (DOTD) Highway Safety Section in administering the Local Road Safety Program (LRSP). The LRSP Team at LTAP conducts outreach to Local Public Agencies (LPA) and facilitates the submission and review of LRSP project applications.

  In an effort to increase local community participation in highway safety, funds are allocated annually for local road safety improvements in Louisiana. LRSP is one of DOTD's **LPA programs** that provides an opportunity for local governments to utilize federal-aid funds for safety improvements on locally owned and maintained roads.

- https://safety.fhwa.dot.gov/local_rural/

  FHWA's Local and Rural Road Safety Program was in response to the fact that the majority of highway fatalities take place on rural roads. In 2012, 19 percent of the US population lived in rural areas but rural road fatalities accounted for 54 percent of all fatalities. Even with reductions in the number of fatalities on the roadways, fatality rate in rural areas is 2.4 times higher than the fatality rate in urban areas.

  Local road agencies often do not have the resources needed to adequately address safety problems on the roads they own and operate. The Local and Rural Safety Program provides national leadership in identifying, developing, and delivering safety programs and products to agencies, elected officials, governments and other stakeholders to improve safety on local and rural roads.

  Addressing safety on local and rural roads presents several challenges including: 1) Safety issues are often random on local and rural roads; 2) Strategies to address local and rural road safety are diverse and draws from several safety areas. This website provides important information to assist in preventing and reducing the severity of crashes on local and rural roads in comprehensible formats and includes:

- Crash Facts
- Funding, Policy and Guidance
- Training, Tools, Guidance and Countermeasures for Locals
- Safety Programs
- Partners and Resources

- https://www.vbgov.com/government/departments/public-works/traffic/Pages/traffic-engineering.aspx

  The Traffic Engineering Division of the Department of Public Works for the City of Virginia Beach, VA has developed a series of information brochures that address frequently asked question related to:

  - Crosswalks
  - Flashing Yellow Arrows
  - Traffic Signals
  - Stop Signs
  - Pedestrians Signals
  - Speed Limits
  - Traffic Calming

# Pedestrian Safety Tips

1. **Cross the street only at intersections**. Do not jaywalk.

2. Use marked crosswalks where available.

3. Do not cross in the middle of the street or between parked cars. Drivers are not expecting pedestrians to cross mid-block and you are more likely to be hit if you do this.

4. **Make eye contact with drivers when crossing busy streets and <u>continue</u> to watch out for traffic the entire time you are in the crosswalk.** Your life may depend on it, regardless of whether or not you have the right-of-way.

5. Remember, don't take those "NO RIGHT TURN ON RED" signs for granted. **<u>Always</u> check for turning vehicles before stepping off the curb** - motorists make mistakes too.

6. Avoid walking in traffic where there are no sidewalks or crosswalks. If you have to walk on a road that does not have sidewalks, walk facing traffic.

7. Stop at the curb and look left, right, and left again before you step into the street. Be sure to evaluate the distance and speed of oncoming traffic before you step out into the street to ensure that a vehicle has adequate distance in which to stop safely.

8. At intersections, scan over your shoulder for turning vehicles. Make eye contact with the driver of a stopped car while crossing in front or in back of it -- making sure that the driver knows you are there. This is also important for cars that might be backing out of driveways.

9. Wear bright colors or reflective clothing if you are walking near traffic at night. Carry a flashlight when walking in the dark.

10. Use extra caution when crossing multiple-lane, higher speed streets.

11. Always look for signs that a car is about to move (rear lights, exhaust smoke, sound of motor, wheels turning), and never walk behind a vehicle that is backing up.

12. Children should not cross streets by themselves or be allowed to play or walk near traffic. Kids are small, unpredictable, and cannot judge vehicle distances and speeds.

13. Always hold your child's hand. Never allow a child under 10 to cross the street alone.

14. In foul weather (rain or snow), allow extra time and distance for a vehicle to stop. Do not let umbrellas or jacket hoods block your view of approaching traffic.

15. If your view of approaching traffic is blocked by something, move to where you can see (e.g., outside edge of a parked car), stop and look left-right-left again.

16. Never run or dash into the street.

17. Watch out for entrances to parking lots. Sidewalks often cross driveways and entrances to parking lots. Always check to see if a car is entering or exiting the parking lot.

18. If the intersection has a pedestrian signal, press the button and wait for the pedestrian signal to display the "WALK" indicator. The "WALK" signal indicates that it is safe for a pedestrian facing the signal may proceed across the roadway in that direction. **Continue to be alert for traffic at all times, however, while in the roadway and always check for turning vehicles.**

19. A flashing "DON'T WALK" signal means that a pedestrian should not start to cross the roadway in the direction of the indicator, once the "DON'T WALK" sign begins to flash. This indicates that there is probably not enough time left in the cycle for you to cross the street safely. However, any pedestrian who has partially completed their crossing should finish crossing the street or proceed to a safety island in the same direction in which they were headed.

20. A steadily illuminated "DON'T WALK" indicator means it is not safe for a pedestrian to enter the roadway in the direction of the indication. Pedestrians waiting to cross should wait for the next "WALK" signal in order to cross the street safely.

# Bicycle Safety Tips

1. Always ride a bike properly sized and fitted to your body. Any bike shop can help with adjustments.

2. Ride on the RIGHT with the flow of traffic. Never ride against traffic.

3. Always obey traffic signs and signals. They apply to bicyclists, just as they apply to motorists.

4. Before turning, use arm signals to let others know where you plan to go, and look for a safe opening.

5. Ride predictably and consistently. Do not make sudden turns or weave between cars.

6. Bicyclists may ride on nearly all roadways (except most freeways and some bridges). Where a Bike Lane (a striped, signed shoulder) exists, ride in that space (except to make turns, to pass a slower vehicle or to avoid hazards). Where no Bike Lane exists, ride in the right should of the right-most lane in your direction. If the lane is too narrow for a motorist to safely pass, take the full lane.

7. Do not pass on the right of motorists or other bicyclists – they may not see you. Pass on the left, after signaling and looking for a safe opening.

8. When turning left choose one of two ways: (1) Like a motorist: signal, look for a safe opening, move into the left turn lane, and turn left, (2) Like a pedestrian: ride straight to the far side crosswalk, get off your bike, wait for the pedestrian signal and walk your bike across when it is safe.

9. Make it a habit to scan the road behind you as you are riding. Practice in an empty parking lot to improve balance and confidence.

10. Ride with both hands ready to brake and allow extra distance when stopping in the rain since brakes are less efficient when wet.

11. Always wear a helmet to protect your head. Adjust your helmet so that it fits snugly and sits forward on your head, protecting your forehead.

12. Watch out for cars turning into your path, cars pulling into or out of driveways, and parked car doors opening in your path.

13. Watch out for road hazards like sewer grates, gravel, ice or potholes.

14. When crossing railroad tracks cross at right angles.

15. When bicycling at night always use a headlight, taillight or rear reflector, pedal reflectors and reflectors on both sides of each wheel. Most new bikes come standard with the reflectors, but not the headlight. Headlights may be purchased at any bicycle shop.

16. Wear bright, light colored clothes that make you more visible.

17. Do not carry passengers (except on approved baby seats).

18. Check brakes and tires regularly.

# SAFE DRIVING

## IS GOOD FOR YOUR CHILD'S HEALTH!

Street Smarts

For more information about the City of San José Street Smarts traffic safety education program, contact:
**408.975.3238**

*Developed in partnership with the Oregon Department of Transportation; portions copyrighted by ODOT and permission granted in advance to reproduce in whole or in part for free, educational uses.*

*This publication can be made available upon request in alternate formats, such as Braille, large print, audio recording or accessible electronic format. Requests can be made by calling:*
***408.535.3500** or **800.735.2929** (CRS).*

**City of San José**

Street Smarts

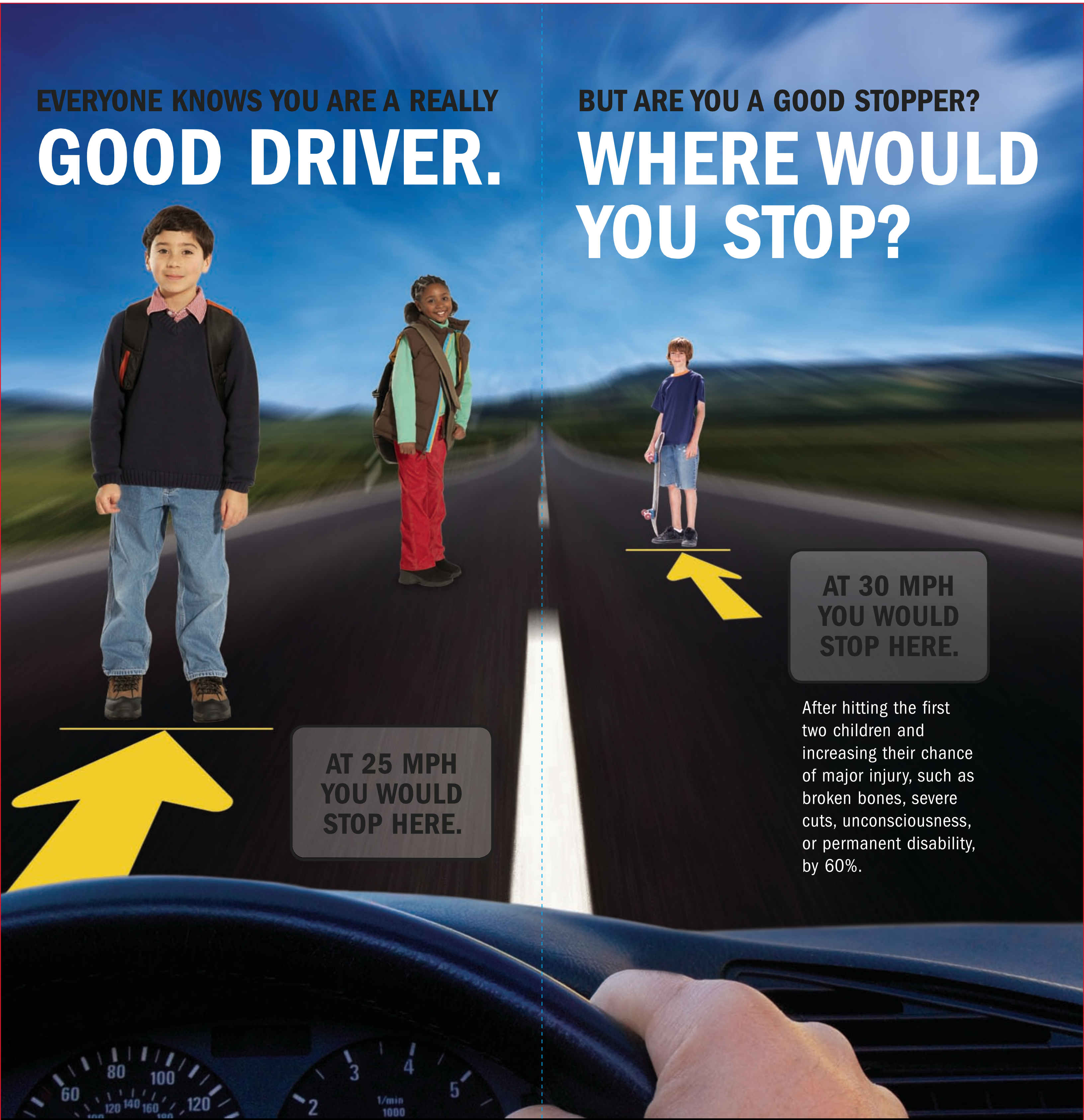
www.GetStreetSmarts.org

## EVERYONE KNOWS YOU ARE A REALLY

# GOOD DRIVER.

## BUT ARE YOU A GOOD STOPPER?

# WHERE WOULD YOU STOP?




After hitting the first two children and increasing their chance of major injury, such as broken bones, severe cuts, unconsciousness, or permanent disability, by 60%.

Driving five miles over the speed limit may not seem like a very big deal, until you harm or kill a child who unexpectedly runs in front of your car. It doesn't matter how good of a driver you are. The faster you go, the longer it takes to stop your moving car. Speeding is hazardous to our children's health.

# DO YOU HAVE KIDS? DO YOU KNOW KIDS?

## THINK ABOUT HOW YOU WANT PEOPLE TO DRIVE AROUND YOUR KIDS...

Street Smarts

### SAFE DRIVING PRACTICES

## DO:

- Come to a complete stop at stop signs.
- Always yield to pedestrians in crosswalks.
- Only load passengers at the curb in the designated safe loading areas.
- Expect children to pop up in the wrong place!
- Follow the safety instructions given by crossing guards and school officials.
- Buckle up **everyone** in your car.
- Always pay attention to the road.


### DANGEROUS DRIVING PRACTICES

## DON'T:

- Pick up or drop off your child in the middle of the street.
- Call your children across the street to your car.
- Double-park.
- Make **U-turns** in school zones.
- Block the crosswalk or driveways with your car.
- Park in red zones or bus zones.
- Leave your vehicle unattended in a passenger loading zone.
- Speed through school zones or residential areas.
- Talk on your cell phone.
- Get distracted while you are driving.

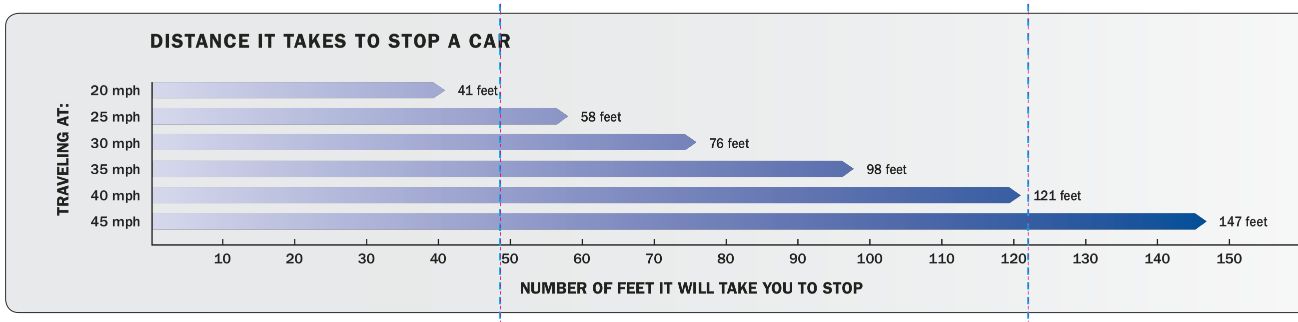
### TEACH THE CHILDREN IN YOUR LIFE TO:

- Walk on the sidewalk, not in the street.
- Look **all** ways before crossing the street.
- Make eye contact with drivers before stepping off a sidewalk.
- Cross the street only in the crosswalk or at an intersection, not in the middle of a block.
- Watch for backing cars.
- Obey adult crossing guards and school safety patrols.
- Pay attention to cars when walking or biking.
- Never step out from between parked cars (drivers can't see them in time to stop).
- Never chase a ball into the street.

### PROTECT YOUR CHILDREN.
### PROTECT OUR CHILDREN.

We need to protect our children. Remember, you have the power to keep them safe. When you're in a school zone, pay extra attention, obey all traffic laws, and drive the speed limit. Good drivers are good stoppers!

**Please drive carefully, especially in school zones.**




### DID YOU KNOW?

- Many speeders in your neighborhood **live** in your neighborhood.
- 23% of fatal accidents happen on local roads, such as residential streets.
- You are more likely to die when struck by a car traveling 30 mph than a car traveling 25 mph.
- According to the World Health Organization's 2007 "Youth and Safety Report": Car crashes are the number one cause of death for young persons, worldwide, between the ages of 10 and 24.

## DON'T BE A STATISTIC!

# 5 WAYS TO GET STREET SMARTS

1. Only cross in marked cross walks
2. Look left, right, left again and behind before crossing
3. Watch for turning cars
4. Establish eye contact with drivers - especially at stop signs
5. When crossing at a walk signal, start only at the WALK, continue through flashing DON'T WALK

Street Smarts www.GetStreetSmarts.org City of San José

# SCHOOL SAFETY
## FOR STUDENTS AND PARENTS

Street Smarts
A public education campaign to change driver, pedestrian and bicyclist behavior.


### Walking to School:
- Parents: Choose the best route to school and walk it with your children.
- Walk with a group, parent, or "buddy." Avoid walking alone.
- Obey all traffic signals, signs and street markings, such as crosswalks.
- Obey the directions of Adult Crossing Guards and School Safety Patrols.
- Look in all directions when crossing. (Left, right, left, front and back)
- Cross the street at a corner or crosswalk only. Do not cross mid-block!
- Stay alert at all times – especially in bad weather.

### Riding a Bike to School:
- Wear a helmet at all times! It's the school policy and state law!
- Ask your parents to help you choose the best cycling route.
- Obey all traffic signals, signs and street markings.
- When riding in the street, ride on the right hand side of the street.
- Ride with the traffic flow; do not ride facing traffic.
- Children under 10 should ride on the sidewalk.
- When riding on sidewalks, ride slow, and watch out for walkers.
- Also watch out for cars entering or leaving driveways.
- Cross streets at corners, and use crosswalks.
- When crossing in a crosswalk, walk your bike across the street.


### Riding in a School Bus:
- Stay out of the street, and don't play around the bus stop.
- Wait for parents where the bus dropped you off; don't cross the street.
- Follow the bus driver's instructions.
- Stay in your seat at all times and keep your things out of the walkway.
- Keep your head, arms and hands inside the bus.


### Riding in a Car to School:
- Wear your seatbelt for the entire ride, even if it is just a short way to go.
- The safest place for children to ride is in the back seat.
- Riding in the back of a pick-up truck without a camper is against the law.
- Make sure children enter or exit the vehicle on the passenger side of the car, next to the sidewalk.
- Park your car a block or two from the school, and walk the rest of the way to avoid congestion.
- OBEY ALL PARKING, WALKING AND DRIVING LAWS, they're for your safety and the safety of our children!
- San José Police Department will be enforcing pedestrian and driving laws around schools this fall to improve safety for our children.

**City of San José**
**www.GetStreetSmarts.org**

# SHSP/HSIP: Infrastructure & Operations

## Possible Causes of Crashes & Potential Countermeasures

## Intersections

**Restricted sight distance**
- Remove sight obstructions
- Provide adequate channelization
- Provide adequate tapers
- Provide left/right turn lanes
- Offset left-turns
- Install warning signs
- Install STOP signs
- Install signal/roundabout
- Install advance markings to supplement signs
- Install STOP bars

**Large volume of left/right turns (from side street)**
- Widen road
- Channelize intersection
- Install STOP signs
- Install signal/roundabout
- Increase curb radii

**Crossing pedestrians/ Large total intersection volume**
- Install / improve ped signing/marking
- Install signal
- Add traffic lane
- Curb extension
- Refuge Island

**Large volume of turning vehicles**
- Provide left/right turn lanes
- Install signal/roundabout

**Lack of adequate gaps**
- Install signal/roundabout
- Install STOP signs

**Slippery surface**
- Improve skid resistance
- Improve drainage

**Poor visibility of signals**
- Upgrade traffic control devices
- Install/enhance advance warning signs
- Install overhead signals
- Install 12" LED signal lenses
- Install visors/backplates
- Relocate signals to far side of intersection
- Remove sight obstructions
- Add illuminated/ retro-reflectorized signs

**Lack of lane discipline w/in intersections**
- Add guide striping

## Bridges

**Alignment/Narrow Roadway**
- Realign bridge/roadway
- Widen structure
- Improve delineation
- Install signing/signals

**Visibility**
- Remove obstruction
- Install advance warning signs

**Vertical Clearance**
- Rebuild structure/adjust roadway grade
- Provide height restriction/warning

**Slippery Surface**
- Improve skid resistance
- Improve drainage

**Rough Surface**
- Rehabilitate joints
- Regrade approaches

**Inadequate barrier system**
- Upgrade approach rail/terminals
- Upgrade bridge -approach rail connections

FHWA Proven Countermeasure

## Roadway Departure (Run-off-road)

**Slippery pavement/ ponded water**
- Improve pavement condition/skid resistance
- Improve drainage

**Inadequate road design/ maintenance**
- Improve superelevation through treatment
- Improve shoulders
- Eliminate shoulder drop-off
- Install/improve traffic barriers
- Install/upgrade double arrow
- Install advanced warning signs
- Enhance signing
- Widen lanes
- Flatten slopes/ditches
- Improve alignment/grade
- Remove/Reduce/ Delineate roadside hazards

**Poor delineation**
- Install roadside delineators
- Install advance warning signs
- Improve/install pavement markings

**Poor visibility**
- Increase sign size
- Install lighting
- Evaluate sight distance
- Longitudinal rumble strips/stripes

## Right Angle

**(Unsignalized Intersection) Restricted sight distance**
- Install warning signs
- Install STOP signs
- Install yield signs
- Remove sight obstructions
- Install signal/roundabout
- Install lighting
- Reduced left turn conflict intersection
- Road Diet

**(Signalized Intersection) Poor visibility of signals**
- Install advance warning signs
- Install back plates
- Remove sight obstructions
- Add signal heads
- Upgrade to 12" LED heads

**(Signalized Intersection) Inadequate signal timing**
- Provide protected only left turn phase
- Adjust amber phase (yellow change interval)
- Provide all-red clearance interval
- Install detection
- Improve signal coordination

## Railroads

**Restricted Sight Distance**
- Install/enhance advance warning signs
- Install/enhance pavement marking
- Remove sight obstructions
- Provide preemption
- Install gates

## Pedestrians & Bicyclists

**Lack of Facilities/Separation/ Poor Visibility**
- Remove sight obstructions
- Install pedestrian crossing signs and pavement markings
- Install median for refuge
- Install lighting
- Install advance warning signs
- Reduce speed limit
- Install/Improve sidewalks/multi-use bicycle paths/arrows
- Road Diet
- Leading Pedestrian Interval
- Pedestrian Hybrid Beacon

**Poor Crossing Conditions**
- Add "WALK" phase
- Bicycle may use full lane
- Rapid Rectangle Flashing Beacon
- Raised Crosswalk
- Paved Shoulders
- Separated/buffered bike lane
- Green bike lane
- Improve/update curb ramp
- Curb radius reduction
- Refuge Island

## Access Related

**Left-turning vehicles**
- Install median
- Install/lengthen left turn lanes

**Improperly located driveway**
- Move driveway to side street
- Install channelizing islands to define driveway location
- Consolidate adjacent driveways

**Right-turning vehicles**
- Provide right turn lanes
- Increase width of driveways
- Widen through lanes
- Increase curb radii

**Large volume of through traffic**
- Move driveway to side street
- Construct a local service road

**Large volume of driveway traffic**
- Signalize driveway
- Provide accel/decel lanes
- Channelize driveway
- Construct a local service road

**Restricted sight distance Inadequate lighting**
- Remove obstruction
- Install lighting

**Median Crossover Issues**
- Improve crossover spacing
- Add turn-lanes

## Nighttime, Overturn, & Wet Weather

**Nighttime - Poor Visibility**
- Install or enhance advance warning signs
- Install or enhance pavement markings
- Install lighting

**Overturn - Roadside Features**
- Flatten slopes/ditches
- Relocate drainage facilities
- Extend culverts
- Provide traversable culvert end treatments
- Install/improve traffic barriers

**Overturn - Inadequate Shoulder**
- Widen shoulder
- Upgrade shoulder surface
- Remove curb/obstruction

**Overturn - Pavement**
- Eliminate edge drop-off
- Improve pavement

**Wet Weather/Slippery Pavement**
- Improve pavement condition
- Install high friction surface treatment
- Improve drainage

**Wet Weather - Poor Visibility**
- Install raised pavement markers
- Improve pavement marking

## Side-swipe or Head-on

**Inadequate road design and/ or maintenance**
- Perform necessary road surface repairs
- Install median or guardrail
- Reevaluate no passing zones
- Provide roadside delineators
- Improve alignment/grade
- Widen lanes
- Provide passing lanes
- Improve shoulders
- Install rumble strips

**Excessive vehicle speed**
- Set speed limit based on speed study

**Inadequate pavement markings**
- Install/improve centerlines, lane lines, edge lines
- Install reflectorized markers

**Inadequate signing**
- Provide advance direction and warning signs
- Add illuminated street name signs
- Superfluous signing
- Limit signs to meet standards
- Road Diet

For more information, please go to: **www.destinationzerodeaths.com**

DESTINATION ZERO DEATHS

SOURCE: ITE Transportation Engineering Handbook w/ Edits by DOTD Highway Safety

Updated: 6/6/2018

*Local Road Safety Program (LRSP) is a federal-aid funding program that provides opportunity for parishes and municipalities to implement low-cost road safety improvements. It is intended to increase local community participation in developing and implementing Local Road Safety Plans and proven safety countermeasures that help eliminate traffic deaths on locally owned roads.*


## CONTACT US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www.louisianalrsp.org

www.louisianaltap.org

LOCAL ROAD SAFETY PROGRAM

# LOCAL ROAD SAFETY PROGRAM

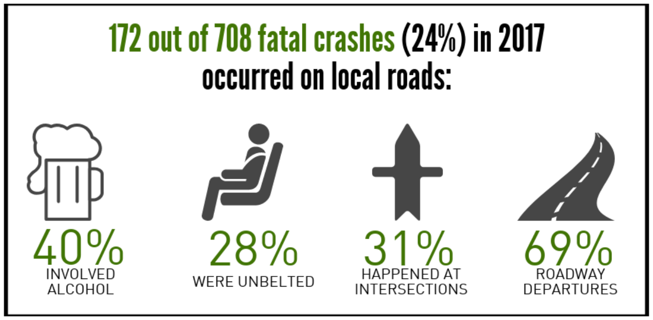
MAKING LOCAL ROADS SAFER FOR ALL LOUISIANANS


Louisiana has
**45,000 miles of local roads**
and only 17,000 miles of state roads.

Road safety is a critical issue on both state highways and local roads.

In 2017, 24% of LA's traffic fatal crashes occurred on locally owned roads.

Over 60% of **172 local road fatal crashes** resulted from roadway departures while 31% happened at intersections.




**SOURCE:**
LSU Highway Safety Research Group
SHSP Data Dashboards

## APPLICATION PROCESS

Project applications for local road safety improvements are accepted year-round. However, those submitted by cutoff dates **March 31, June 30, September 30, and December 31** shall be given priority for project selection.

## ELIGIBLE PROJECTS

**Low-cost proven safety countermeasures** such as curve delineations, rumble strips, high friction surface treatments, pavement markings, signage, flashing beacons, intersection improvements, mini-roundabouts, and more. Projects that are prioritized in **Local Road Safety Plans** may also be funded.

## TECHNICAL ASSISTANCE

**Louisiana Local Technical Assistance Program (LTAP)** administers the LRSP. Our team provides technical assistance in crash data analysis, local road safety planning, road safety assessments, training and development for Local Public Agencies (LPAs), and on-site field visits.

## LOCAL ROAD SAFETY PLANS

LTAP's LRSP team works closely with parishes and municipalities to develop and implement **Local Road Safety Plans** that reflect the state's vision of reaching **Destination Zero Deaths.**
These plans serve as a their roadmap to making local roads safer for all.


Local Road Safety Plans:
Your Map to Safer Roadways
No matter what your resources, a Local Road Safety Plan will guide you to data-driven solutions and safer roads.
https://safety.fhwa.dot.gov/provencountermeasures/local_road/
START HERE!
Identify Stakeholders
Law Enforcement
Public Health
EMS
Elected Officials
Café
Risks Ahead
Chevron signs reduce nighttime crashes by 25%.
Choose Proven Solutions
Chevrons
Roundabouts
Targeted Enforcement
Crosswalks
Use Safety Data
Crashes
Maintenance Logs
Safety Audits
Traffic Violations
In 2017, over 50% of fatalities occurred on rural roads, but just 19% of Americans live in rural areas.
Store
Implement Solutions
Education & Enforcement
Captial Projects
Maintenance Work
Safer Roads Ahead
More than 75% of all roads are maintained by local agencies.
LOCAL ROAD SAFETY PLANS
Help Get People Home Safely

## You Can Help!

### Obey the Speed Limit


Drive 25 mph or less to give you more time to react to the unexpected, such as children darting out from behind parked cars, pets or obstacles in the road, and pedestrians. Unless you make a conscious effort, you may drive faster than you should on residential streets.

Remind neighbors and anyone using your vehicle to obey the speed limit, and practice good driving habits.

Studies show that driving at a responsible speed on residential streets has very little effect on the time it takes to complete your journey.

### Avoid Using Neighborhood Streets as Shortcuts


The more we use residential streets as shortcuts, the more we disrupt the quality of life in neighborhoods.

### Observe the Rules of the Road


Don't take chances, even on short trips. Statistics show that most accidents occur close to home. In particular, make sure you and all of your passengers buckle up.

### Be Aware of Your Perception

To a person standing still in their front yard, cars traveling 25-30 mph may appear to be going more than 40 mph . When cars accelerate, it may also sound like they are going faster than 25 mph. Often, residents perceive vehicles as traveling faster than they actually are. One way to determine if a street has a legitimate speeding problem is to do a study.

## Frequently Asked Questions

**Q: Where will you do the speed study?**
A: Usually, the neighborhood selects the location for the speed study since they are the most familiar with their neighborhood. However, if they wish, Traffic Engineering will select a location based on observation of the most likely site for speeders. Only one location can be chosen; therefore, it is advisable that the neighborhood choose the site that experiences the worst-case scenario, or the highest perceived number of speeders.

**Q: Can you install speed bumps on our street?**
A: Physical devices are among the many options considered in Phase 4. Physical devices are installed only as a last resort, after all other attempts are unsuccessful. There are strict criteria that must be met, and all devices must be approved by emergency services.

**Q: Can you install STOP signs to slow speeders?**
A: The City installs STOP signs to indicate right-of-way. Installing STOP signs for speed control goes directly against federal guidelines. The guidelines are based on previous engineering practices and studies, and have determined that STOP signs can actually exacerbate problems after extended use. First, people tend to speed in between STOP signs, to "make up" for their perceived lost time. Second, when drivers must constantly stop for traffic, but do not see good reason to, they will develop contempt for STOP signs.

**Q: Can "Children At Play" signs be put up?**
A: "Children At Play" signs and similar caution signs do not slow down vehicles. Many municipalities no longer install "Children At Play" signs because these signs give parents a false sense of security that the City cannot provide. The City does not condone children playing in the street, and this is further reinforced by City Code.

# Traffic Calming Program

*Working Together to Find a Solution*


Speed Trailor used in Traffic Calming Program

Department of Public Works
Traffic Engineering Division
2405 Courthouse Drive
Virginia Beach, Virginia 23456-9031
(757) 385-4131 / /FAX (757)385-4913
www.vbgov.com

# Traffic Calming Program (TCP)

*Working Together to Find a Solution*

The City of Virginia Beach, Department of Public Works/Traffic Engineering Division has a Traffic Calming Program (TCP) designed to improve the quality of life on our neighborhood streets. The program is intended to address speeding in residential neighborhoods on streets classified as local or residential roads.

### TCP Goals

- Increase the quality of life for our residents
- Reduce effects of motor vehicles on environment
- Achieve slower motor vehicle speeds
- Increase perception of safety for non-motorists
- Reduce cut-through traffic

### What is 'Traffic Calming'?

***Traffic Calming is defined as "the combination of non-physical and physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users."***

## Traffic Calming Phases

Neighborhoods could complete up to four phases of the program, depending on traffic volume and speed. The following **four phases** of the program must be completed sequentially.

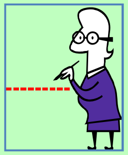
**(1) Awareness and Education -** Traffic Engineering discusses the program with civic league leaders or similar representatives. The neighborhood or civic league selects one street and location for evaluation.

**(2) Selective Enforcement -** Traffic Engineering performs a 48 hour speed study on the selected street to see if it qualifies. Traffic Engineering and the Police Department schedules enforcement on the designated street during the highest violation periods. Enforcement is conducted weekly for twelve or more weeks, after which a traffic study will be performed to determine if program compliance has been achieved.

**(3) Increased Fines -** If a street remains in non-compliance after selective enforcement, 75% of the affected area residents must sign a petition agreeing to an increased minimum fine of $200 for speeding. Once the petition has been submitted and verified, Traffic Engineering will conduct studies to select the streets that will be covered. Signs will be posted to indicate the streets to be included in Phase 3. Police enforcement will be scheduled for a twelve or more week cycle, after which a traffic study will be performed to determine if program compliance has been achieved.

**(4) Physical Measures -** If a street remains in non-compliance after Phase 3, Traffic Engineering again requires 75% of the affected area residents in the neighborhood to sign a petition supporting physical devices installed on the designated street. Once the petition has been submitted and verified, Traffic Engineering designs and schedules installation of the devices. Installation occurs only if the Police Dept., Fire Dept., and EMS approve of the design.

## How to Participate



**Request -** the neighborhood association, civic league, or appointed representative writes a request to the Traffic Engineering. The City will then contact you to set up a meeting.

**Eligible Streets–** The TCP is restricted to streets classified as local residential streets, with posted speed limits of 25 mph, a two-lane road, with a minimum of 12 dwellings fronting the street per 1,000 feet of roadway. Traffic Engineering will determine if the street is eligible.


**Documented Speeding Problem -** To qualify for the Traffic Calming Program, the average speed must be at least 29 mph, or the 85th Percentile speed at least 33 mph.

**Program Evaluation -** each phase of the program is evaluated for effectiveness. Evaluation consists of several traffic studies of the selected street. An initial evaluation is performed prior to implementation of the traffic calming program. This initial study is used to document the speeding problem, establish the controls, and determine benchmarks to measure program effectiveness. Subsequent traffic studies will be performed to determine compliance with the program objectives.


The portable speed trailer visually displays drivers' real-time speed; therefore, it may be effective in increasing awareness of local speed limits.

The trailer is best used in residential areas and is used as part of the Traffic Calming Program or can be used as part of other safety education programs.

# APPENDIX B

## Misc. Forms

- Ac.TCM.01 Request for Study Form
- Ac.TCM.02 Traffic Calming Study Petition Form
- Ac.TCM.03 Traffic Calming Priority Ranking/Rating Form

We the residents of the potential Traffic Calming Impact Area would like to request that Ascension Parish initiate a Traffic Calming Study in our neighborhood.

**A. <u>This request is being made from a Neighborhood/Homeowners Association</u>**

Association Name:____________________________________________

Association Representative:________________________ Association Position:________________________

Phone Number:____________________ Email:____________________________________

*Attached is a copy of the Associations Meeting Minutes and/or resolution approving making this Study Request.*

B. **<u>This request is being made from an Individual representing households along the area of study</u>**

Applicant Name:____________________________________________

Applicant Address:____________________________________________

Phone Number:____________________ Email:____________________________________

*Attached is a copy of the Traffic Calming Study Petition Form Ac.02 which includes the signatures from 10 residents of separate households along the proposed area of study (i.e. includes only one signature per household).*

Requested Traffic Calming Study Limits: (Identify street limits including street name, block limits and/or address limits for area of concern):

____________________________________________
____________________________________________
____________________________________________
____________________________________________
____________________________________________

Specific Traffic Concerns: (please indicate all that applies)

| | Concerns | | Concerns |
|---|---|---|---|
| ☐ | Speeding | ☐ | Pedestrian Safety |
| | | | |
| ☐ | Cut-Through Traffic | ☐ | Parking Issues |
| | | | *Other Issues Indicate Below* |
| ☐ | Trucks and Commercial Vehicles | ☐ | |
| | | | |
| ☐ | School Traffic | ☐ | |

# NEIGHBORHOOD REQUEST FOR TRAFFIC CALMING STUDY AND/OR FINAL PLAN ACCEPTANCE

**Neighborhood/Street**________________________________________**Page ___ of ___.**

| No. | Print Name | Signature | Request Study | Final Plan Acceptance | |
|---|---|---|---|---|---|
| | | | | Support | Oppose |
| | Address: | | ☐ | ☐ | ☐ |
| | Address: | | ☐ | ☐ | ☐ |
| | Address: | | ☐ | ☐ | ☐ |
| | Address: | | ☐ | ☐ | ☐ |
| | Address: | | ☐ | ☐ | ☐ |
| | Address: | | ☐ | ☐ | ☐ |
| | Address: | | ☐ | ☐ | ☐ |
| | Address: | | ☐ | ☐ | ☐ |
| | Address: | | ☐ | ☐ | ☐ |
| | Address: | | ☐ | ☐ | ☐ |

# NEIGHBORHOOD TRAFFIC CALMING PROJECT RATING

**Project/Neighborhood Name:**

| **Street Name** | Begin Limits | to | End Limits |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

| **Criteria/Warrant** | **Available Points** | **Point Basis** | | | | **Points** |
|---|---|---|---|---|---|---|
| Traffic Volume | (0-30) | 1 pt. will be assigned for the Average Daily Traffic volume divided by 100 (**max 30 pts**) | ADT | ADT/100 | | |
| Speed | (0-30) | 2 pts. will be assigned for each mph that the 85th Percentile speed exceeds the posted speed (**max 30 pts**) | Speeds: 85th Percentile | Posted | Differential | |
| Accidents | (0-10) | 1 pt. will be assigned for each preventable collision/accident that has occurred over the last 3 yrs. (**max 10pts**) | Preventable Accidents | | | |
| School Zones | (0-10) | 10 pts. if school/schools abut or marked school crossings are in place within the limits of the study street, if none exists 0 pts. | Schools or Crossings (Y or N) | | | |
| Pedestrian Generators | (0-10) | 5 pts. will be assigned for each facility (parks, community centers, libraries, transit stops, commercial uses... )that generate a significant number of pedestrians (**10 pts max**) | # Of Generators | | | |
| Sidewalks | (0-10) | 10 pts. will be assigned if no sidewalks are present, 5pts if sidewalks on one side of the rdwy only | Sidewalks Both Sides (Y or N) | Sidewalks One Side (Y or N) | | |
| | | | | | Total Points (100 max) | |

Data Entry Fields

# APPENDIX C

## FHWA
## Making Our Roads Safer
## One Counter Measure at a Time

U.S. Department of Transportation
Federal Highway Administration


# Making Our Roads Safer

## ONE COUNTERMEASURE AT A TIME

***20 Proven Safety Countermeasures that offer significant and measurable impacts to improving safety***

Safe Roads for a Safer Future
*Investment in roadway safety saves lives*
http://safety.fhwa.dot.gov

# Proven Safety Countermeasures

## ROADWAY DEPARTURE

1. EnhancedDelineation and Friction for Horizontal Curves
2. Longitudinal Rumble Strips and Stripes
3. SafetyEdge$_{sm}$
4. Roadside Design Improvements at Curves
5. Median Barriers

## PEDESTRIANS/BICYCLES

13. Leading Pedestrian Intervals
14. Medians and Pedestrian Crossing Islands in Urban and Suburban Areas
15. Pedestrian Hybrid Beacons
16. Road Diets/Reconfigurations
17. Walkways

## INTERSECTIONS

6. Backplates with Retroreflective Borders
7. Corridor Access Management
8. Left-and Right-Turn Lanes at Two-Way Stop-Controlled Intersections
9. Reduced Left-Turn Conflict Intersections
10. Roundabouts
11. Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections
12. Yellow Change Intervals

## CROSSCUTTING

18. Local Road Safety Plans
19. Road Safety Audits
20. USLIMITS2

➔For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures.

# 1. Enhanced Delineation and Friction for Horizontal Curves

This proven safety countermeasure for reducing crashes at curves includes a variety of potential strategies that can be implemented in combination or individually. These strategies fall into two categories: enhanced delineation and increased pavement friction.

Chevron signs installed along a curve.

## Enhanced Delineation

Enhanced delineation treatments can alert drivers in advance of the curve and vary by the severity of the curvature and operating speed. Price ranges for these strategies are low to moderate. Treatments include the following:

- Pavement markings.
- Post-mounted delineation.
- Larger signs and signs with enhanced retroreflectivity.
- Dynamic advance curve warning signs and sequential curve signs.

## Increased Pavement Friction

High friction surface treatment (HFST) is another highly cost-effective countermeasure. HFST compensates for the high friction demand at curves where the available pavement friction is not adequate to support operating speeds due to one or more of the following situations:

- Sharp curves.
- Inadequate cross-slope design.
- Wet conditions.
- Polished roadway surfaces.
- Driving speeds in excess of the curve advisory speed.

To implement these proven safety countermeasures, agencies can take the following steps:

1. Develop a process for identifying and treating problem curves.
2. Use the appropriate application for the identified problem(s), consider the full range of enhanced delineation and friction treatments.
3. Improve consistency in application of horizontal curve guidance provided in the *Manual on Uniform Traffic Control Devices* for new and existing devices.
4. Review signing practices and policies to ensure they comply with the intent of the new guidance.

### SAFETY BENEFITS:

**CHEVRON SIGNS**

**25%**

Reduction in nighttime crashes

**16%**

Reduction in non-intersection fatal and injury crashes

Source: CMF Clearinghouse, CMF IDs 2438 and 2439

**HIGH FRICTION SURFACE TREATMENTS**

**52%**

Reduction in wet road crashes

**24%**

Reduction in curve crashes

Source: CMF Clearinghouse, CMF IDs 7900 and 7901

# 2. Longitudinal Rumble Strips and Stripes

SAFETY BENEFITS:

**CENTER LINE RUMBLE STRIPS**

**44-64%**

Head-on, opposite-direction, and sideswipe fatal and injury crashes

**SHOULDER RUMBLE STRIPS**

**13-51%**

Single vehicle, run-off-road fatal and injury crashes

Source: NCHRP Report 641, *Guidance for the Design and Application of Shoulder and Centerline Rumble Strips.*

Shoulder rumble strips and center line rumble stripes are installed on this roadway.

Source: FHWA

***Longitudinal rumble strips*** are milled or raised elements on the pavement intended to alert drivers through vibration and sound that their vehicles have left the travel lane. They can be installed on the shoulder, edge line of the travel lane, or at or near center line of an undivided roadway.

***Rumble stripes*** are edge line or center line rumble strips where the pavement marking is placed over the rumble strip, which can result in an increased visibility of the pavement marking during wet, nighttime conditions.

With roadway departure crashes accounting for more than half of the fatal roadway crashes annually in the United States, rumble strips and stripes are designed to address these crashes caused by distracted, drowsy, or otherwise inattentive drivers who drift from their lane. They are most effective when deployed in a systemic application since driver error may occur on all roads.

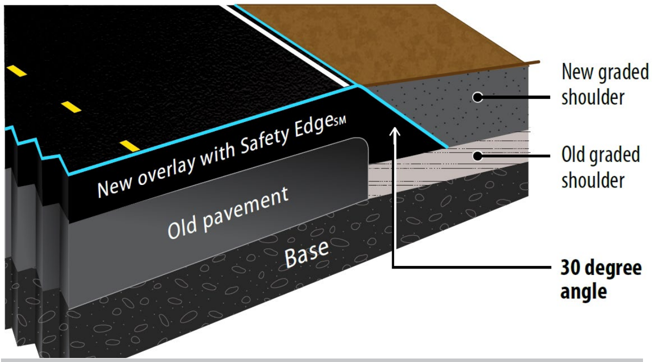
Example of an edge line rumble stripe.

Source: Missouri DOT

Transportation agencies should consider milled center line rumble strips (including in passing zone areas) and milled edge line or shoulder rumble strips with bicycle gaps for systemic safety projects, location-specific corridor safety improvements, as well as reconstruction or resurfacing projects.

# 3. SafetyEdge$_{SM}$

SafetyEdge$_{SM}$ technology shapes the edge of the pavement at approximately 30 degrees from the pavement cross slope during the paving process. This systemic safety treatment eliminates the vertical drop-off at the pavement edge, allowing drifting vehicles to return to the pavement safely. It has minimal effect on asphalt pavement project cost with the potential to improve pavement life.




Cross-section view of an overlay with SafetyEdge$_{SM}$.

Source: FHWA-SA-17-044

Vehicles may leave the roadway for various reasons, ranging from distracted driver errors to low visibility, or to the presence of an animal on the road. Exposed vertical pavement edges can cause vehicles to be unstable and prevent their safe return to the roadway. SafetyEdge$_{SM}$ gives drivers the opportunity to return to the roadway while maintaining control of their vehicles.

For both SafetyEdge$_{SM}$ and traditional edge, agencies should bring the adjacent shoulder or slope flush with the top of the pavement. Since over time the edge may become exposed due to settling, erosion, and tire wear, the gentle slope provided by SafetyEdge$_{SM}$ is preferred versus the traditional vertical pavement edge.

Transportation agencies should develop standards for implementing SafetyEdge$_{SM}$ on all new asphalt paving and resurfacing projects where curbs are not present, while encouraging standard application for concrete pavements.

Example of SafetyEdge$_{SM}$ after backfill material settles or erodes.

Source: FHWA

SafetyEdge$_{SM}$ adds nominal cost to repaving a road.

**Calculated benefit-cost ratios typically range between**

**500-1400**

Source: Safety Effects of the SafetyEdge$_{SM}$, FHWA-SA-17-044.

Rural road crashes involving edge drop-offs are

**2 to 4 times**

**more likely to include a fatality than other crashes on similar roads.**

Source: S.L. Hallmark, et al., Safety Impacts of Pavement Edge Drop-offs, (Washington, DC: AAA Foundation for Traffic Safety: 2006), p 93.

## SAFETY BENEFIT:

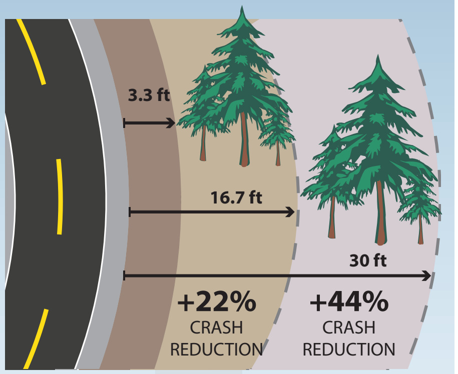
**11%**

**Reduction in fatal and injury crashes**

Source: Safety Effects of the SafetyEdge$_{SM}$, FHWA-SA-17-044.

# 4. Roadside Design Improvements at Curves

## Increasing the Clear Zone prevents crashes




Source: Leidos. Data Source: CMF Clearinghouse (CMF IDs 35 and 36)

**SAFETY BENEFIT:**

**27%** of all fatal crashes occur at curves

**80%** of all fatal crashes at curves are roadway departure crashes

Source: Fatality Analysis Reporting System (FARS)

Roadside design improvement at curves is a strategy encompassing several treatments that target the high-risk roadside environment along the outside of horizontal curves. These treatments prevent roadway departure fatalities by giving vehicles the opportunity to recover safely and by reducing crash severity.

Roadside design improvements can be implemented alone or in combination and are particularly recommended at horizontal curves—where data indicates a higher-risk for roadway departure fatalities—and where cost effectiveness can be maximized.

### Roadside Design Improvements to Provide for a Safe Recovery

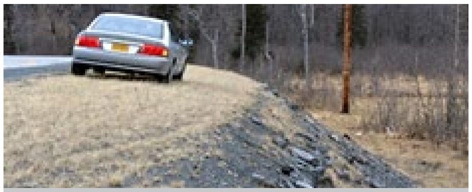
In cases where a vehicle leaves the roadway, strategic roadside design elements, including clear zone addition or widening, slope flattening, and shoulder addition or widening, can provide drivers with an opportunity to regain control and re-enter the roadway.

- A **clear zone** is an unobstructed, traversable area beyond the edge of the through traveled way for the recovery of errant vehicles. Clear zones are free of rigid fixed objects such as trees and utility cabinets or poles. AASHTO's *Roadside Design Guide* details the clear zone width adjustment factors to be applied at horizontal curves.
- **Slope flattening** reduces the steepness of the sideslope to increase drivers' ability to keep the vehicle stable, regain control of the vehicle, and avoid obstacles.
- **Adding or widening shoulders** gives drivers more recovery area to regain control in the event of a roadway departure.

### Roadside Design Improvements to Reduce Crash Severity

Since not all roadside hazards can be removed at curves, installing roadside barriers to shield unmovable objects or embankments may be an appropriate treatment. Roadside barriers come in three forms:

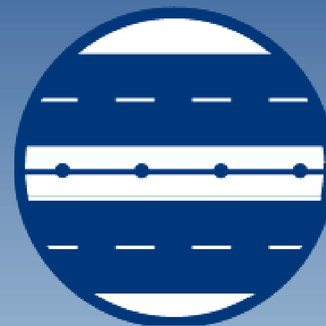
- **Cable barrier** is a flexible barrier made from wire rope supported between frangible posts.
- **Guardrail** is a semi-rigid barrier, usually either a steel box beam or W-beam. These deflect less than flexible barriers, so they can be located closer to objects where space is limited.
- **Concrete barrier** is a rigid barrier that does not deflect. These are typically reserved for use on divided roadways.



Shoulder is provided along roadway curve.

Source: Alaska DOT

# 5. Median Barriers



Median barriers are longitudinal barriers that separate opposing traffic on a divided highway and are designed to redirect vehicles striking either side of the barrier. Median barriers significantly reduce the severity of cross-median crashes, which are attributed to the relatively high speeds that are typical on divided highways. Approximately 8 percent of all fatalities on divided highways are due to head-on crashes.

Median cable barrier prevents a potential head-on crash.

Source: Washington State DOT

In the past, median barriers were typically only used when medians were less than 30 feet wide, but many States realized they were experiencing cross-median fatal crashes in medians that exceeded 30 feet. AASHTO's *Roadside Design Guide* was revised in 2006 to encourage consideration of barriers in medians up to 50 feet wide.

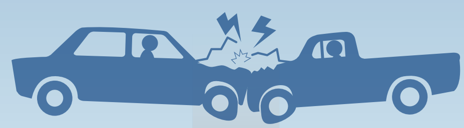
The application of cable median barriers is a very cost-effective means of reducing the severity of median crossover crashes. Median barriers can be **cable, concrete,** or **beam guardrail**.

- **Cable barriers** are softer, resulting in less impact force and redirection, are more adaptable to slopes typically found in medians, and can be installed through less invasive construction methods.
- **Concrete barriers** are rigid, yielding little to no deflection upon impact, and absorbing little crash energy. Although this system is expensive to install, it performs well when hit and only requires repair in the most extreme circumstances.
- **Beam guardrails** are considered semi-rigid barriers. When impacted, they deform and deflect, absorbing some of the crash energy, and usually redirecting the vehicle. Beam guardrails are less expensive to install than rigid barriers, and are more resilient than cable barriers.

To reduce the number and severity of cross-median crashes, transportation agencies should review their median crossover crash history to identify the locations where median barriers are most warranted. Agencies should also consider implementing a systemic median barrier policy based on cross-median crash risk factors.

**8%**

**OF ALL FATALITIES ON DIVIDED HIGHWAYS ARE DUE TO HEAD-ON CRASHES[1]**

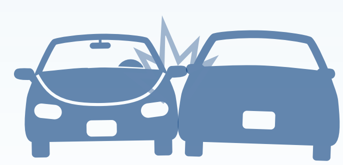


**SAFETY BENEFIT:**

**MEDIAN BARRIERS INSTALLED ON RURAL FOUR-LANE FREEWAYS**

**97%**

**Reduction in cross-median crashes [2]**



[1] Fatality Analysis Reporting System (FARS).

[2] NCHRP Report 794, *Median Cross-Section Design for Rural Divided Highways*.

# 6. Backplates with Retroreflective Borders


Source: FHWA

SAFETY BENEFIT:

**15%**

Reduction in total crashes

Source: CMF Clearinghouse, CMF ID 1410.

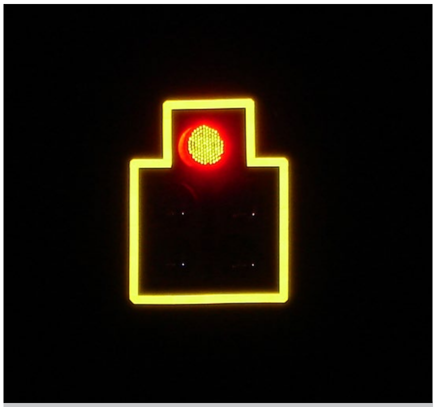
Backplates added to a traffic signal indication improve the visibility of the illuminated face of the signal by introducing a controlled-contrast background. The improved visibility of a signal head with a backplate is made even more conspicuous by framing it with a retroreflective border. Signal heads that have backplates equipped with retroreflective borders are more visible and conspicuous in both daytime and nighttime conditions.

This treatment is recognized as a human factors enhancement of traffic signal visibility, conspicuity, and orientation for both older and color vision deficient drivers. This countermeasure is also advantageous during periods of power outages when the signals would otherwise be dark, providing a visible cue for motorists.

Transportation agencies should consider backplates with retroreflective borders as part of their efforts to systemically improve safety performance at signalized intersections. Adding a retroreflective border to an existing signal backplate is a very low-cost safety treatment. The most effective means of implementing this proven safety countermeasure is to adopt it as a standard treatment for signalized intersections across a jurisdiction.


Example of a signal backplate framed with a retroreflective border.

Source: FHWA



Retroreflective borders are highly visible during the night.

Source: South Carolina DOT

# 7. Corridor Access Management

Access management refers to the design, application, and control of entry and exit points along a roadway. This includes intersections with other roads and driveways that serve adjacent properties. Thoughtful access management along a corridor can simultaneously enhance safety for all modes, facilitate walking and biking, and reduce trip delay and congestion.

A raised median reduces conflict points along this roadway.

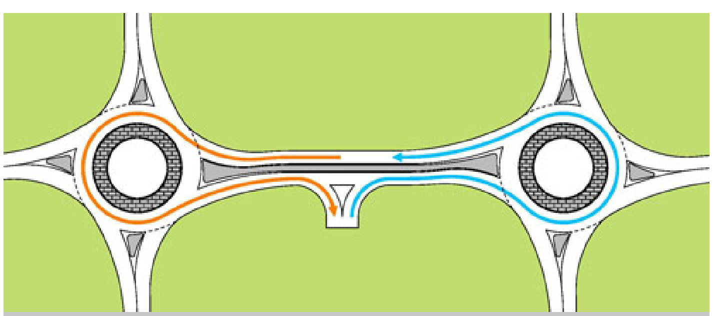
Source: Missouri DOT

Every intersection, from a signalized intersection to an unpaved driveway, has the potential for conflicts between vehicles, pedestrians, and bicycles. The number and types of conflict points—locations where the travel paths of two users intersect—influence the safety performance of the intersection or driveway.

The following access management strategies can be used individually or in combination with one another:

- Driveway closure, consolidation, or relocation.
- Limited-movement designs for driveways (such as right-in/right-out only).
- Raised medians that preclude across-roadway movements.
- Intersection designs such as roundabouts or those with reduced left-turn-conflicts (such as J-turns, median U-turns, etc.).
- Turn lanes (i.e., left-only, right-only, or interior two-way left).
- Lower speed one-way or two-way off-arterial circulation roads.

Successful corridor access management involves balancing overall safety and corridor mobility for all users along with the access needs of adjacent land uses.


Use of roundabouts, raised median, and right-in/right-out driveways can be an effective access management plan.

Source: FHWA-SA-15-005


This intersection design restricts left-turn movements to improve safety.

Source: FHWA

## SAFETY BENEFITS:

**5-23%**

Reduction in total crashes along 2-lane rural roads

**25-31%**

Reduction in injury and fatal crashes along urban/ suburban arterials

Source: *Highway Safety Manual*

# 8. Left and Right Turn Lanes at Two-Way Stop-Controlled Intersections

SAFETY BENEFITS:

**LEFT-TURN LANES**

**28-48%**

Reduction in total crashes

**RIGHT-TURN LANES**

**14-26%**

Reduction in total crashes

Source: *Highway Safety Manual*


Example of left-turn lanes.

Source: FHWA

Auxiliary turn lanes—either for left turns or right turns—provide physical separation between turning traffic that is slowing or stopped and adjacent through traffic at approaches to intersections. Turn lanes can be designed to provide for deceleration prior to a turn, as well as for storage of vehicles that are stopped and waiting for the opportunity to complete a turn.

While turn lanes provide measurable safety and operational benefits at many types of intersections, they are particularly helpful at two-way stop-controlled intersections. Crashes occurring at these intersections are often related to turning maneuvers. Since the major route traffic is free flowing and typically travels at higher speeds, crashes that do occur are often severe. The main crash types include collisions of vehicles turning left across opposing through traffic and rear-end collisions of vehicles turning left or right with other vehicles following closely behind. Turn lanes reduce the potential for these types of crashes.

Installing left-turn lanes and/or right-turn lanes should be considered for the major road approaches for improving safety at both three- and four-leg intersections with two-way stop control on the minor road, where significant turning volumes exist, or where there is a history of turn-related crashes. Pedestrian and bicyclist safety and convenience should also be considered when adding turn lanes at an intersection.

Example of a right-turn lane.

Source: FHWA

# 9. Reduced Left-Turn Conflict Intersections

Reduced left-turn conflict intersections are geometric designs that alter how left-turn movements occur in order to simplify decisions and minimize the potential for related crashes. Two highly effective designs that rely on U-turns to complete certain left-turn movements are known as the restricted crossing U-turn (RCUT) and the median U-turn (MUT).

Example of RCUT intersection.

Source: FHWA

## Restricted Crossing U-turn (RCUT)

The RCUT intersection modifies the direct left-turn and through movements from cross-street approaches. Minor road traffic makes a right turn followed by a U-turn at a designated location – either signalized or unsignalized – to continue in the desired direction.

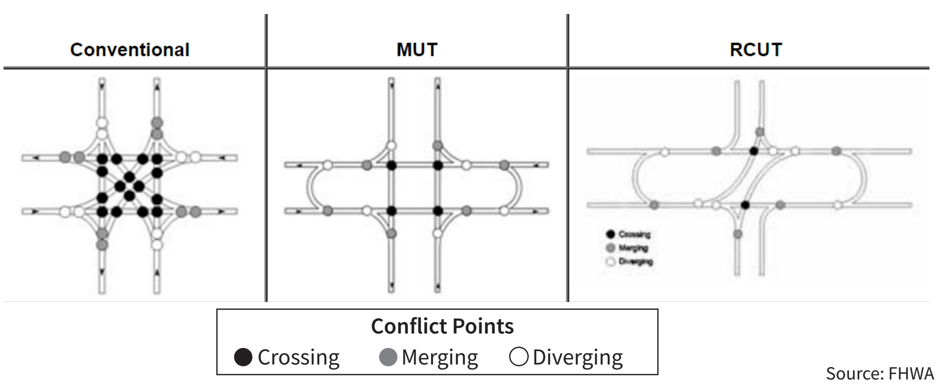
The RCUT is suitable for a variety of circumstances, including along rural, high-speed, four-lane, divided highways or signalized routes. It also can be used as an alternative to signalization or constructing an interchange. RCUTs work well when consistently used along a corridor, but also can be used effectively at individual intersections.

## Median U-turn (MUT)

The MUT intersection modifies direct left turns from the major approaches. Vehicles proceed through the main intersection, make a U-turn a short distance downstream, followed by a right turn at the main intersection. The U-turns can also be used for modifying the cross-street left turns.

The MUT is an excellent choice for heavily traveled intersections with moderate left-turn volumes. When implemented at multiple intersections along a corridor, the efficient two-phase signal operation of the MUT can reduce delay, improve travel times, and create more crossing opportunities for pedestrians and bicyclists.

### *MUT and RCUT Can Reduce Conflict Points by 50%*




Source: FHWA

Example of MUT intersection.

Source: FHWA

## SAFETY BENEFITS:

**RCUT**

**54%**

Reduction in injury and fatal crashes[1]

**MUT**

**30%**

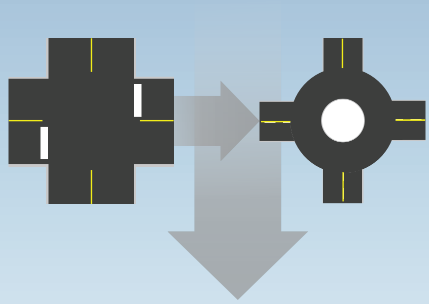
Reduction in intersection-related injury crash rate[2]

1 Edara et al., "Evaluation of J-turn Intersection Design Performance in Missouri," December 2013.

2 FHWA, *Median U-Turn Intersection Informational Guide*, FHWA-SA-14-069 (Washington, DC: 2014), pp. 41-42.

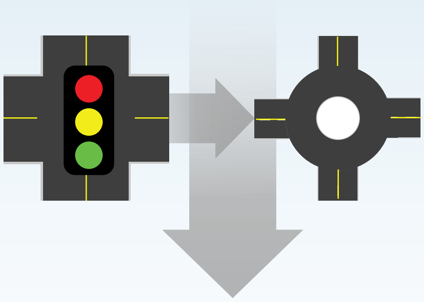
# 10. Roundabouts

### TWO-WAY STOP-CONTROLLED INTERSECTION TO A ROUNDABOUT



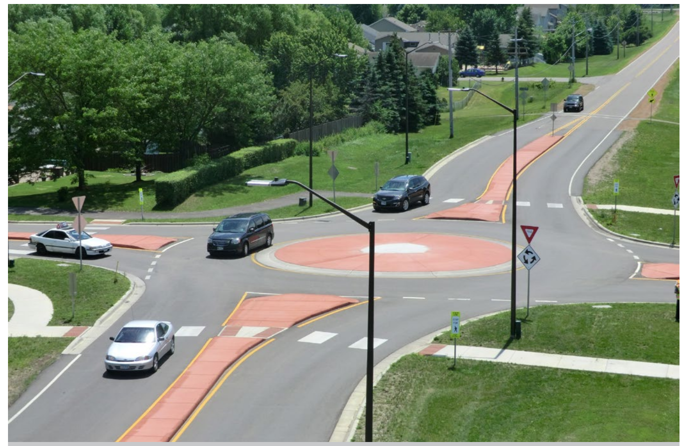
**82%**
Reduction in severe crashes

### SIGNALIZED INTERSECTION TO A ROUNDABOUT



**78%**
Reduction in severe crashes

Source: *Highway Safety Manual*



Example of a single-lane roundabout.

Source: FHWA

The modern roundabout is a type of circular intersection configuration that safely and efficiently moves traffic through an intersection. Roundabouts feature channelized approaches and a center island that results in lower speeds and fewer conflict points. At roundabouts, entering traffic yields to vehicles already circulating, leading to improved operational performance.

Roundabouts provide substantial safety and operational benefits compared to other intersection types, most notably a reduction in severe crashes.

Roundabouts can be implemented in both urban and rural areas under a wide range of traffic conditions. They can replace signals, two-way stop controls, and all-way stop controls. Roundabouts are an effective option for managing speed and transitioning traffic from high-speed to low-speed environments, such as freeway interchange ramp terminals, and rural intersections along high-speed roads.

Example of a multi-lane roundabout.

Source: FHWA

FHWA encourages agencies to consider roundabouts during new construction and reconstruction projects as well as for existing intersections that have been identified as needing safety or operational improvements.

# 11. Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections


This systemic approach to intersection safety involves deploying a group of multiple low-cost countermeasures, such as enhanced signing and pavement markings, at a large number of stop-controlled intersections within a jurisdiction. It is designed to increase driver awareness and recognition of the intersections and potential conflicts.


Example of countermeasures on the through approach.

Source: South Carolina DOT

**Average Benefit-Cost Ratio**

**12:1**

The systemic approach to safety has three components: (1) analyze systemwide data to identify a problem, (2) look for similar risk factors present in severe crashes, and (3) deploy on a large scale low-cost countermeasures that address the risk factors contributing to crashes.

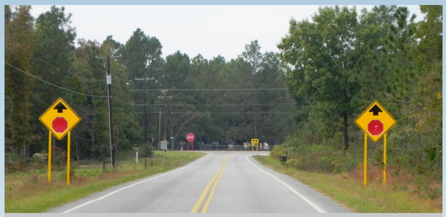
The low-cost countermeasures for stop-controlled intersections generally consist of the following treatments:

### *On the Through Approach*

- Doubled up (left and right), oversized advance intersection warning signs, with street name sign plaques.
- Enhanced pavement markings that delineate through lane edge lines.

### *On the Stop Approach*

- Doubled up (left and right), oversized advance “Stop Ahead” intersection warning signs.
- Doubled up (left and right), oversized Stop signs.
- Retroreflective sheeting on sign posts.
- Properly placed stop bar.
- Removal of any vegetation, parking, or obstruction that limits sight distance.
- Double arrow warning sign at stem of T-intersections.



Example of countermeasures on the stop approach.

Source: South Carolina DOT

**SAFETY BENEFITS:**

**10%**
Reduction in injury and fatal crashes

**15%**
Reduction in nighttime crashes

Source: T. Le et al, “Safety Effects of Low-Cost Systemic Safety Improvements at Signalized and Stop-Controlled Intersections,” 96th Annual Meeting of the Transportation Research Board, Paper Number 17-05379, January 2017. **id.trb.org/view.aspx?id=1439120**.

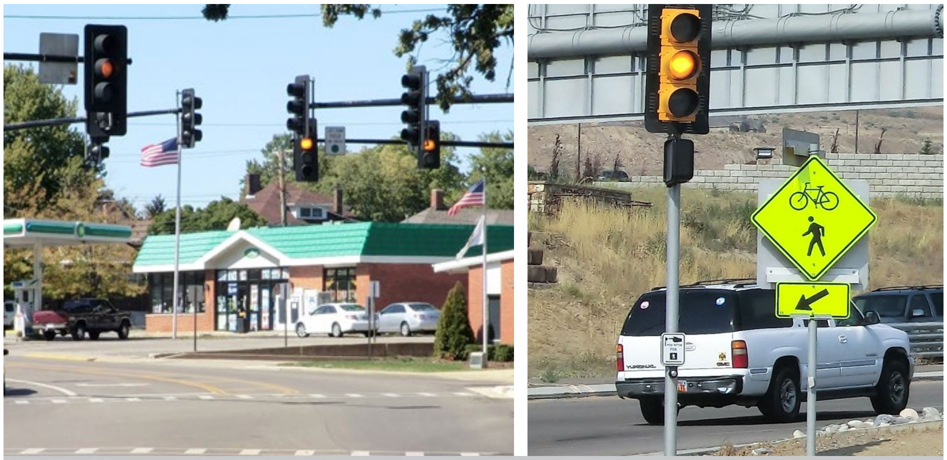
# 12. Yellow Change Intervals

**SAFETY BENEFITS:**

**36-50%**
Reduction in red light running

**8-14%**
Reduction in total crashes

**12%**
Reduction in injury crashes



Properly-timed yellow change intervals can reduce red-light running and improve overall intersection safety.

Source: FHWA

At a signalized intersection, the yellow change interval is the length of time that the yellow signal indication is displayed following a green signal indication. The yellow signal confirms to motorists that the green has ended and that a red will soon follow.

Since red-light running is a leading cause of severe crashes at signalized intersections, it is imperative that the yellow change interval be appropriately timed. Too brief an interval may result in drivers being unable to stop safely and cause unintentional red-light running, while too long an interval may result in drivers treating the yellow as an extension of the green phase and invite intentional red light running. Factors such as the speed of approaching vehicles, driver perception-reaction time, vehicle deceleration rates, intersection width, and roadway approach grades should all inform the timing calculation.

Transportation agencies can improve signalized intersection safety and reduce red-light running by reviewing and updating their traffic signal timing policies and procedures concerning the yellow change interval. Agencies should institute regular evaluation and adjustment protocols for existing traffic signal timing. Refer to the *Manual on Uniform Traffic Control Devices* for basic requirements and further recommendations about yellow change interval timing.

Source: NCHRP Report 731, *Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections.*

# 13. Leading Pedestrian Intervals

A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter an intersection 3-7 seconds before vehicles are given a green indication. With this head start, pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn left.

An LPI allows a pedestrian to establish presence in the crosswalk before vehicles are given a green indication.

Source: FHWA

LPIs provide the following benefits:

- Increased visibility of crossing pedestrians.
- Reduced conflicts between pedestrians and vehicles.
- Increased likelihood of motorists yielding to pedestrians.
- Enhanced safety for pedestrians who may be slower to start into the intersection.

Pedestrians wait for the walk signal.

Source: pedbikeimages.org / Burden

FHWA's *Handbook for Designing Roadways for the Aging Population* recommends the use of the LPI at intersections with high turning-vehicle volumes. Transportation agencies should refer to the *Manual on Uniform Traffic Control Devices* for guidance on LPI timing. Costs for implementing LPIs are very low, since only signal timing alteration is required. This makes it an easy and inexpensive countermeasure that can be incorporated into pedestrian safety action plans or policies and can become routine agency practice.

**SAFETY BENEFIT:**

**60%**

**Reduction in pedestrian-vehicle crashes at intersections**

LPIs are beneficial at intersections with high left-turning volumes.

Source: pedbikeimages.org / Burden

Source: Aaron C. Fayish and Frank Gross, "Safety Effectiveness of Leading Pedestrian Intervals Evaluated by a Before–After Study with Comparison Groups," Transportation Research Record 2198 (2010): 15–22. DOI: 10.3141/2198-03

# 14. Medians and Pedestrian Crossing Islands in Urban and Suburban Areas


Median and pedestrian crossing islands near a roundabout.

Source: www.pedbikeimages.org / Dan Burden

## SAFETY BENEFITS:

### RAISED MEDIAN

**46%**

Reduction in pedestrian crashes

### PEDESTRIAN CROSSING ISLAND

**56%**

Reduction in pedestrian crashes

Source: *Desktop Reference for Crash Reduction Factors*, FHWA-SA-08-011, September 2008, Table 11.

Example of a road with a median and pedestrian crossing islands.

Source: City of Charlotte, North Carolina


Example of a pedestrian crossing island.

Source: pedbikeimages.org / Dan Burden

A ***median*** is the area between opposing lanes of traffic, excluding turn lanes. Medians in urban and suburban areas can be defined by pavement markings, raised medians, or islands to separate motorized and non-motorized road users.

A ***pedestrian crossing island*** (or refuge area) is a raised island, located between opposing traffic lanes at intersection or midblock locations, which separate crossing pedestrians from motor vehicles.

Pedestrian crashes account for approximately 15 percent of all traffic fatalities annually, and over 75 percent of these occur at non-intersection locations.[1] For pedestrians to safely cross a roadway, they must estimate vehicle speeds, adjust their walking speed, determine gaps in traffic, and predict vehicle paths. Installing raised medians or pedestrian crossing islands can help improve safety by simplifying these tasks and allowing pedestrians to cross one direction of traffic at a time.

Transportation agencies should consider medians or pedestrian crossing islands in curbed sections of urban and suburban multi-lane roadways, particularly in areas with a significant mix of pedestrian and vehicle traffic and intermediate or high travel speeds. Some example locations that may benefit from raised medians or pedestrian crossing islands include:

- Mid-block areas.
- Approaches to multi-lane intersections.
- Areas near transit stops or other pedestrian-focused sites.

[1] National Highway Traffic Safety Administration, *Traffic Safety Facts - 2015 Data - Pedestrians*. Report DOT HS 812 375, (Washington, DC: 2017).

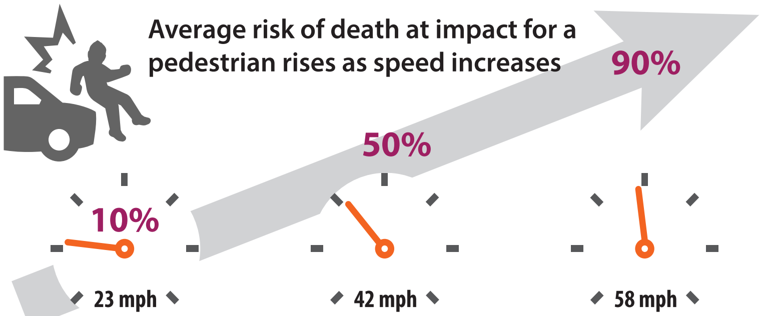
# 15. Pedestrian Hybrid Beacons

The pedestrian hybrid beacon (PHB) is a traffic control device designed to help pedestrians safely cross busy or higher-speed roadways at midblock crossings and uncontrolled intersections. The beacon head consists of two red lenses above a single yellow lens. The lenses remain "dark" until a pedestrian desiring to cross the street pushes the call button to activate the beacon. The signal then initiates a yellow to red lighting sequence consisting of steady and flashing lights that directs motorists to slow and come to a stop. The pedestrian signal then flashes a WALK display to the pedestrian. Once the pedestrian has safely crossed, the hybrid beacon again goes dark.

Example of PHBs mounted on a mast arm.

Source: FHWA

More than 75 percent of pedestrian fatalities occur at non-intersection locations, and vehicle speeds are often a major contributing factor.[1] As a safety strategy to address this pedestrian crash risk, the PHB is an intermediate option between a flashing beacon and a full pedestrian signal because it assigns right of way and provides positive stop control. It also allows motorists to proceed once the pedestrian has cleared their side of the travel lane, reducing vehicle delay.



Data from the AAA Foundation for Traffic Safety, Impact Speed and a Pedestrian's Risk of Severe Injury or Death, September 2011.

Transportation agencies should refer to the *Manual on Uniform Traffic Control Devices* for information on the application of PHBs. In general, PHBs are typically used when gaps in traffic are not large enough or vehicle speeds are too high for pedestrians to cross safely. PHBs are not widely implemented, so agencies should consider an education and outreach effort when implementing a PHB within a community.

## SAFETY BENEFITS:

**69%**
Reduction in pedestrian crashes

**29%**
Reduction in total crashes

**15%**
Reduction in serious injury and fatal crashes

Pedestrians cross the roadway at a PHB location.

Source: City of Tuscon, Arizona

Source: CMF Clearinghouse, CMF IDs: 2911, 2917, 2922.

[1] National Highway Traffic Safety Administration, *Traffic Safety Facts - 2015 Data - Pedestrians*. Report DOT HS 812 375, (Washington, DC: 2017).

# 16. Road Diets

## (Roadway Reconfiguration)

A "Road Diet," or roadway reconfiguration, can improve safety, calm traffic, provide better mobility and access for all road users, and enhance overall quality of life.

SAFETY BENEFIT:

**4-LANE → 3-LANE ROAD DIET CONVERSIONS**

**19-47%**

Reduction in total crashes

Source: *Evaluation of Lane Reduction "Road Diet" Measures on Crashes,* FHWA-HRT-10-053.


Before and after photos of a Road Diet project.

Source: City of Orlando, Florida

A Road Diet typically involves converting an existing four-lane undivided roadway to a three-lane roadway consisting of two through lanes and a center two-way left-turn lane (TWLTL).

Benefits of Road Diet installations may include:

- An overall crash reduction of 19 to 47 percent.
- Reduction of rear-end and left-turn crashes due to the dedicated left-turn lane.
- Reduced right-angle crashes as side street motorists cross three versus four travel lanes.
- Fewer lanes for pedestrians to cross.
- Opportunity to install pedestrian refuge islands, bicycle lanes, on-street parking, or transit stops.
- Traffic calming and more consistent speeds.
- A more community-focused, "Complete Streets" environment that better accommodates the needs of all road users.

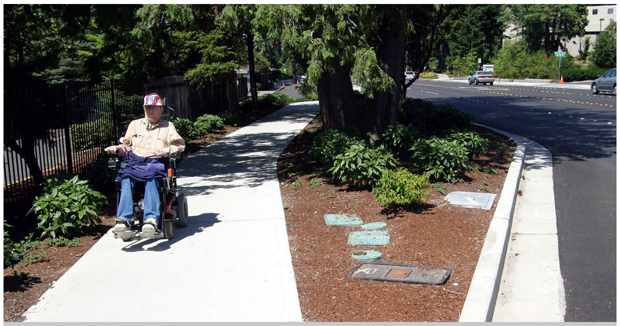
A Road Diet can be a low-cost safety solution when planned in conjunction with a simple pavement overlay, and the reconfiguration can be accomplished at no additional cost.

Road Diet project in Honolulu, Hawaii.

Source: Leidos

# 17. Walkways

A walkway is any type of defined space or pathway for use by a person traveling by foot or using a wheelchair. These may be pedestrian walkways, shared use paths, sidewalks, or roadway shoulders.[1]



Example of a sidewalk in a residential area.

Source: pedbikeimages.org / Burden

With more than 5,000 pedestrian fatalities and 70,000 pedestrian injuries occurring in roadway crashes annually, it is important for transportation agencies to improve conditions and safety for pedestrians and to integrate walkways more fully into the transportation system.[2]

Paved shoulder used as a walkway.

Source: pedbikeimages.org / Burden

Well-designed pedestrian walkways, shared use paths, and sidewalks improve the safety and mobility of pedestrians. In some rural or suburban areas, where these types of walkways are not feasible, roadway shoulders provide an area for pedestrians to walk next to the roadway.

Transportation agencies should work towards incorporating pedestrian facilities into all roadway projects unless exceptional circumstances exist. It is important to provide and maintain accessible walkways along both sides of the road in urban areas, particularly near school zones and transit locations, and where there is pedestrian activity. Walkable shoulders should also be considered along both sides of rural highways routinely used by pedestrians.

## SAFETY BENEFITS:

**SIDEWALKS**

**65-89%**

Reduction in crashes involving pedestrians walking along roadways

**PAVED SHOULDERS**

**71%**

Reduction in crashes involving pedestrians walking along roadways

Example of a shared use path.

Source: pedbikeimages.org / Burden

Source: *Desktop Reference for Crash Reduction Factors*, FHWA-SA-08-011, Table 11.

[1] FHWA defines a pedestrian walkway as a continuous way designated for pedestrians and separated from motor vehicle traffic by a space or barrier. By contrast, sidewalks are walkways that are paved and separated from the street, generally by a curb and gutter.

**https://safety.fhwa.dot.gov/legislationay**

[2] National Highway Traffic Safety Administration, *Traffic Safety Facts - 2015 Data - Pedestrians.* Report DOT HS 812 375, (Washington, DC: 2017).

# 18. Local Road Safety Plans

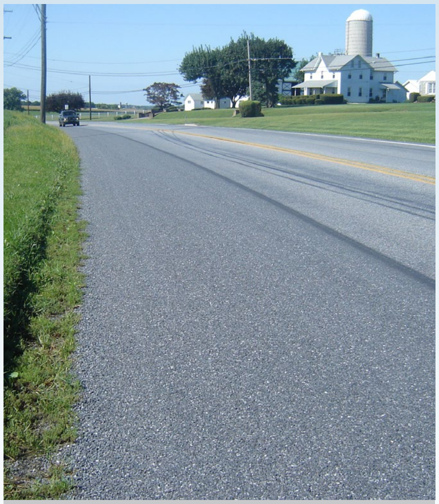
Local roads experience

**3x the fatality rate**

of the

**Interstate Highway System.**

Source: FARS and FHWA Highway Statistics Series (2014)



Safety improvements on local roads can be determined through the LRSP process.

Source: Delaware Valley Regional Planning Commission

A local road safety plan (LRSP) provides a framework for identifying, analyzing, and prioritizing roadway safety improvements on local roads. The LRSP development process and content are tailored to local issues and needs. The process results in a prioritized list of issues, risks, actions, and improvements that can be used to reduce fatalities and serious injuries on the local road network.


While local roads are less traveled than State highways, they have a much higher rate of fatal and serious injury crashes. Developing an LRSP is an effective strategy to improve local road safety for all road users and support the goals of a State's overall strategic highway safety plan.

Although the development process and resulting plan can vary depending on the local agency's needs, available resources, and targeted crash types, aspects common to LRSPs include:

- Stakeholder engagement representing the 4E's – engineering, enforcement, education, and emergency medical services, as appropriate.
- Collaboration among municipal, county, Tribal, State and/or Federal entities to leverage expertise and resources.
- Identification of target crash types and crash risk with corresponding recommended proven safety countermeasures.
- Timeline and goals for implementation and evaluation.

Local road agencies should consider developing an LRSP to be used as a tool for reducing roadway fatalities, injuries, and crashes.[1] The plan should be viewed as a living document that can be updated to reflect changing local needs and priorities.

[1] *Developing Safety Plans: A Manual for Local Rural Road Owners*, FHWA-SA-12-017, provides guidance on developing an LRSP.

# 19. Road Safety Audits

**A road safety audit is a proactive, formal safety performance examination of an existing or future road or intersection by an independent and multi-disciplinary team.**

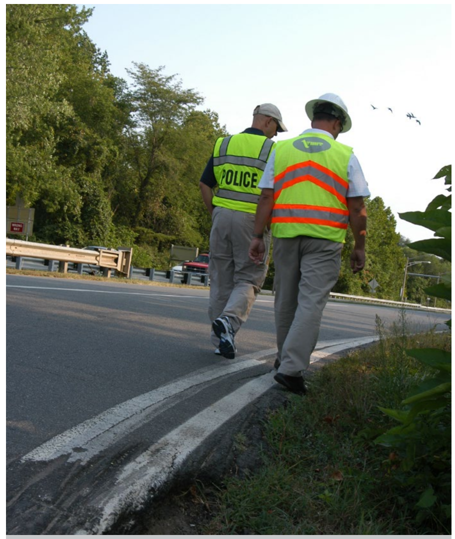
**SAFETY BENEFIT:**

# 10-60%

**Reduction in total crashes**

Source: *Road Safety Audits: An Evaluation of RSA Programs and Projects*, FHWA-SA-12-037; and *FHWA Road Safety Audit Guidelines*, FHWA-SA-06-06.

While most transportation agencies have established traditional safety review procedures, a road safety audit (RSA) is unique. RSAs are performed by a multi-disciplinary team independent of the project. RSAs consider all road users, account for human factors and road user capabilities, are documented in a formal report, and require a formal response from the road owner. (See the eight steps for conducting an RSA below.)




Multi-disciplinary team performs field review during an RSA.

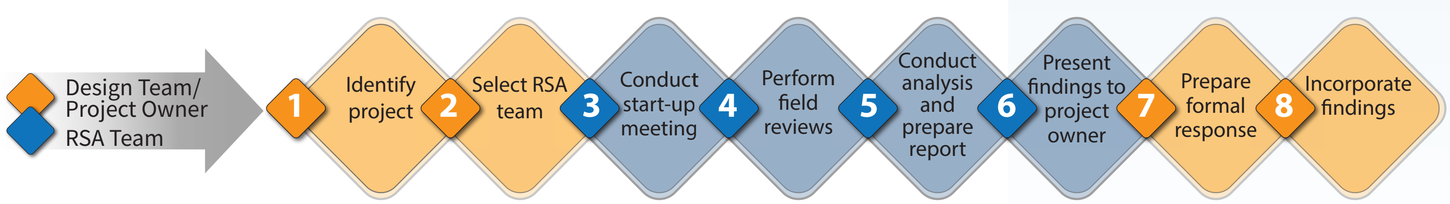
Source: FHWA

RSAs provide the following benefits:

- Reduced number and severity of crashes due to safer designs.
- Reduced costs resulting from early identification and mitigation of safety issues before projects are built.
- Improved awareness of safe design practices.
- Increased opportunities to integrate multimodal safety strategies and proven safety countermeasures.
- Expanded ability to consider human factors in all facets of design.

RSAs can be performed in any phase of project development, from planning through construction. RSAs can also be conducted on any size project, from minor intersection and roadway retrofits to large-scale construction projects. Agencies are encouraged to conduct an RSA at the earliest stage possible, as all roadway design options and alternatives are being explored.

## CONDUCTING AN RSA



# 20. USLIMITS2


**USLIMITS2 helps practitioners assess and establish safe, reasonable, and consistent speed limits**

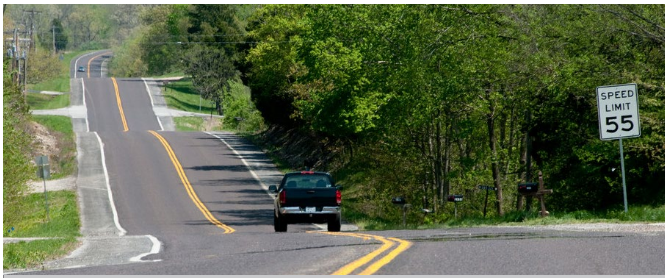

USLIMITS2 helps support speed limit decisions.

Source: Richard Retting

*"USLIMITS2 acts as an external, impartial, second set of eyes."*

Georgia DOT Traffic Engineer

USLIMITS2[1] is a free, web-based tool designed to help practitioners assess and establish safe, reasonable, and consistent speed limits for specific segments of roadway. It is applicable to all types of facilities, from rural and local roads and residential streets to urban freeways.



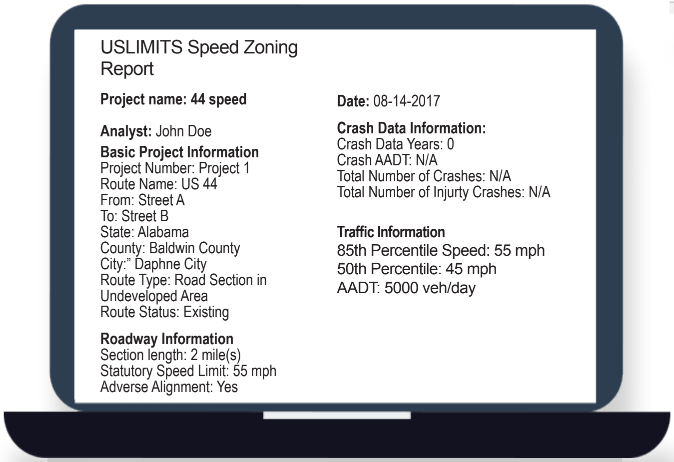

USLIMITS2 is applicable to all types of roadways.

Source: Missouri DOT

USLIMITS2 supports customary engineering studies[2] used to determine appropriate speed limits. These studies typically include evaluating criteria such as 85th percentile speed, traffic volumes, roadway type, roadway setting, number of access points, crash history, pedestrian/bicyclist activity, etc. Similarly, USLIMITS2 produces an unbiased and objective suggested speed limit value based on 50th and 85th percentile speeds, traffic volume, roadway characteristics, and crash data.

Traffic engineers often communicate with the public, community leaders, and government officials to explain the methodology behind setting speed limits. USLIMITS2 provides an objective second opinion and helps support these speed limit decisions. USLIMITS2 augments the credibility of engineering speed studies, helping to address concerns from local government officials and private citizens when speed limits are adjusted.

To begin using USLIMITS2, users create a new project or upload an existing project file for revisions or updates through the online tool. The website contains the user guide, information on the tool's decision logic and related research, and frequently asked questions.


USLIMITS Speed Zoning Report

**Project name: 44 speed**

**Date:** 08-14-2017

**Analyst:** John Doe

**Basic Project Information**
Project Number: Project 1
Route Name: US 44
From: Street A
To: Street B
State: Alabama
County: Baldwin County
City:" Daphne City
Route Type: Road Section in Undeveloped Area
Route Status: Existing

**Roadway Information**
Section length: 2 mile(s)
Statutory Speed Limit: 55 mph
Adverse Alignment: Yes

**Crash Data Information:**
Crash Data Years: 0
Crash AADT: N/A
Total Number of Crashes: N/A
Total Number of Injurty Crashes: N/A

**Traffic Information**
85th Percentile Speed: 55 mph
50th Percentile: 45 mph
AADT: 5000 veh/day

Users can save their USLIMITS2 project files for future analysis or reviews.

1 USLIMITS2 is available free online at **https://safety.fhwa.dot.gov/uslimits/**.

2 For more information on setting speed limits based on engineering studies, refer to the *Manual on Uniform Traffic Control Devices*.


https://safety.fhwa.dot.gov/provencountermeasures.

# APPENDIX D

## FHWA Desktop Reference
## Engineering Speed Management
## Counter Measures
## Potential Effectiveness in Reducing Speed

# Engineering Speed Management Countermeasures: A Desktop Reference of Potential Effectiveness in Reducing Speed
## July 2014

This chart summarizes studies about engineering countermeasures used to manage speeds. Studies where an increase in speed were reported are also shown since this information is also relevant in selection of countermeasures.

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| **Vertical Deflections Within the Roadway** | | | | | | | | | | | | | | | | | |
| **Speed Hump**—rounded, raised area placed across the roadway, typically 12 to 14 feet long | pedestrian | urban | local | 1 (1999) | 178 | — | 48 to 11544 | 46 to 110443 | — | — | — | 35 | 27 | -8 | — | various | |
| | pedestrian | urban | local | 2 (2005) | 7 | — | 400 to 4362 | 401 to 3384 | — | — | — | 32 | 26 | -6 | — | VA | |
| | pedestrian | urban | local | 3 (2000) | 4 | — | 475 to 1506 | 433 to 1343 | — | — | — | 36 | 31 | -5 | — | WA | |
| | pedestrian | urban | local | 4 (2005) | 1 | 25 | 1300 | — | 22 | 23 | 1 | 37 | 29 | -8 | 1-mon | FL | |
| | pedestrian | rural/urban | local | 5 (2002) | 3 | 25 | 218 to 746 | — | 24 | 18 | -6 | 28 | 22 | -6 | 1-mon | IA | |
| | pedestrian | urban | — | 1 (1999) | 4 | — | — | — | — | — | — | 36 | 29 | -7 | — | — | with speed table |
| | pedestrian | urban | — | 1 (1999) | 2 | — | 2456 to 3685 | 2593 to 2931 | — | — | — | 38 | 25 | -13 | — | — | with choker |

U.S. Department of Transportation
Federal Highway Administration

Safe Roads for a Safer Future
Investment in roadway safety saves lives
http://safety.fhwa.dot.gov

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| **Speed Cushion**—raised area typically 6 to 7 feet wide that allows most emergency vehicles to straddle the hump | pedestrian | urban | — | 1 (1999) | 1 | — | 3323 | 2321 | — | — | — | 35 | 28 | -7 | — | various | |
| | pedestrian | — | — | 2 (2005) | 2 | — | 1042 to 1556 | 693 to 1563 | — | — | — | 31 to 37 | 26 to 30 | -5 to -7 | — | VA | |
| **Speed Table**—a long speed hump typically 22 feet in length with a flat section in the middle and ramps on the ends | pedestrian | urban | — | 1 (1999) | 72 | — | 198 to 14500 | 242 to 14400 | — | — | — | 37 | 31 | -6 | — | various | |
| | pedestrian | urban | residential | 6 (2003) | 19 | — | 198 to 2102 | 364 to 2061 | — | — | — | 38 | 29 | -9 | — | GA | |
| | pedestrian | rural community | 2-lane | 7 (2007) | 1 | — | 1200 | — | 27 | 24 | -3 | 33 | 29 | -4 | 1-mon | IA | |
| | pedestrian | rural community | local | 5 (2002) | 3 | 25 | 218 to 746 | — | 24 | 18 | -6 | 28 | 22 | -6 | 1-mon | IA | removable speed table |
| | pedestrian | urban | — | 1 (1999) | 2 | — | 6500 to 8440 | 6400 to 6780 | — | — | — | 37 | 29 | -8 | — | — | with center island |
| | pedestrian | urban | residential | 8 (2001) | 1 | 30 | 1600 | — | 34 | 23 | -11 | 38 | 27 | -11 | within 12-mon | MN | raised crosswalk |
| **Raised Intersection**—a raised plateau, with ramps on all approaches, where roads intersect | pedestrian | urban | — | 1 (1999) | 2 | — | — | — | — | — | — | 37 | 38 | 1 | — | various | |
| | pedestrian | urban | local | 9 (2004) | 1 | — | — | — | — | — | — | 30 | 30 | 0 | 12-mon | NY | |
| **Horizontal Deflections/Roadway Narrowing** | | | | | | | | | | | | | | | | | |
| **Choker/Bulb-out**—mid-block curb extensions that narrow road by extending the sidewalk or widening the planting strip | pedestrian | urban | — | 1 (1999) | 4 | — | 750 to 6150 | 331 to 5040 | — | — | — | 34 | 30 | -4 | — | various | |
| | pedestrian | urban | residential | 10 (1997) | 6 | — | — | — | — | — | — | 30 | 29 | -1 | — | — | |
| | pedestrian | urban | residential | 8 (2001) | 1 | — | 950 to 1050 | — | 34 | 31 | -4 | 38 | 34 | -4 | within 12-mon | MN | choker with crosswalk |
| | pedestrian | urban | residential | 8 (2001) | 1 | — | 950 to 1050 | — | 33 | 31 | -2 | 37 | 34 | -3 | within 12-mon | MN | choker + "SLOW" + landscaping |
| | pedestrian | rural community | 2-lane | 11 (2010) | — | — | — | — | 39 | 39 | 0 | — | — | — | — | simulator | curb + gutter bulb-outs |
| **Neck Down**—intersection curb extensions that narrow a road by extending the width of a sidewalk | pedestrian | urban | — | 1 (1999) | 3 | — | 2800 to 8110 | 4660 to 5660 | — | — | — | 29 | 30 | 1 | — | various | |
| | pedestrian | urban | local street | 9 (2004) | 2 | — | — | — | 23 | 25 | 2 | 27 | 31 | 4 | 12-mon | NY | |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| **Chicanes**—curb extensions that alternate from one side of the street to the other forming s-shaped curves, also includes lateral shifts which shift traff c to one side of the road for an extended distance and then back | pedestrian | urban | — | 10 (1997) | 2 | — | 1380 to 3200 | 790 to 2400 | — | — | — | 33 | 27 | -6 | — | various | |
| | pedestrian | urban | residential | 3 (2000) | 4 | — | 1380 to 1965 | 790 to 1993 | — | — | — | 31 | 22 | -9 | at least 4 years | WA | |
| | pedestrian | urban | arterial (school zone) | 12 (1998) | 1 | — | 8000 | — | — | — | — | 31 | 28 | -3 | — | Canada | |
| | pedestrian | rural community | 2-lane | 11 (2010) | — | — | — | — | 39 | 30 | -9 | — | — | — | — | simulator | |
| | pedestrian | rural community | 2-lane | 11 (2010) | — | — | — | — | 39 | 33 | -6 | — | — | — | — | simulator | painted chicane |
| **Center Island**—raised or painted island along the centerline that narrows travel lanes | pedestrian | urban | — | 1 (1999) | — | — | — | — | — | — | — | — | — | — | — | various | |
| | pedestrian | urban | — | 1 (1999) | 2 | — | 6500 to 8440 | 6400 to 6780 | — | — | — | 37 | 29 | -8 | — | — | |
| | pedestrian | urban | local street | 9 (2004) | 1 | — | — | — | 30 | 28 | -2 | 36 | 33 | -3 | 12-mon | NY | |
| | pedestrian | rural | — | 13 (2002) | 2 | — | — | — | — | — | — | 44 | 38 | -6 | 1-mon | MN | |
| | pedestrian | rural | within community (2-lane) | 13 (2002) | 1 | 30 | 900 | — | 34 | 29 | -5 | 44 | 38 | -6 | 2-wks | MN | |
| | pedestrian | rural | within community (2-lane) | 13 (2002) | 1 | 30 | 900 | — | 35 | 31 | -4 | 44 | 38 | -6 | 6-wks | MN | |
| | pedestrian | rural | community entrance (2-lane) | 7 (2007) | 2 | 25 | 2669 | — | 31 | 29 | -1 | 36 | 35 | -1 | 1-mon | IA | combined + tubular channelizers |
| | pedestrian | rural | community entrance (2-lane) | 14 (2008) | — | 35 | — | — | 41 | 43 | 2 | 51 | 50 | -1 | — | simulator | median |
| | pedestrian | rural | community entrance (2-lane) | 14 (2008) | — | 35 | — | — | 41 | 40 | -1 | 52 | 46 | -6 | — | simulator | median + gateway |
| | pedestrian | rural | community entrance (2-lane) | 14 (2008) | — | 35 | — | — | 41 | 41 | 0 | 52 | 50 | -2 | — | simulator | median in series |
| | pedestrian | rural | community entrance (2-lane) | 14 (2008) | — | 35 | — | — | 41 | 40 | -1 | 51 | 46 | -5 | — | simulator | median in series with crosswalk |
| | pedestrian | rural | community entrance (2-lane) | 15 (2013) | 3 | 25 | 593 to 1448 | — | 28 | 27 | 1 | 35 | 34 | -1 | 1-mon | IA | temporary curbing |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| (*cont'd*) **Center Island**—raised or painted island along the centerline that narrows travel lanes | pedestrian | rural | community entrance (2-lane) | 15 (2013) | 3 | 25 | 593 to 1448 | — | 29 | 27 | -2 | 35 | 33 | -2 | 12-mon | IA | temporary curbing |
| | pedestrian | rural | community entrance (2-lane) | 16 (1999) | 5 | — | — | — | 38 | 29 | -9 | 44 | 33 | -11 | — | Austria | braking islands |
| | roadway departure | rural | 2-lane | 17 (2008) | 8 | 50 to 55 | — | — | — | — | -4 | — | — | -5 | — | Austria | painted island + edge line |
| **Reduce Lane Width with Markings**—narrowing of the lanes using pavement markings, median, etc. | pedestrian | rural community | 2-lane | 7 (2007) | 2 | 30 | 1680 | — | 28 | 29 | 1 | 34 | 35 | 1 | 1-mon | IA | narrowing with pavement marking |
| | pedestrian | rural community | 2-lane | 7 (2007) | 2 | 30 | 1680 | — | 28 | 29 | 1 | 34 | 35 | 1 | 12-mon | IA | narrowing with pavement marking |
| | pedestrian | urban | residential | 18 (1984) | 2 | — | — | — | 34 | 34 | 0 | — | — | — | 1-wk | FL | narrowing using edgeline + centerline |
| | intersection | rural | intersection (2-lane) | 19 (2008) | 9 | 50 to 55 | — | — | — | — | -4 | — | — | -5 | 3-mon | PA, KY, MO, FL | edgeline + centerline |
| | roadway departure | urban | high speed intersection 4-lane | 20 (2008) | — | — | — | — | — | — | -4 | — | — | — | — | — | 2.7 ft. lane width reduction |
| | roadway departure | urban | freeway exit | 21 (2000) | — | — | — | — | 31 | 30 | -1 | — | — | — | 1-mon | VA | narrowing using herringbone markings |
| | roadway departure | rural day | 2-lane | 22 (2005) | 3 | — | — | — | 57 | 58 | 1 | — | — | — | 1-mon | TX | edgeline + centerline |
| | roadway departure | rural night | 2-lane | 22 (2005) | 3 | — | — | — | 60 | 59 | 1 | — | — | — | 1-mon | TX | edgeline (existing centerline |
| **Road Diet**—reducing the number of lanes by reallocating roadway space for other uses (e.g. bike lanes, center turn lanes, medians, parking, shoulder lanes, etc. | pedestrian | urban | 4-lane undivided | 23 (2001) | 1 | — | — | — | — | — | -4 | — | — | — | — | CA | 4- to 3-lane |
| | pedestrian | urban | 4-lane undivided | 23 (2001) | 1 | — | — | — | 35 | 32 | -3 | — | — | — | — | IA | 4- to 3-lane |
| | pedestrian | urban | 4-lane undivided | 23 (2001) | 1 | — | — | — | — | — | — | — | — | -1 | — | IA | 4- to 3-lane |
| | pedestrian | urban | minor arterial | 8 (2001) | 1 | 35 | 5400 to 9100 | — | 45 | 43 | -2 | 51 | 49 | -2 | — | MN | 4- to 3-lane |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | $85^{th}$ %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| **Surface Treatments and Markings** | | | | | | | | | | | | | | | | | |
| **Transverse Rumble Strips**—raised or grooved patterns installed on the roadway travel lane or shoulder pavements perpendicular to the direction of travel | pedestrian | rural | high-speed intersection | 20 (2008) | 3 | 70 | — | — | — | — | — | — | — | -1 | 5-mon | — | |
| | pedestrian | rural | intersection | 24 (2003) | 11 | — | — | — | — | — | — | 55 | 54 | -1 | 1-mon | TX | |
| | roadway departure | rural | 2-lane | 25 (2005) | 3 | — | — | — | 46 | 46 | -0 | 49 | 52 | 3 | 1-wk | KY | cars |
| | work zone | rural | work zone (2-lane) | 26 (2000) | 2 | — | 1250 to 1850 | — | — | — | -2 | — | — | — | 1-day | TX | cars |
| | work zone | rural | work zone (2-lane) | 26 (2000) | 2 | — | 1250 to 1850 | — | — | — | -2 | — | — | — | 1-day | TX | trucks |
| **Transverse Bars**—lines placed across the lane perpendicular to direction of travel | pedestrian | rural | community entrance (2-lane) | 15 (2013) | 3 | — | 843 to 1947 | — | 38 | 37 | -1 | 44 | 44 | 0 | 1-mon | IA | |
| | pedestrian | rural | community entrance (2-lane) | 15 (2013) | 3 | — | 843 to 1947 | — | 37 | 38 | 1 | 44 | 43 | -1 | 12-mon | IA | |
| | work zone | rural | work zone (4-lane divided) | 39 (2003) | 1 | — | — | — | — | — | -2 | — | — | -2 | — | Canada | |
| | work zone | rural | work zone | 40 (2001) | 1 | 70 | 18000 | — | 64 | 63 | -1 | 68 | 67 | -1 | — | KS | |
| **Converging Chevrons**—on-pavement chevrons | roadway departure | rural | freeway to freeway ramp | 36 (2003) | — | — | 39010 | — | 64 | 49 | -15 | 70 | 53 | -17 | 20-mon | WI | |
| | roadway departure | rural | freeway to freeway ramp | 37 (2008) | — | 30 adv. | 18000 | — | 47 | 47 | 0 | 53 | 52 | -1 | 1-mon | TX | |
| | roadway departure | rural | freeway to freeway ramp | 37 (2008) | — | 30 adv. | 18000 | — | 48 | 48 | 0 | 53 | 53 | 0 | 6-mon | TX | |
| | roadway departure | rural | S-curve (2-lane) | 38 (2006) | 1 | 35/15 adv. | — | — | — | — | — | 37 | 33 | -4 | 15-mon | OH | |
| | pedestrian | rural | intersection | 8 (2001) | 1 | 30 | 4000 | — | 36 | 32 | -4 | 41 | 35 | -6 | 1-wk | MN | |
| | pedestrian | rural | intersection | 8 (2001) | 1 | 30 | 4000 | — | 36 | 34 | -2 | 41 | 39 | -2 | 2-yr | MN | |
| | pedestrian | rural | intersection | 8 (2001) | 1 | 30 | 4000 | — | 36 | 31 | -5 | 41 | 35 | -5 | 4-yr | MN | |
| | pedestrian | rural | community entrance | 7 (2007) | 2 | 25 | 2200 to 2420 | — | 30 | 29 | -1 | 36 | 35 | -1 | 1-mon | IA | |
| | pedestrian | rural | community entrance | 7 (2007) | 2 | 25 | 2200 to 2420 | — | 30 | 29 | -1 | 36 | 33 | -3 | 12-mon | IA | |
| | roadway departure | rural | freeway to freeway ramp | 35 (2010) | — | — | 18000 to 18600 | — | 31 | 29 | -2 | 35 | 33 | -2 | 1-mon | GA | |
| | roadway departure | rural | freeway to freeway ramp | 35 (2010) | — | — | 18000 to 18600 | — | 31 | 30 | -1 | 35 | 34 | -1 | 9-mon | GA | converging chevrons |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| **Optical Speed Bars**—transverse stripes on travel lane (sometimes spaced progressively closer to create the illusion of traveling faster) | pedestrian | rural | intersection | 20 (2008) | 4 | — | — | — | — | — | -1 | — | — | -1 | — | — | |
| | pedestrian | rural | community entrance | 7 (2007) | 3 | 25 to 30 | 886 to 1870 | — | 39 | 38 | -1 | 47 | 46 | -1 | 1-mon | IA | |
| | pedestrian | rural | community entrance | 7 (2007) | 2 | 25 to 30 | 234 to 662 | 263 to 646 | 39 | 34 | -5 | 47 | 42 | -5 | 1-mon | IA | with DSFS —"YOUR SPEED XX" |
| | pedestrian | rural | intersection | 27 (2010) | 1 | — | 4,450 | — | 53 | 51 | -2 | 62 | 60 | -2 | 6-mon | New Zealand | herringbone pattern |
| | pedestrian | rural | community entrance | 28 (2011) | 1 | — | 2800 | — | 37 | 29 | -8 | — | — | — | — | Italy | with dragon's teeth |
| | intersection | rural | intersection (2-lane) | 29 (2013) | 1 | 37 | — | — | 42 | 31 | -11 | 48 | 3 | -13 | 12-mon | Spain | with RPM + reffectors to guardrail |
| | intersection | rural | intersection | 30 (2000) | — | 62 | — | — | — | — | -6 | — | — | — | simulator | Australia | full lane width |
| | intersection | rural | intersection | 30 (2000) | — | 62 | — | — | — | — | -4 | — | — | — | simulator | Australia | optical speed bar |
| | roadway departure | rural | horizontal curves | 25 (2005) | 3 | — | — | — | 46 | 46 | 0 | 49 | 49 | 0 | 1-wk | KY | transverse bars |
| | roadway departure | rural | horizontal curves | 25 (2005) | 3 | — | — | — | 46 | 45 | -1 | 49 | 51 | 2 | 1-yr | KY | transverse bars |
| | roadway departure | rural | 4- lane undivided | 31 (2007) | 2 | 45 | 12000 | — | 55 | 52 | -3 | — | — | — | 1-wk | VA | transverse bars |
| | roadway departure | rural | 4- lane undivided | 31 (2007) | 2 | 45 | 12000 | — | 56 | 49 | -7 | — | — | — | 3-mon | VA | transverse bars |
| | roadway departure | rural | curve (2-lane) | 32 (2007) | 2 | 45 -65/ 40 adv. | — | — | 48 | 49 | 1 | 52 | 56 | 4 | 4-mon | NY, MI, TX | optical speed bar |
| | roadway departure | rural | curve (2-lane) | 31 (2007) | — | — | 5215 | — | 46 | 44 | -2 | — | — | — | 1-wk | VA | optical speed bar |
| | roadway departure | rural | curve (2-lane) | 31 (2007) | — | — | 5215 | — | 46 | 45 | -1 | — | — | — | 3-mon | VA | optical speed bar |
| | roadway departure | rural | 2-lane | 33 (2009) | — | 55 day 45 night | — | — | 64 | 62 | -2 | 71 | 69 | -2 | 1-wk | AZ | optical speed bar |
| | roadway departure | rural | 2-lane | 33 (2009) | — | 55 day/ 45 night | — | — | 64 | 59 | -4 | 71 | 68 | -3 | 3-mon | AZ | optical speed bar |
| | roadway departure | rural | curve (freeway) | 34 (2008) | — | 50 | — | — | 57 | 54 | -3 | 60 | 59 | -1 | 1-wk | WI | optical speed bar |
| | roadway departure | rural | freeway exit ramp | 32 (2007) | 1 | 65/ 30 adv. | — | — | 38 | 34 | -4 | 44 | 39 | -5 | 4-mon | NY, MI, TX | optical speed bar |
| | roadway departure | rural | 2-lane | 27 (2010) | 1 | — | 2500 | — | 51 | 50 | -1 | 60 | 59 | -1 | 2-wk | New Zealand | herringbone |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| (*cont'd*) **Optical Speed Bars**—transverse stripes on travel lane (sometimes spaced progressively closer to create the illusion of traveling faster) | roadway departure | rural | 2-lane | 27 (2010) | 1 | — | 2500 | — | 51 | 48 | -3 | 60 | 60 | 0 | 6-mon | New Zealand | herringbone |
| | roadway departure | rural | freeway ramp | 21 (2000) | 4 | — | — | — | 33 | 30 | -3 | — | — | — | 2-wk | NY, VA | herringbone markings |
| | pedestrian | rural | intersection | 27 (2010) | 1 | — | 4,450 | — | 53 | 52 | -1 | 61 | 61 | 0 | 2-wks | — | Herringbone |
| **"SLOW" Legend on Pavement** | pedestrian | urban | residential | 8 (2001) | 1 | 30 | 950 | — | 28 | 29 | 0 | 32 | 33 | 1 | — | MN | |
| | roadway departure | urban | curve (2-lane) day | 41 (1998) | 1 | 35/15 adv | 5000 | — | 34 | 33 | -1 | — | — | — | 2-wk | VA | with curve symbol |
| | roadway departure | urban | curve (2-lane) night | 41 (1998) | 1 | 35/15 adv | 5000 | — | 35 | 32 | -3 | — | — | — | 2-wk | VA | with curve symbol |
| | roadway departure | rural | curve | 15 (2012) | 2 | 55/none to 35 mph | 780 to 1880 | — | 49 | 48 | -1 | 54 | 53 | -1 | 1-mon | IA | with curve symbol+ bars |
| | roadway departure | rural | curve | 15 (2012) | 2 | 55/none to 35 mph | 780 to 1880 | — | 49 | 48 | -1 | 54 | 53 | -1 | 12-mon | IA | with curve symbol + bars |
| **Speed Limit XX Pavement Legend** | pedestrian | rural | within community | 7 (2007) | 1 | 25 | 2200 | — | 30 | 30 | 0 | 35 | 34 | -1 | 1-mon | IA | |
| | pedestrian | rural | within community | 7 (2007) | 1 | 25 | 2200 | — | 30 | 29 | -1 | 35 | 33 | -2 | 12-mon | IA | |
| | pedestrian | rural | within community | 7 (2007) | 1 | 25 | 2420 | — | 28 | 28 | 0 | 32 | 3 | -1 | 1-mon | IA | with lane narrowing |
| | pedestrian | rural | within community | 7 (2007) | 1 | 25 | 2420 | — | 28 | 29 | 1 | 32 | 33 | 1 | 12-mon | IA | with lane narrowing |
| | pedestrian | rural | community entrance | 7 (2007);15 (2013) | 5 | 25 to 35 | 1009 to 2850 | — | 37 | 35 | -2 | 42 | 40 | -3 | 1-mon | IA | with red colored pavement |
| | pedestrian | rural | community entrance | 7 (2007);15 (2013) | 2 | 25 to 35 | 1009 to 2850 | — | 40 | 39 | -1 | 46 | 45 | -1 | 12-mon | IA | with red colored pavement |
| | pedestrian | rural | community entrance | 15 (2013) | 3 | 25 to 35 | 1009 to 3070 | — | 35 | 34 | -1 | 40 | 39 | -1 | 1-mon | IA | colored pavement + dragon's teeth |
| **"50 MPH" + Curve Symbol** | roadway departure | urban | curve (divided 4-lane highway) | 42 (2005) | 1 | — | — | — | 67 | 60 | -7 | — | — | — | 1-mon | TX | |
| **"CURVE AHEAD" Pavement Legend** | roadway departure | rural | curve | 42 (2005) | 1 | — | 990 | — | 56 | 61 | 5 | — | — | — | 3-mon | TX | |
| | roadway departure | rural | curve | 42 (2005) | 1 | — | 1160 | — | 60 | 59 | -1 | — | — | — | 3-mon | TX | |
| **Vertical Delineation** | | | | | | | | | | | | | | | | | |
| **Center Island Using Tubular Channelizers** | pedestrian | rural community | community entrance (2-lane) | 7 (2007) | 2 | 25 | 2669 | — | 30 | 29 | -1 | 36 | 35 | -1 | 1-mon | IA | |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| **Post Mounted Delineators**—reflective buttons place on post at edge of road | roadway departure | rural | curve (2-lane) | 25 (2005) | 3 | — | — | — | 46 | 46 | 0 | 49 | 50 | 1 | 1-wk | KY | |
| | roadway departure | rural | curve (2-lane) | 11 (2010) | — | — | — | — | 43 | 35 | -8 | — | — | — | — | simulator | one side of curve |
| | roadway departure | rural | curve (2-lane) | 11 (2010) | — | — | — | — | 43 | 34 | -9 | — | — | — | — | simulator | both sides of curve |
| **Streaming PMD** | roadway departure | rural | curve (2-lane) | 11 (2010) | — | — | — | — | 43 | 24 | -19 | — | — | — | — | simulator | |
| **Chevrons with Reflective Post** | roadway departure | rural | curve (2-lane) | 46 (2010) | 2 | — | — | — | 56 | 54 | -2 | 65 | 63 | -2 | 1-mon | TX | |
| **Reflective Post Added to Existing Chevrons** | roadway departure | rural | curve (2-lane) | 47 (2012) | 4 | — | 830 to 2280 | — | 50 | 50 | 0 | 56 | 55 | -1 | 1-mon | IA | |
| | roadway departure | rural | curve (2-lane) | 47 (2012) | 1 | — | 1710 | — | 54 | 53 | -1 | 59 | 57 | -2 | 12-mon | IA | |
| **Layered Landscaping**—roadside plantings used to create vertical friction | pedestrian | rural | community entrance (2-lane) | 14 (2008) | — | 35 | — | — | 43 | 44 | 1 | 54 | 53 | -1 | — | simulator | at treatment |
| | pedestrian | rural | community entrance (2-lane) | 14 (2008) | — | 35 | — | — | 42 | 40 | -2 | 51 | 45 | -6 | — | simulator | 300 ft. downstream of treatment |
| **Landscaped Median** | roadway departure | urban | collector | 48 (2000) | 1 | — | 11400 | 10900 | 37 | 33 | -4 | 43 | 37 | -6 | — | CO | with curbside islands |
| **Dynamic Signing** | | | | | | | | | | | | | | | | | |
| **Speed Activated Speed Limit Sign**—a blank out sign that displays "SPEED LIMIT XX" for vehicles exceeding threshold speed | roadway departure | urban | collector | 55 (2013) | 1 | 30 | — | — | 33 | 27 | -6 | 36 | 30 | -6 | 2-mon | CO | with striping between travel/ parking lanes + signing |
| | roadway departure | urban | collector | 55 (2013) | 2 | 30 | — | — | — | — | — | 39 | 34 | -5 | 1-yr | CO | with physical narrowing + pedestrian refuge |
| | roadway departure | urban | collector | 55 (2013) | 3 | 30 | — | — | — | — | — | 37 | 33 | -4 | 1-yr | CO | |
| | roadway departure | urban | collector | 55 (2013) | 1 | 30 | — | — | — | — | — | 37 | 32 | -5 | 3-yr | CO | |
| **Speed Limit Sign with LED** | pedestrian | rural | community entrance | 15 (2013) | 2 | 25 | 980 to 2240 | — | 33 | 30 | -3 | 42 | 28 | -4 | 1-mon | IA | |
| | pedestrian | rural | community entrance | 15 (2013) | 2 | 25 | 980 to 2240 | — | 33 | 30 | -3 | 42 | 38 | -4 | 12-mon | IA | |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| **Speed Feedback Sign**—displays the speed of drivers traveling over the threshold speed with the message "YOUR SPEED XX | pedestrian | urban | school zone | 50 (2005) | 3 | 35 to 45 | — | — | 49 | 44 | -5 | 55 | 49 | -6 | 1-wk | TX | |
| | pedestrian | urban | school zone | 50 (2005) | 3 | 35 to 45 | — | — | 49 | 42 | -7 | 54 | 51 | -3 | 4-mon | TX | |
| | pedestrian | rural | community entrance | 7 (2007); 15 (2013) | 1 | 25 | 295 | 367 | 38 | 37 | -1 | 46 | 45 | -1 | 1-mon | IA | |
| | pedestrian | rural | community entrance | 7 (2007); 15 (2013) | 1 | 25 | 295 | 318 | 38 | 37 | 0 | 46 | 45 | -1 | 12-mon | IA | |
| | pedestrian | rural | community entrance | 51 (2006) | 4 | 30 to 45 | — | — | 46 | 41 | -5 | 51 | 46 | -5 | 1-mon | MN | |
| | pedestrian | rural | community entrance | 51 (2006) | 4 | 30 to 45 | — | — | 47 | 40 | -7 | 51 | 46 | -5 | 12-mon | MN | |
| | pedestrian | rural | community entrance | 52 (2009) | 12 | 25 to 40 | — | — | 42 | 36 | -6 | — | — | — | 1-wk | PA | |
| | intersection | urban | signalized intersection | 50 (2005) | 2 | 45 to 55 | — | — | 51 | 47 | -4 | 57 | 54 | -4 | 1-wk | TX | |
| | intersection | urban | signalized intersection | 50 (2005) | 2 | 45 to 55 | — | — | 51 | 49 | -2 | 57 | 55 | -2 | 4-mon | TX | |
| | roadway departure | urban | collector (2-lane) | 53 (2004) | 4 | 25 | 2700 to 4900 | — | 29 | 28 | -1 | 34 | 32 | -5 | 1-mon | WA | |
| | roadway departure | urban | collector (2-lane) | 53 (2004) | 4 | 25 | 2700 to 4900 | — | 28 | 27 | -1 | 33 | 28 | -5 | 2-yr | WA | |
| | roadway departure | urban | collector/ minor arterial | 54 (2009) | 16 | 25 | — | — | — | — | — | — | — | -2 | 1-yr | WA | |
| | roadway departure | urban | collector/ minor arterial | 54 (2009) | 16 | 25 | — | — | — | — | — | — | — | -3 | 5 to 8-yr | WA | |
| | roadway departure | urban | collector/ minor arterial | 54 (2009) | 16 | 30 to 35 | — | — | — | — | — | — | — | -4 | 1-yr | WA | |
| | roadway departure | urban | collector/ minor arterial | 54 (2009) | 16 | 30 to 35 | — | — | — | — | — | — | — | -6 | 5 to 8-yr | WA | |
| | roadway departure | urban | 2-lane | 54 (2009) | 9 | 25 to 35 | — | — | — | — | — | 40 | 36 | -4 | 1-mon | WA | |
| | roadway departure | urban | 2-lane | 54 (2009) | 4 | 25 to 35 | — | — | — | — | — | 37 | 33 | -4 | 12-mon | WA | |
| | roadway departure | urban | 2-lane | 54 (2009) | 9 | 25 to 35 | — | — | — | — | — | 39 | 35 | -4 | 2 to 3-yr | WA | |
| | roadway departure | urban | 2-lane | 54 (2009) | 11 | 25 to 35 | — | — | — | — | — | 38 | 33 | -5 | 4+ yr. | WA | |
| | roadway departure | urban | curve (2-lane) | 54 (2009) | 1 | 30 | — | — | — | — | — | 41 | 38 | -3 | 1-mon | WA | |
| | roadway departure | urban | curve (2-lane) | 54 (2009) | 2 | 30 to 35 | — | — | — | — | — | 42 | 38 | -4 | 2 to 3-yr | WA | |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| (*cont'd*) **Speed Feedback Sign**—displays the speed of drivers traveling over the threshold speed with the message "YOUR SPEED XX" | roadway departure | urban | curve (2-lane) | 54 (2009) | 1 | 30 | — | — | — | — | — | 41 | 35 | -6 | 4+ yr. | WA | |
| | roadway departure | rural | interstate (curve) | 56 (2006) | 2 | 45 adv. | 16750 | — | 56 | 53 | -3 | — | — | — | 2 to 4-mon | OR | passenger cars |
| | roadway departure | rural | interstate (curve) | 56 (2006) | 2 | 45 adv. | 16750 | — | 51 | 49 | -2 | — | — | — | 2 to 4-mon | OR | trucks |
| | roadway departure | rural | curve (2-lane) | 57 (2013) | 11 | 50 to 65/30 to 50 adv. | — | — | — | — | -2 | — | — | -3 | 1-mon | AZ, FL, IA, OH, OR, TX, WA | |
| | roadway departure | rural | curve (2-lane) | 57 (2013) | 11 | 50 to 65/30 to 50 adv. | — | — | — | — | -3 | — | — | -3 | 12-mon | AZ, FL, IA, OH, OR, TX, WA | |
| | roadway departure | rural | curve (2-lane) | 57 (2013) | 11 | 50 to 65/30 to 50 adv. | — | — | — | — | -2 | — | — | -2 | 2-yr | AZ, FL, IA, OH, OR, TX, WA | |
| | roadway departure | rural | curve (2-lane) | 50 (2005) | 2 | 55/20 adv. | — | — | 36 | 33 | -3 | 42 | 39 | -3 | 1-wk | TX | |
| | roadway departure | rural | curve (2-lane) | 50 (2005) | 2 | 55/20 adv. | — | — | 36 | 35 | -1 | 42 | 40 | -2 | 4-mon | TX | |
| | roadway departure | rural | curve (2-lane) | 58 (2012) | 3 | — | 455 to 710 | — | 54 | 51 | -3 | 61 | 57 | -4 | 1-mon | MN | passenger cars |
| | work zone | rural | interstate | 62 (2011) | 3 | 55 | 28000 | — | 61 | 57 | -4 | 66 | 61 | -5 | 1-wk | NE | passenger cars |
| | work zone | rural | interstate | 62 (2011) | 3 | 55 | 28000 | — | 58 | 55 | -3 | 62 | 59 | -3 | 1-wk | NE | trucks |
| | work zone | rural | interstate | 62 (2011) | 3 | 55 | 28000 | — | 61 | 56 | -5 | 66 | 60 | -6 | 5-wk | NE | passenger cars |
| | work zone | rural | interstate | 62 (2011) | 3 | 55 | 28000 | — | 58 | 56 | -3 | 62 | 59 | -3 | 5-wk | NE | trucks |
| | work zone | rural | arterial | 63 (2006) | 1 | — | — | — | — | — | — | 66 | 63 | -3 | — | TX | |
| **Speed Feedback Sign with Action Message**—"YOUR SPEED XX" + "SLOW DOWN" | roadway departure | urban | 2-lane | 54 (2009) | 9 | 25 | — | — | — | — | — | 34 | 32 | -2 | 1 to 6-mon | WA | |
| | roadway departure | urban | 2-lane | 54 (2009) | 3 | 25 | — | — | — | — | — | 33 | -31 | -2 | 12-mon | WA | |
| | roadway departure | urban | 2-lane | 54 (2009) | 5 | 25 | — | — | — | — | — | 33 | 31 | -2 | 2 to 3-yr | WA | |
| | roadway departure | urban | curve (2-lane) | 54 (2009) | 1 | 25 | — | — | — | — | — | 36 | 31 | -5 | 1 to 6-mon | WA | |
| | roadway departure | urban | curve (2-lane) | 54 (2009) | 1 | 25 | — | — | — | — | — | 36 | 31 | -5 | 4+ yr. | WA | |
| | intersection | rural | signalized intersection | 20 (2008) | 3 | 50 to 55 | — | — | — | — | -2 | — | — | -1 | — | WA, TX | at sign |
| | work zone | rural | interstate | 63 (2006) | 1 | — | — | — | — | — | — | 65 | 63 | -2 | — | TX | |
| | pedestrian | rural | community entrance | 7 (2007) | 1 | 25 | 2870 | — | 31 | 26 | -5 | 59 | 52 | -7 | 3-mon | IA | SLOW DOWN 25 |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| **Speed Feedback Sign plus New Curve Advisory Speed Sign** | roadway departure | rural | curve (2-lane) | 58 (2012) | 3 | — | 455 to 710 | — | 54 | 50 | -4 | 61 | 57 | -4 | 12-mon | MN | PC |
| | roadway departure | rural | curve (2-lane) | 58 (2012) | 3 | — | 455 to 710 | — | 53 | 50 | -3 | 53 | 50 | -3 | 1-mon | MN | center of curve, |
| | roadway departure | rural | curve (2-lane) | 58 (2012) | 3 | — | 455 to 710 | — | 53 | 50 | -3 | 53 | 49 | -4 | 12-mon | MN | center of curve |
| **"YOUR SPEED XX"** | pedestrian | rural | community entrance | 7 (2007); 15 (2013) | 2 | 25 to 30 | 234 to 662 | 263 to 646 | 39 | 34 | -5 | 47 | 42 | -5 | 1-mon | IA | with optical speed bars |
| **"SLOW"** | pedestrian | rural | recreational area | 13 (2002) | 1 | 35 | — | — | 36 | 36 | 0. | 43 | 44 | 1 | 1-mon | MN | |
| **Speed Activated Curve Warning Sign and "SLOW DOWN" Action Message** | roadway departure | rural | curve (2-lane) | 59 (2002) | 3 | 30 to 50 | — | — | 39 | 35 | -4 | — | — | — | — | United Kingdom | |
| | roadway departure | rural | curve (2-lane) | 57 (2013) | 11 | 50 to 70/35 to 50 adv. | — | — | — | — | -2 | — | — | -2 | 1-mon | AZ, FL, IA, OH, OR, TX, WA | |
| | roadway departure | rural | curve (2-lane) | 57 (2013) | 11 | 50 to 70/35 to 50 adv. | — | — | — | — | -3 | — | — | -2 | 12-mon | AZ, FL, IA, OH, OR, TX, WA | |
| | roadway departure | rural | curve (2-lane) | 57 (2013) | 11 | 50 to 70/35 to 50 adv. | — | — | — | — | -2 | — | — | -2 | 2-yr | AZ, FL, IA, OH, OR, TX, WA | |
| **"TOO FAST FOR CURVE"** | roadway departure | rural | curve (interstate) | 60 (2003) | 1 | 50 | — | — | — | — | -3 | — | — | — | — | WI | trucks |
| **"50 MPH CURVES" + "YOUR SPEED XX"** | roadway departure | rural | interstate | 61 (2000) | 5 | 55 to 65/50 to 60 adv. | — | — | 64 | 63 | -1 | — | — | — | — | CA | passenger cars |
| **"50 MPH CURVES" + "YOUR SPEED XX"** | roadway departure | rural | interstate | 61 (2000) | 5 | 55 to 65/50 to 60 adv. | — | — | 58 | 56 | -2 | — | — | — | — | CA | trucks |
| **Flashing Beacon** | work zone | rural | 2-lane | 64 (2007) | 3 | 45 | — | — | — | — | -3 | — | — | -3 | — | SC | |
| | work zone | rural | multi-lane | 64 (2007) | 1 | 45 | — | — | — | — | -3 | — | — | -3 | — | SC | |
| | work zone | rural | interstate | 64 (2007) | 1 | 45 | — | — | — | — | -6 | — | — | -5 | — | SC | |
| **Variable Speed Limit** | roadway departure | rural | freeway | 65 (2005) | 2 | — | — | — | — | — | — | 82 | 77 | -5 | — | WA | |
| **Curve Warning Sign with Flashers**— ffashing lights on sign | roadway departure | rural | 2-lane curve | 25 (2005) | 2 | — | — | — | 47 | 46 | -1 | 51 | 50 | -1 | — | — | |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| **Static Signing** | | | | | | | | | | | | | | | | | |
| **Chevron Signs**—use of standard chevron signing | roadway departure | rural | 2-lane | 46 (2010) | 2 | 70/45 & 50 adv. | — | — | 57 | 55 | -2 | 65 | 64 | -1 | 1-mon | TX | |
| | roadway departure | rural | 2-lane | 25 (2005) | 1 | — | — | — | 48 | 48 | 0 | 52 | 52 | 0 | 1-wk | KY | at PC |
| | roadway departure | rural | 2-lane | 46 (2010) | 2 | 70/45 & 50 adv. | — | — | 56 | 54 | -2 | 65 | 63 | -2 | 1-mon | TX | with full post delineation |
| **Chevrons with Full Post Delineation** | roadway departure | rural | 2-lane | 47 (2012) | 4 | 50 to 55/35 to 50 adv. | — | — | 50 | 50 | 0 | 56 | 55 | -1 | 1-mon | IA | |
| **Curve Sign + Flags** | roadway departure | rural | 2-lane | 25 (2005) | 3 | — | — | — | 46 | 45 | -1 | 49 | 49 | 0 | 1-wk | KY | at PC |
| **Arrow (MUTCD: W1-6)** | roadway departure | rural | 2-lane | 25 (2005) | 1 | — | — | — | 43 | 44 | 1 | 46 | 47 | 1 | 1-wk | KY | at PC |
| **Intersection Treatments** | | | | | | | | | | | | | | | | | |
| **Roundabout**—large, raised, circular islands at the middle of major intersections, around which all oncoming vehicles must traverse | pedestrian | rural | — | 66 (2005) | 19 | — | — | 20400 | — | — | — | 48 | 28 | -20 | — | MD, CA, WA, MI, Canada | |
| | intersection | suburban | Y intersection (2-lane) | 67 (2005) | 1 | — | — | 5500 | — | — | — | 32 | 24 | -8 | 1 to 3 years | MI | |
| | intersection | urban | — | 68 (2005) | 1 | — | 11000 to 12000 | 15500 | — | — | — | 47 | 33 | -14 | — | CO | |
| **Traffic Circle**—circular, raised island placed within the middle of an intersection | intersection | urban | — | 1 (1999) | 45 | — | 240 to 10910 | 269 to 8280 | — | — | — | 34 | 30 | -4 | — | TX, WA, CA, CO, NC, OH, OR, FL, GA, MD, NE, MA, MN, AZ | |
| **Access Control** | | | | | | | | | | | | | | | | | |
| **Half-Closure** | pedestrian | urban | — | 1 (1999) | 11 | — | 220 to 9540 | 151 to 9180 | — | — | — | 30 | 24 | -6 | — | — | |
| **Diagonal Diverter** | pedestrian | urban | — | 1 (1999) | 7 | — | 474 to 2057 | 177 to 574 | — | — | — | 28 | 27 | -1 | — | — | |
| **Full Closure** | pedestrian | urban | — | 1 (1999) | 2 | — | 1540 to 1980 | 850 to 1080 | — | — | — | 18 | 13 | -3 | — | — | |
| **Choker + Speed Hump** | pedestrian | urban | — | 1 (1999) | 2 | — | 2456 to 3685 | 2593 to 2931 | — | — | — | 38 | 25 | -13 | — | — | |
| **Half-Closure + Median Barrier** | pedestrian | urban | — | 1 (1999) | 2 | — | 10160 to 10320 | 1120 to 2120 | — | — | — | 38 | 32 | -6 | — | — | |

| Countermeasure | Safety Focus | Area | Roadway | Reference | Sites | Speed Limit (mph) | Volume (vpd) | | Mean Speed (mph) | | | 85th %tile Speed (mph) | | | Period | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Before | After | Before | After | Change | Before | After | Change | | | |
| **Gateway Entrance Treatments** | | | | | | | | | | | | | | | | | |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 40 | — | — | 45 | 41 | -4 | 50 | 46 | -5 | 1-mon | United Kingdom | red bars + signing + bulb-outs |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 20 | — | — | 35 | 24 | -11 | 41 | 30 | -11 | 1-mon | United Kingdom | narrowing + speed cushions |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 20 | — | — | 35 | 15 | -10 | 41 | 30 | -11 | 12-mon | United Kingdom | narrowing + speed cushions |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 30 | — | — | 40 | 30 | -11 | 47 | 35 | -13 | 1-mon | United Kingdom | red box + speed limit + dragon's teeth + signing |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 30 | — | — | 40 | 33 | -8 | 47 | 38 | -9 | 12-mon | United Kingdom | red box + speed limit + dragon's teeth + signing |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 30 | — | — | 38 | 33 | -5 | 43 | 39 | -4 | 1-mon | United Kingdom | red box + speed limit + dragon's teeth + signing |
| **Entrance Treatments**—multiple treatments placed at community entrance to reduce speeds into community | pedestrian | rural | community entrance | 49 (2000) | 1 | 30 | — | — | 38 | 32 | -6 | 43 | 36 | -7 | 12-mon | United Kingdom | red box + speed limit + dragon's teeth + signing |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 30 | — | — | 41 | 39 | -2 | 47 | 47 | 0 | 1-mon | United Kingdom | red patches + "SLOW" + dragon's teeth + signing |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 30 | — | — | 41 | 37 | -4 | 47 | 44 | -3 | 12-mon | United Kingdom | red patches + "SLOW" + dragon's teeth + signing |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 40 | — | — | 51 | 45 | -6 | 60 | 51 | -9 | 1-mon | United Kingdom | red lines of decreasing size and width + signing |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 40 | — | — | 51 | 45 | -6 | 60 | 53 | -7 | 12-mon | United Kingdom | red lines of decreasing size and width + signing |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 40 | — | — | 44 | 39 | -6 | 50 | 43 | -7 | 1-mon | United Kingdom | red box + speed limit + signing |
| | pedestrian | rural | community entrance | 49 (2000) | 1 | 40 | — | — | 44 | 38 | -7 | 50 | 43 | -7 | 12-mon | United Kingdom | red box + speed limit + signing |

Notes: Information is presented to one signiffcant digit unless the study only provided integer values. In some cases the study only provided resulting changes in speed rather than providing the actual before and after value.

## Abbreviations

common state destinations are used and are not listed here (e.g. Iowa = IA)
advisory (adv)
intersection (isect)
month (mon.)
pedestrian (ped)
post mounted delineator (PMD)
rumble strips (RS)
run off road (ROR)
years (yrs.)

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# APPENDIX E

## FHWA Desktop Reference
## Engineering Speed Management
## Counter Measures
## Potential Effectiveness in Reducing Crashes

# Engineering Speed Management Countermeasures: A Desktop Reference of Potential Effectiveness in Reducing Crashes

## July 2014

This chart summarizes studies about the effectiveness of engineering countermeasures. Studies where an increase in crashes were reported are also shown since this information is also relevant in selection of countermeasures.

| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Vertical Deflections Within the Roadway** | | | | | | | | | | | | |
| **Speed Hump**—rounded, raised area placed across the roadway, typically 12 to 14 feet long | pedestrian | urban | — | 100 (2009) | 6 | — | all | — | — | -48% | CA | -43% change in average volume |
| | pedestrian | urban | — | 100 (2009) | 5 | — | all | — | — | 3% | FL | -28% change in average volume |
| | pedestrian | urban | — | 100 (2009) | 16 | — | all | — | — | -46% | MD | -32% change in average volume |
| | pedestrian | urban | — | 100 (2009) | 20 | — | all | — | — | -33% | NE | volume change unknown |
| | pedestrian | urban | — | 100 (2009) | 4 | — | all | — | — | -46% | OH | -29% change in average volume |
| | pedestrian | urban | — | 100 (2009) | 5 | — | all | — | — | -40% | OR | -20% change in average volume |
| **Speed Table**—a long speed hump typically 22 feet in length with a flat section in the middle and ramps on the ends | pedestrian | urban | residential | 6 (2003) | 19 | 2-3 yrs./2-3 yrs. | total | — | — | -38% | GA | |
| | pedestrian | urban | residential | 6 (2003) | 19 | 2-3 yrs./2-3 yrs. | injury | — | — | -93% | GA | |
| | pedestrian | urban | — | 100 (2009) | 4 | — | all | — | — | -64% | MD | -15% change in average volume |
| | pedestrian | urban | — | 100 (2009) | 4 | — | all | — | — | -36% | OR | -20% change in average volume |

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| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Speed Cushion**—raised area that allows most emergency vehicles to straddle the hump | pedestrian | no crash studies found for speed cushions | | | | | | | | | | |
| **Raised Intersection**—a raised plateau, with ramps on all approaches, where roads intersect | pedestrian | — | — | 69 (2004) | — | — | serious/ minor injury | 1.05 | ★ | — | — | |
| **Horizontal Deflections/Roadway Narrowing** | | | | | | | | | | | | |
| **Choker/Bulb-out**—mid-block curb extensions that narrow road by extending the sidewalk or widening the planting strip | pedestrian | no crash studies found for chokers | | | | | | | | | | |
| **Neck Down**—intersection curb extensions that narrow a road by extending the width of a sidewalk | pedestrian | no crash studies found for neck-downs | | | | | | | | | | |
| **Chicanes**—curb extensions that alternate from one side of the street to the other forming S-shaped curves | pedestrian | no crash studies found for chicanes | | | | | | | | | | |
| **Center Island**—raised or painted island along the centerline that narrows travel lanes | pedestrian | — | — | 70 (2011) | — | — | all | 0.61 | ★★★★ | — | UT | raised median |
| | pedestrian | — | — | 70 (2011) | — | — | fatal/ serious | 0.56 | ★★★★ | — | UT | raised median |
| | pedestrian | urban | principal arterial | 71 (2008) | — | — | all | 0.29 | ★★★ | — | UT | raised median |
| | pedestrian | urban | principal arterial | 71 (2008) | — | — | angle | 0.45 | ★★★ | — | UT | raised median |
| | pedestrian | urban | principal arterial | 72 (2010) | — | — | all | 0.86 | ★★★ | — | NJ | raised median |
| | pedestrian | urban | principal arterial | 69 (2004) | — | — | serious/ minor | 0.78 | ★★★★★ | — | — | raised median |
| | pedestrian | urban | principal arterial | 69 (2004) | — | — | PDO | 1.09 | ★★★★★ | — | — | raised median |
| | pedestrian | rural | principal arterial | 69 (2004) | — | — | serious/ minor | 0.88 | ★★★★★ | — | — | raised median |
| | pedestrian | rural | principal arterial | 69 (2004) | — | — | PDO | 0.82 | ★★★★★ | — | — | raised median |
| | pedestrian | urban | — | 69 (2004) | — | — | fatal/seri- ous/ minor | 0.61 | ★★★★ | — | — | raised median |
| | pedestrian | rural | — | 69 (2004) | — | — | PDO | 2.28 | ★★ | — | — | raised median |
| | pedestrian | rural | — | 69 (2004) | — | — | fatal/ serious/ minor | 1.94 | ★ | — | — | raised median |

| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (*cont'd*) **Center Island**—raised or painted island along the centerline that narrows travel lanes | pedestrian | urban/ subur-ban | principal arterial | 73 (2002) | — | — | vehicle/ped | 0.61 | ★★ | — | WA, OR, CA, AZ, UT, KS, TX, MO, Wi, OH, PA, MA, MD, NC, FL | raised median + unmarked crosswalk |
| | pedestrian | urban/ subur-ban | principal arterial | 73 (2002) | — | — | vehicle/ped | 0.54 | ★★★ | — | WA, OR, CA, AZ, UT, KS, TX, MO, Wi, OH, PA, MA, MD, NC, FL | raised median + marked crosswalk |
| | pedestrian | rural | stop-con-trolled intersec-tion | 74 (2008) | — | — | all | 0.69 | ★★ | — | PA, KY, MO | lane narrowing + painted median + rumble strips |
| | pedestrian | rural | stop-con-trolled intersec-tion | 74 (2008) | — | — | fatal/seri-ous/ minor | 0.80 | ★★ | — | PA, KY, MO | lane narrowing + painted median + rumble strips |
| | pedestrian | rural | stop-con-trolled intersec-tion | 74 (2008) | — | — | angle | 0.58 | ★★ | — | PA, KY, MO | lane narrowing + painted median + rumble strips |
| | pedestrian | rural | stop-con-trolled intersec-tion | 74 (2008) | — | — | rear-end | 1.54 | ★★ | — | PA, KY, MO | lane narrowing + painted median + rumble strips |
| **Reduce Lane Width with Markings**—narrowing of the lanes using pavement markings, median, etc. | roadway departure | rural | — | 69 (2004) | — | — | injury | 1.05 | ★★★ | — | — | 8 inch edge line |
| **Road Diet**—reducing the number of lanes by reallocating roadway space for other uses (e.g. bike lanes, center turn lanes, medians, parking, shoulder lanes, etc. | pedestrian | urban | 3-lane | 75 (2003) | 1 | 20 mon/ 20 mon | all | — | — | 62% | MT | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 75 (2003) | 1 | — | all | — | — | -28% | MN | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 75 (2003) | 1 | 1 yrs./1 yrs. | all | — | — | -17% | CA | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 75 (2003) | 1 | 1 yrs./1 yrs. | all | — | — | -17% | CA | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 75 (2003) | 1 | 2 yrs./2 yrs. | all | — | — | -52% | CA | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 75 (2003) | 9 | 1 yrs./1 yrs. | all | — | — | -34% | WA | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 75 (2003) | 9 | 1 yrs./1 yrs. | all | — | — | -57% | IA | 4- to 3-lane |
| | pedestrian | subur-ban | 3-lane | 76 (2010) | 30 treat-ment/ 51 control | 17.5 yrs./4.5 yrs. | all | 0.81 | — | — | CA, WA | 4- to 3-lane |

| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (*cont'd*) **Road Diet**—reducing the number of lanes by reallocating roadway space for other uses (e.g. bike lanes, center turn lanes, medians, parking, shoulder lanes, etc. | pedestrian | small urban | 3-lane | 76 (2010) | 15 treatment/ 296 control | 4.7 yrs./3.5 yrs. | all | 0.53 | — | — | IA | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 77 (2007) | — | — | all | 0.67 | — | — | MN | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 77 (2007) | — | — | injury | 1.00 | — | — | MN | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 77 (2007) | — | — | PDO | 0.54 | — | — | MN | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 77 (2007) | — | — | angle | 0.76 | — | — | MN | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 78 (2012) | — | — | all | 0.95 | ★★★ | — | MI | 4- to 3-lane |
| | pedestrian | urban | 3-lane | 79 (2006) | 15 treatment / 15 control | 11 to 21 yrs./1 to 11 yrs. | all | — | — | -25% | IA | 4- to 3-lane |
| | pedestrian | urban | 3-lane minor arterial | 80 (2008) | — | — | all | 0.71 | ★★★★ | — | — | 4- to 3-lane |
| | pedestrian | urban | 3-lane arterial | 78 (2012) | — | 3 yrs./3 yrs. | all | 0.91 | — | — | MI | 4- to 3-lane |
| | pedestrian | urban | 3-lane arterial | 78 (2012) | — | 3 yrs./3 yrs. | not specified | 0.59 | — | — | MI | 4- to 3-lane |
| **Surface Treatments and Markings** | | | | | | | | | | | | |
| **Transverse Rumble Strips**—raised or grooved patterns installed on the roadway travel lane or shoulder pavements perpendicular to the direction of travel | roadway departure | urban/ suburban | local | 69 (2004) | — | — | all | 0.66 | ★★★★ | — | — | |
| | roadway departure | urban/ suburban | local | 69 (2004) | — | — | serious/ minor | 0.64 | ★★★★ | — | — | |
| | roadway departure | urban/ suburban | local | 69 (2004) | — | — | PDO | 0.73 | ★★ | — | — | |
| | roadway departure | rural | minor arterial at stop control | 81 (2010) | — | — | all | 1.2 | ★★★★ | — | MN, IA | |
| | roadway departure | rural | major collector at stop control | 81 (2010) | — | — | all | 0.67 to 1.4 | ★★★ | — | MN, IA | |
| | roadway departure | rural | major collector at stop control | 81 (2010) | — | — | fatal/serious/ minor | 0.91 | ★★★★ | — | MN, IA | |
| | roadway departure | rural | major collector at stop control | 81 (2010) | — | — | fatal/serious | 0.75 | ★★★★ | — | MN, IA | |

| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (*cont'd*) **Transverse Rumble Strips**—raised or grooved patterns installed on the roadway travel lane or shoulder pavements perpendicular to the direction of travel | roadway departure | rural | major collector at stop control | 81 (2010) | — | — | PDO | 1.20 | ★★★★ | — | MN, IA | |
| | pedestrian | rural | low-volume | 82 (2011) | — | — | all | 0.76 | ★★★ | — | China | at pedestrian crosswalk |
| | roadway departure | rural | curve | 69 (2004) | — | — | ROR serious/minor | 0.94 | ★★ | — | — | with RPMs |
| | roadway departure | rural | — | 83 (1986) | — | — | all | 0.47 | ★★ | — | KY | with RPMs |
| | roadway departure | rural | — | 83 (1986) | — | — | wet road | 0.51 | ★ | — | KY | with RPMs |
| | roadway departure | rural | — | 83 (1986) | — | — | nighttime | 0.36 | ★ | — | KY | with RPMs |
| | roadway departure | rural | — | 83 (1986) | — | — | all | 1.10 | ★ | — | KY | with RPMs + transverse markings |
| | roadway departure | rural | — | 83 (1986) | — | — | wet road | 0.91 | ★ | — | KY | with RPMs + transverse markings |
| | roadway departure | rural | — | 83 (1986) | — | — | nighttime | 0.83 | ★ | — | KY | with RPMs + transverse markings |
| **Transverse Markings**—pavement markings placed across the lane perpendicular to direction of travel | roadway departure | rural | freeway to freeway connector | 36 (2003) | 1 | 2 yrs./2 yrs. | — | — | — | -48% | WI | converging chevrons |
| | roadway departure | urban | — | 84 (1996) | — | — | all | 0.68 | ★★★ | — | — | converging chevrons |
| | roadway departure | no crash studies found for optical speed bars, herringbone, dragon's teeth, or transverse bars | | | | | | | | | | |
| **Pavement Marking Legends**—speed limit or other on-pavement signing | roadway departure | no crash studies found for any type of pavement marking legends | | | | | | | | | | |
| **In-roadway Warning Lights** | roadway departure | rural | interstate (4-lane) | 45 (1977) | 1 | 9 mon/9 mon | crashes under foggy conditions | — | — | -75% | VA | |
| **Vertical Delineation** | | | | | | | | | | | | |
| **Vertical Treatments**—vertical objects such as post mounted delineators which are placed along the roadway to provide better delineation and/or provide a feeling of friction | roadway departure | rural | curve | 85 (2006) | — | — | ROR | — | — | -15% | OH | post mounted delineator |
| | roadway departure | rural | — | 69 (2004) | — | — | injury | 1.04 | — | — | — | post mounted delineator |
| | roadway departure | rural | curve | 86 (2008); 87 (2005) | — | — | total | 0.70 to 0.80 | — | — | — | post mounted delineator |
| | roadway departure | rural | curve (4-lane) | 88 (2009) | 4 | — | total | — | — | -47% | Italy | sequential flashing beacons + chevrons + curve warning signs |

| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (*cont'd*) **Vertical Treatments**—vertical objects such as post mounted delineators which are placed along the roadway to provide better delineation and/or provide a feeling of friction | roadway departure | rural | curve (4-lane) | 88 (2009) | 4 | — | nighttime | — | — | -76% | Italy | sequential flashing beacons + chevrons + curve warning signs |
| | roadway departure | rural | curve (4-lane) | 88 (2009) | 4 | — | ROR | — | — | -47% | Italy | sequential flashing beacons + chevrons + curve warning signs |
| | roadway departure | rural | curve (4-lane) | 88 (2009) | 4 | — | rainy | — | — | -42% | Italy | sequential flashing beacons + chevrons + curve warning signs |
| | roadway departure | rural | curve (4-lane) | 88 (2009) | 4 | — | injury | — | — | -37% | Italy | sequential flashing beacons + chevrons + curve warning signs |
| | roadway departure | no crash studies found for reflective post treatment, streaming PMDs | | | | | | | | | | |
| **Landscaping**—roadside plantings used to create vertical friction | roadway departure | urban | collector | 48 (2000) | 1 | 31 mon/17 mon | all | no change | — | — | — | landscaped median and curbside islands |
| **Gateway Entrance Treatments** | | | | | | | | | | | | |
| **Gateway Treatment**—placed at community entrance to remind drivers of changing roadway character | pedestrian | rural | community entrance | 89 (2009) | 7 | 3-9 yrs./2-7 yrs. | — | — | — | -2% & -32% | CA | 3400 to 27500 vpd gateway monument |
| | pedestrian | no crash studies found for pavement marking gateways or combination of entrance treatments | | | | | | | | | | |
| **Dynamic Signing** | | | | | | | | | | | | |
| **Dynamic Speed Feed-back Signs**—displays message for drivers traveling over the threshold speed | roadway departure | rural | curve (2-lane) | 59 (2002) | 2 | — | injury | — | — | -54 to -100% | United Kingdom | "SLOW DOWN" + curve warning |
| | roadway departure | rural | interstate | 61 (2000) | 5 | 5-yrs./6-mon | all | — | — | -2% | CA | "50 MPH CURVES" + "YOUR SPEED XX" |
| | roadway departure | rural | curve (2-lane) | 57 (2013) | 22 | 3-yrs./ 2-yrs. | all | 0.93 to 0.95 | — | — | IA, FL, WA, AZ, OR, OH, TX | "YOUR SPEED XX" + curve advisory sign |
| | roadway departure | rural | curve (2-lane) | 57 (2013) | 22 | 3-yrs./ 2-yrs. | single vehicle | 0.95 | — | — | IA, FL, WA, AZ, OR, OH, TX | "YOUR SPEED XX" + curve advisory sign |
| | roadway departure | no crash studies found for flashing beacons | | | | | | | | | | |

| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Intersection Treatments** | | | | | | | | | | | | |
| **Roundabout**—large, raised, circular islands at the middle of major intersections, around which all oncoming vehicles must traverse | intersection | — | — | 90 (1994) | 181 | — | injury | 0.35 | ★★ | — | Netherlands | |
| | intersection | — | — | 90 (1994) | 181 | — | PDO | 0.58 | ★★ | — | Netherlands | |
| | intersection | all | — | 90 (1994) | 181 | — | vehicle/ped | 0.27 | ★ | — | Netherlands | |
| | intersection | all | — | 90 (1994) | 181 | — | vehicle/ped | 0.27 | ★ | — | Netherlands | |
| | intersection | all | urban/rural | 91 (2013) | 13 | 3 yrs./3 yrs. | fatal/injury | 0.47 | ★★★★ | — | WI | low speed roundabout |
| | intersection | all | urban/rural | 91 (2013) | 11 | 3 yrs./3 yrs. | all | 0.66 | ★★★★ | — | WI | high speed roundabout |
| | intersection | all | urban/rural | 91 (2013) | 11 | 3 yrs./3 yrs. | fatal/injury | 0.51 | ★★★ | — | WI | high speed roundabout |
| | intersection | rural | rural | 92 (2012) | 19 | 98 data yrs./98 data yrs. | all | 0.33 | ★★★ | — | MD, WA, KS, WI, MN, OR | high-speed roundabout |
| | intersection | rural | rural | 92 (2012) | 19 | 98 data yrs./98 data yrs. | injury | 0.13 | ★★★ | — | MD, WA, KS, WI, MN, OR | high-speed roundabout |
| | intersection | rural | rural | 92 (2012) | 19 | 98 data yrs./98 data yrs. | fatal/injury | 0.11 | ★★★ | — | MD, WA, KS, WI, MN, OR | high-speed roundabout |
| | intersection | rural | rural | 92 (2012) | 19 | 98 data yrs./98 data yrs. | angle | 0.17 | ★★★ | — | MD, WA, KS, WI, MN, OR | high-speed roundabout |
| | intersection | rural | rural | 92 (2012) | 19 | 98 data yrs./98 data yrs. | rear-end | 0.85 | ★★★ | — | MD, WA, KS, WI, MN, OR | high-speed roundabout |
| | intersection | rural | rural | 92 (2012) | 19 | 98 data yrs./98 data yrs. | injury angle | 0.09 | ★★★ | — | MD, WA, KS, WI, MN, OR | high-speed roundabout |
| | intersection | rural | rural | 92 (2012) | 19 | 98 data yrs./98 data yrs. | sideswipe | 2.79 | ★★★ | — | MD, WA, KS, WI, MN, OR | high-speed roundabout |
| | intersection | rural | rural | 92 (2012) | 19 | 98 data yrs./98 data yrs. | ffixed object | 4.66 | ★★★ | — | MD, WA, KS, WI, MN, OR | high-speed roundabout |
| | intersection | rural | rural | 92 (2012) | 19 | 98 data yrs./98 data yrs. | frontal/opposing direction/sideswipe | 2.40 | ★★ | — | MD, WA, KS, WI, MN, OR | high-speed roundabout |
| | intersection | rural | rural | 92 (2012) | 19 | 98 data yrs./98 data yrs.[7] | rear-end injury | 0.54 | ★★ | — | MD, WA, KS, WI, MN, OR | high-speed roundabout |

| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (*cont'd*) **Roundabout**—large, raised, circular islands at the middle of major intersections, around which all oncoming vehicles must traverse | intersection | all | urban/ rural | 91 (2013) | 13 | 3 yrs./ 3 yrs. | all | 1.10 | ★★★★ | — | WI | low speed roundabout |
| | intersection | rural | one-way stop | 92 (2012) | 2 | 98 data yrs./98 data yrs. | all | 0.74 | ★★★ | — | OR, KS | 3-leg to roundabout |
| | intersection | rural | one-way stop | 92 (2012) | 2 | 98 data yrs./98 data yrs. | injury | 0.28 | ★★★ | — | OR, KS | 3-leg to roundabout |
| | intersection | all | urban/ rural | 91 (2013) | 2 | 3 yrs./3 yrs. | all | 1.24 | ★★★ | — | WI | no control/yield to roundabout |
| | intersection | all | urban/ rural | 91 (2013) | 12 | 3 yrs./3 yrs. | all | 1.10 | ★★★★ | — | WI | multi-lane roundabout |
| | intersection | all | urban/ rural | 91 (2013) | 12 | 3 yrs./3 yrs. | fatal/injury | 0.37 | ★★★★ | — | WI | multi-lane roundabout |
| | intersection | all | urban/ rural | 91 (2013) | 12 | 3 yrs./3 yrs. | all | 0.64 | ★★★★ | — | WI | single-lane roundabout |
| | intersection | all | urban/ rural | 91 (2013) | 12 | 3 yrs./3 yrs. | fatal/injury | 0.82 | ★★★ | — | WI | single-lane roundabout |
| | intersection | urban | — | 93 (2001) | 9 | 2 to 5 yrs./1.3 to 5.3 yrs. | all | 0.95 | ★★★ | — | CO, FL, KS, ME, MD, SC, VT | stop-control to multi-lane roundabout |
| | intersection | urban | — | 93 (2001) | 14 | 2 to 5 yrs./1.3 to 5.3 yrs. | all | 0.28 | ★★★★ | — | CO, FL, KS, ME, MD, SC, VT | stop-control to single-lane roundabout |
| | intersection | urban | — | 93 (2001) | 14 | 2 to 5 yrs./1.3 to 5.3 yrs. | injury | 0.12 | ★★★★ | — | CO, FL, KS, ME, MD, SC, VT | stop-control to single-lane roundabout |
| | intersection | urban | — | 93 (2001) | 14 | 2 to 5 yrs./1.3 to 5.3 yrs. | all | 0.42 | ★★★★ | — | CO, FL, KS, ME, MD, SC, VT | stop-control to single-lane roundabout |
| | intersection | urban | — | 93 (2001) | 14 | 2 to 5 yrs./1.3 to 5.3 yrs. | injury | 0.18 | ★★★★ | — | CO, FL, KS, ME, MD, SC, VT | stop-control to single-lane roundabout |
| | intersection | all | urban/ rural | 91 (2013) | 5 | 3 yrs./3 yrs. | all | 1.11 | ★★★★ | — | WI | all-way stop-control to roundabout |
| | intersection | all | urban/ rural | 91 (2013) | 5 | 3 yrs./3 yrs. | fatal/injury | 0.54 | ★★★ | — | WI | all-way stop-control to roundabout |
| | intersection | all | all | 94 (2007) | 10 | 3.7 yrs./3.3 yrs. | all | 1.03 | ★★★ | — | FL, MS, MO, NV, OR, WA | all-way stop-control to roundabout |
| | intersection | all | urban/ rural | 91 (2013) | 12 | 3 yrs./3 yrs. | all | 0.75 | ★★★★ | — | WI | two-way stop-control to roundabout |

| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (*cont'd*) **Roundabout**—large, raised, circular islands at the middle of major intersections, around which all oncoming vehicles must traverse | intersection | all | urban/ rural | 91 (2013) | 12 | 3 yrs./3 yrs. | fatal/injury | 0.65 | ★★★★ | — | WI | two-way stop-control to roundabout |
| | Intersection | all | multi-lane/ single-lane | 94 (2007) | 36 | 3.7 yrs./3.3 yrs. | all | 0.56 | ★★★★★ | — | CO, FL, KS, MD, ME, NV, OR, VT, WA, WI | minor stop-control to roundabout |
| | intersection | all | multi-lane/ single-lane | 94 (2007) | 36 | 3.7 yrs./3.3 yrs. | injury | 0.18 | ★★★★★ | — | CO, FL, KS, MD, ME, NV, OR, VT, WA, WI | minor stop-control to roundabout |
| | intersection | rural | single-lane | 94 (2007) | 9 | 3.7 yrs./3.3 yrs. | all | 0.29 | ★★★★ | — | KS; MD | minor stop-control to roundabout |
| | intersection | rural | single-lane | 94 (2007) | 9 | 3.7 yrs./3.3 yrs. | injury | 0.13 | ★★★★ | — | KS; MD | minor stop-control to roundabout |
| | intersection | urban | multi-lane/ single-lane | 94 (2007) | 17 | 3.7 yrs./3.3 yrs. | all | 0.61 to 0.88 | ★★★★ | — | FL, KS, MD, ME, NV, OR, VT, WA, WI | minor stop-control to roundabout |
| | intersection | urban | multi-lane/ single-lane | 94 (2007) | 17 | 3.7 yrs./3.3 yrs. | injury | 0.19 to 0.22 | ★★★★ | — | FL, KS, MD, ME, NV, OR, VT, WA, WI | minor stop-control to roundabout |
| | intersection | subur- ban | multi-lane/ single-lane | 94 (2007) | 10 | 3.7 yrs./3.3 yrs. | all | 0.22 to 0.81 | ★★★★ | — | CO, KS, MD, WA | minor stop-control to roundabout |
| | intersection | subur- ban | multi-lane/ single-lane | 94 (2007) | 10 | 3.7 yrs./3.3 yrs. | injury | 0.22 to 0.29 | ★★★★ | — | CO, KS, MD, WA | minor stop-control to roundabout |
| | intersection | — | — | 95 (2007) | 62 | 3 yrs./1 yrs. | injury | 0.56 | ★★★★ | — | Belgium | unsignalized to roundabout |
| | intersection | — | — | 95 (2007) | 62 | 3 yrs./1 yrs. | minor injury | 0.54 | ★★★★ | — | Belgium | unsignalized to roundabout |
| | intersection | — | — | 95 (2007) | 62 | 3 yrs./1 yrs. | serious injury | 0.80 | ★★★★ | — | Belgium | unsignalized to roundabout |
| | intersection | urban/ subur- ban | 2-lane urban/sub- urban | 96 (2013) | 16 | 3.9 yrs./3.1 yrs. | all | 0.81 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to 2-lane roundabout |
| | intersection | urban/ subur- ban | 2-lane urban/ suburban | 96 (2013) | 16 | 3.9 yrs./3.1 yrs. | injury | 0.29 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to 2-lane roundabout |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (*cont'd*) **Roundabout**—large, raised, circular islands at the middle of major intersections, around which all oncoming vehicles must traverse | intersection | urban/ subur- ban | 1-lane urban/ suburban | 96 (2013) | 12 | 3.9 yrs./3.1 yrs. | all | 0.74 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to single-lane roundabout |
| | intersection | all | urban/ rural | 91 (2013) | 5 | 3 yrs./3 yrs. | all | 0.96 | ★★★ | — | WI | signalized to single- or multi-lane roundabout |
| | intersection | urban | urban/ rural | 91 (2013) | 5 | 3 yrs./3 yrs. | all | 0.65 | ★★★ | — | WI | signalized to single- or multi-lane roundabout |
| | intersection | urban | urban/ rural | 91 (2013) | 5 | 3 yrs./3 yrs. | injury | 0.26 | ★★★ | — | WI | signalized to single- or multi-lane roundabout |
| | intersection | urban/ subur- ban | 2-lane/1- lane | 96 (2013) | 28 | 3.9 yrs./3.1 yrs. | injury | 0.45 | ★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to single- or multi-lane roundabout |
| | intersection | all | urban/ rural | 91 (2013) | 5 | 3 yrs./3 yrs. | fatal/injury | 0.35 | ★★★ | — | WI | signalized to single- or multi-lane roundabout |
| | intersection | — | — | 95 (2007) | 33 | 3 yrs./1 yrs. | injury | 0.68 | ★★★★ | — | Belgium | signalized to roundabout |
| | intersection | — | — | 95 (2007) | 33 | 3 yrs./1 yrs. | major injury | 0.87 | ★★★ | — | Belgium | signalized to roundabout |
| | intersection | — | — | 95 (2007) | 33 | 3 yrs./1 yrs. | minor injury | 0.69 | ★★★ | — | Belgium | signalized to roundabout |
| | intersection | all | 2-lane/1- lane: (urban/ suburban) | 96 (2013) | 28 | 3.9 yrs./3.1 yrs. | all | 0.52 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to roundabout |
| | intersection | all | 2-lane/1- lane: (urban/ suburban) | 96 (2013) | 28 | 3.9 yrs./3.1 yrs. | injury | 0.22 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to roundabout |
| | intersection | urban/ subur- ban | 2-lane/1- lane | 96 (2012); 94 (2007); 97 (2011) | 13/5/13 | 3.9 yrs./3.1 yrs. | all | 0.99 to 1.15 | ★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to roundabout |
| | intersection | urban | multi-lane/ single-lane | 94 (2007) | 5 | 3.7 yrs./ 3.3 yrs. | injury | 0.40 | ★★★★ | — | FL, MD, MI, SC | signalized to roundabout |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (*cont'd*) **Roundabout**—large, raised, circular islands at the middle of major intersections, around which all oncoming vehicles must traverse | intersection | urban | 2-lane/ 1-lane: (urban) | 96 (2013) | 13 | 3.9 yrs./3.1 yrs. | injury | 0.45 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to roundabout |
| | intersection | urban | urban | 97 (2011) | 13 | 3.9 yrs./3.1 yrs. | fatal/injury | 0.44 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to roundabout |
| | intersection | urban/ subur-ban | 2-lane/ 1-lane | 96 (2012); 97 (2011) | 28/ 28 | 3.9 yrs./3.1 yrs. | injury | 0.34 to 0.37 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to roundabout |
| | intersection | urban/ subur-ban | 2-lane/ 1-lane | 96 (2012) | 28 | 3.9 yrs./3.1 yrs. | fatal/injury | 0.28 to 0.45 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to roundabout |
| | intersection | subur-ban | multi-lane/ 2-lane/ 1-lane/ suburban (2-lane: 8, 1-lane: 7) | 94 (2007); 96 (2013); 97 (2011) | 4/ 15/ 15 | 3.7 yrs./ 3.3 yrs. | all | 0.33 to 0.58 | ★★★★ | — | CO and VT/ CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to roundabout |
| | intersection | subur-ban | 2-lane/ 1-lane | 96 (2013) | 15 | 3.9 yrs./3.1 yrs. | injury | 0.26 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to roundabout |
| | intersection | subur-ban | suburban | 97 (2011) | 15 | 3.9 yrs./3.1 yrs. | fatal/injury | 0.26 | ★★★★ | — | CO, FL, IN, MD, MI, NY, NC, SC, VT, WA | signalized to roundabout |
| | intersection | rural | inter-change offi ramp/on ramp | 98 (2012) | 1 | 30 mon/ 6 mon | all | 0.63 | ★★★ | — | MS | signalized to roundabout |
| | intersection | rural | inter-change offi ramp/on ramp | 98 (2012) | 1 | 30 mon/ 6 mon | injury | 0.40 | ★★★ | — | MS | signalized to roundabout |

| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Signing** | | | | | | | | | | | | |
| **Chevron Signs**—use of standard chevron signing | roadway departure | rural | principal arterial/ freeways/ express-ways | 88 (2009) | 15 | — | all crashes | 0.59 | ★★★ | — | Italy | with curve warning sign |
| | roadway departure | rural | principal arterial/ freeways/ express-ways | 88 (2009) | 15 | — | ROR crashes | 0.56 | ★★★ | — | Italy | with curve warning sign |
| | roadway departure | rural | 2-lane | 88 (2009) | 15 | — | fatal/serious injury/mi-nor injury | 1.46 | ★★★ | — | Italy | with curve warning sign |
| | roadway departure | rural | 2-lane | 88 (2009) | 15 | — | nighttime | 0.66 | ★★★ | — | Italy | with curve warning sign |
| | roadway departure | rural | principal arterial/ freeways/ express-ways | 88 (2009); 99 (2009) | — | — | all crashes on | 0.63 to 1.27 | ★★★ | — | CA, WA; Italy | |
| | roadway departure | rural | principal arterial/ freeways/ express-ways | 88 (2009); 99 (2009) | — | — | ROR crashes | 0.9 | ★★★ | — | CA, WA; Italy | |
| | roadway departure | rural | on principal arterial/ freeways/ express-ways | 88 (2009); 99 (2009) | — | — | property damage | 0.83 | ★★★ | — | CA, WA; Italy | |
| | roadway departure | rural | principal arterial/ freeways/ express-ways | 88 (2009); 99 (2009) | — | — | fatal and in-jury crashes | 1.46 | ★★★ | — | CA, WA; Italy | |
| | roadway departure | rural | principal arterial/ freeways/ express-ways | 88 (2009); 99 (2009) | — | — | nighttime | 1.92 | ★★★ | — | CA, WA; Italy | |
| | roadway departure | rural | principal arterial/ freeways/ express-ways | 88 (2009); 99 (2009) | — | — | wet road crashes on | 0.41 | ★★★ | — | CA, WA; Italy | |

| Category | Safety Focus | Area | Roadway | Reference | Sites | Study Period (before/after) | Crash Type | CMF | CMF Clearinghouse Star Rating | Crash Reduction | Location | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (*cont'd*) **Chevron Signs**—use of standard chevron signing | roadway departure | rural | 2-lane | 88 (2009); 99 (2009) | — | — | all crashes | 0.96 | ★★★ | — | CA, WA; Italy | |
| | roadway departure | rural | 2-lane | 88 (2009); 99 (2009) | — | — | head-on/ sideswipe | 0.94 | ★★★ | — | CA, WA; Italy | |
| | roadway departure | rural | 2-lane | 88 (2009); 99 (2009) | — | — | fatal and injury | 0.84 | ★★★ | — | CA, WA; Italy | |
| | roadway departure | rural | 2-lane | 88 (2009); 99 (2009) | — | — | nighttime | 0.75 | ★★★ | — | CA, WA; Italy | |
| | roadway departure | rural | 2-lane | 88 (2009); 99 (2009) | — | — | nighttime head-on/ sideswipe | 0.78 | ★★★ | — | CA, WA; Italy | |
| **Access Control** | | | | | | | | | | | | |
| **Closure/Diversions**—road closings or diversion of traffic | roadway departure | no crash studies found for half-closure | | | | | | | | | | |
| | roadway departure | no crash studies found for diagonal diverters | | | | | | | | | | |
| | roadway departure | no crash studies found for full closure | | | | | | | | | | |

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**The crash modification factor warehouse can be accessed at: http://www.cmfclearinghouse.org**


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**Abbreviations**

common state destinations are used and are not listed here (e.g. Iowa = IA)
advisory (adv)
intersection (isect)
month (mon.)
pedestrian (ped)
post mounted delineator (PMD)
rumble strips (RS)
run offroad (ROR)
years (yrs.)

# APPENDIX F

Stop Sign Warrants

The application of Stop Signs for speed control has been debated nationally and has a high level of confusion and misunderstanding amongst the general public. The Manual on Uniform Traffic Control Devices (MUTCD) is approved by the Federal Highway Administrator as the Nation Standard. Stop Signs are traffic control devices, and not traffic calming devices.

In accordance with the MUTCD Section 2A.05, a Stop Sign is functionally classified as a Regulatory Sign which by definition, gives notice of traffic laws or regulations. The MUTCD clearly states that "*Regulatory and warning signs should be used conservatively because these signs, if used to excess, tend to lose their effectiveness"* and Section 2B.04 states that "*Stop Signs should not be used for speed control"*.

Stop Signs are used to establish Right of Way Control at Intersections with consideration given to:

- combined vehicular, bicycle, and pedestrian volumes entering the intersection
- In-sufficient sight distance and/or unique geometric conditions
- Driver expectations
- Intersection crash records
- Need to control left-turn movements
- Need to control vehicle/pedestrian conflicts
- Need to balance traffic operational characteristics of an intersection

National studies have shown that the improper use of Stop Signs can actually increase speeds and decrease safety due to:

- Drivers perception that the stop sign is unnecessary, and it will be ignored
- Higher mid-block speeds resulting from drivers need to accelerate from the stop to "regain lost time"
- Driver expectations not being met resulting in reduced compliance and higher vehicle/bike/pedestrian conflicts

In addition to concerns noted above the unwarranted traffic stops can result in unnecessary traffic delays along the corridor, increased traffic noise at the signs, and potential re-distribution/diversion of traffic to adjoining streets.

The following provides the current State and Federal directives related to Stop Sign placement/warrants.

# I. Administrative Policies

## AUTHORIZATION FOR 2009 MUTCD

DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

INTRADEPARTMENTAL CORRESPONDENCE

IN REPLY REFER TO
FILE NO.

REFERRED TO

- ___ REFERRED FOR ACTION
- ___ ANSWER FOR MY SIGNATURE
- ___ FOR FILE
- ___ FOR YOUR INFORMATION
- ___ FOR SIGNATURE
- ___ RETURN TO ME
- ___ PLEASE SEE ME
- ___ PLEASE TELEPHONE ME
- ___ FOR APPROVAL
- ___ PLEASE ADVISE ME

BY ___ DATE ___
BY ___ DATE ___
BY ___ DATE ___

**MEMORANDUM**

TO: Rhett Deselle
Assistant Secretary of Operations

FROM: Richard Savoie
Chief Engineer

DATE: December 13, 2011

SUBJECT: 2009 Edition of the Manual on Uniform Traffic Control Devices dated December 2009

Louisiana Revised Statutes 32:235 states that "The department shall adopt a manual and specifications for a uniform system of traffic control devices consistent with the provisions of this Chapter (RS 32:1 to RS 32:399) for use upon highways within this state. Such uniform system shall correlate with and so far as possible conform to the system then current as provided by the United States Department of Transportation, Federal Highway Administration, …"

In December 2009 the Federal Highway Administration published the 2009 Edition of the Manual on Uniform Traffic Control Devices (MUTCD) in the Federal Register. The rule required that states adopt changes to the MUTCD within 2 years of issuance. In accordance with this rule, the effective adoption date for the Department for the 2009 Edition of the MUTCD will be December 16, 2011.

The 2009 Edition of the MUTCD is to be used as the minimum requirements for the study and the preliminary design of all traffic signs, signals and pavement markings, which is scheduled to begin on or after December 16, 2011.

Procurement of copies of the MUTCD is the responsibility of each section and district. The complete manual can be viewed or downloaded from the MUTCD website, mutcd.fhwa.dot.gov.

Cc: Mr. Charles Bolinger, FHWA
Each District Administrator
Each District Traffic Operations Engineer
Each Division Administrator

RECOMMENDED FOR APPROVAL — DATE 12/13/11

RECOMMENDED FOR APPROVAL — DATE 12/13/11

RECOMMENDED FOR APPROVAL — DATE

APPROVED — DATE 12-14-11

When two vehicles approach an intersection from different streets or highways at approximately the same time, the right-of-way rule requires the driver of the vehicle on the left to yield the right-of-way to the vehicle on the right. The right-of-way can be modified at through streets or highways by placing YIELD (R1-2) signs (see Sections 2B.08 and 2B.09) or STOP (R1-1) signs (see Sections 2B.05 through 2B.07) on one or more approaches.

*Guidance:*

02 *Engineering judgment should be used to establish intersection control. The following factors should be considered:*

- *A. Vehicular, bicycle, and pedestrian traffic volumes on all approaches;*
- *B. Number and angle of approaches;*
- *C. Approach speeds;*
- *D. Sight distance available on each approach; and*
- *E. Reported crash experience.*

03 *YIELD or STOP signs should be used at an intersection if one or more of the following conditions exist:*

- *A. An intersection of a less important road with a main road where application of the normal right-of-way rule would not be expected to provide reasonable compliance with the law;*
- *B. A street entering a designated through highway or street; and/or*
- *C. An unsignalized intersection in a signalized area.*

04 *In addition, the use of YIELD or STOP signs should be considered at the intersection of two minor streets or local roads where the intersection has more than three approaches and where one or more of the following conditions exist:*

- *A. The combined vehicular, bicycle, and pedestrian volume entering the intersection from all approaches averages more than 2,000 units per day;*
- *B. The ability to see conflicting traffic on an approach is not sufficient to allow a road user to stop or yield in compliance with the normal right-of-way rule if such stopping or yielding is necessary; and/or*
- *C. Crash records indicate that five or more crashes that involve the failure to yield the right-of-way at the intersection under the normal right-of-way rule have been reported within a 3-year period, or that three or more such crashes have been reported within a 2-year period.*

05 *YIELD or STOP signs should not be used for speed control.*

Support:

06 Section 2B.07 contains provisions regarding the application of multi-way STOP control at an intersection.

*Guidance:*

07 *Once the decision has been made to control an intersection, the decision regarding the appropriate roadway to control should be based on engineering judgment. In most cases, the roadway carrying the lowest volume of traffic should be controlled.*

08 *A YIELD or STOP sign should not be installed on the higher volume roadway unless justified by an engineering study.*

Support:

09 The following are considerations that might influence the decision regarding the appropriate roadway upon which to install a YIELD or STOP sign where two roadways with relatively equal volumes and/or characteristics intersect:

- A. Controlling the direction that conflicts the most with established pedestrian crossing activity or school walking routes;
- B. Controlling the direction that has obscured vision, dips, or bumps that already require drivers to use lower operating speeds; and
- C. Controlling the direction that has the best sight distance from a controlled position to observe conflicting traffic.

**Standard:**

10 **Because the potential for conflicting commands could create driver confusion, YIELD or STOP signs shall not be used in conjunction with any traffic control signal operation, except in the following cases:**

- **A. If the signal indication for an approach is a flashing red at all times;**
- **B. If a minor street or driveway is located within or adjacent to the area controlled by the traffic control signal, but does not require separate traffic signal control because an extremely low potential for conflict exists; or**
- **C. If a channelized turn lane is separated from the adjacent travel lanes by an island and the channelized turn lane is not controlled by a traffic control signal.**

## Section 2B.06 STOP Sign Applications

*Guidance:*

01 *At intersections where a full stop is not necessary at all times, consideration should first be given to using less restrictive measures such as YIELD signs (see Sections 2B.08 and 2B.09).*

02 *The use of STOP signs on the minor-street approaches should be considered if engineering judgment indicates that a stop is always required because of one or more of the following conditions:*

- *A. The vehicular traffic volumes on the through street or highway exceed 6,000 vehicles per day;*
- *B. A restricted view exists that requires road users to stop in order to adequately observe conflicting traffic on the through street or highway; and/or*
- *C. Crash records indicate that three or more crashes that are susceptible to correction by the installation of a STOP sign have been reported within a 12-month period, or that five or more such crashes have been reported within a 2-year period. Such crashes include right-angle collisions involving road users on the minor-street approach failing to yield the right-of-way to traffic on the through street or highway.*

Support:

03 The use of STOP signs at grade crossings is described in Sections 8B.04 and 8B.05.

## Section 2B.07 Multi-Way Stop Applications

Support:

01 Multi-way stop control can be useful as a safety measure at intersections if certain traffic conditions exist. Safety concerns associated with multi-way stops include pedestrians, bicyclists, and all road users expecting other road users to stop. Multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal.

02 The restrictions on the use of STOP signs described in Section 2B.04 also apply to multi-way stop applications.

*Guidance:*

03 *The decision to install multi-way stop control should be based on an engineering study.*

04 *The following criteria should be considered in the engineering study for a multi-way STOP sign installation:*

- *A. Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.*
- *B. Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.*
- *C. Minimum volumes:*
  - *1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and*
  - *2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but*
  - *3. If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 2.*
- *D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.*

Option:

05 Other criteria that may be considered in an engineering study include:

- A. The need to control left-turn conflicts;
- B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;
- C. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop; and
- D. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection.

# APPENDIX G

Miscellaneous Traffic Calming Measures

Signing and Striping Plans