QUICK BUILD GUIDE

JANUARY 2025

VISION ZERO
CENTRAL FLORIDA

metroplan orlando
A REGIONAL TRANSPORTATION PARTNERSHIP

INTRODUCTION

A core element of Vision Zero is project delivery, where decision-makers and system designers advance projects and policies for safe and equitable multimodal travel by securing funding and implementing projects, prioritizing roads with the most pressing transportation safety issues. This document provides an overview of the Quick Build process, including general guidance and resources. While some general design guidance is provided, a list of resources and references that were consulted during the preparation of this document is provided and practitioners are encouraged to consult these sources in the development of Quick Build designs for their communities.

PURPOSE

The purpose of the MetroPlan Orlando Quick Build Guide is to provide information related to the Quick Build process, including differences between Demonstration, Pilot, Interim Design and Long-term Capital projects.

The guide accomplishes the following:

- Outlines steps for a successful project, including the planning, design and implementation process and notes considerations such as ADA compliance, emergency vehicle access, and truck movements. This guide also includes considerations for project evaluations and community engagement.
- Identifies general list of materials, including surface treatments, like acrylic traffic paint, vertical barrier types, signage, and other materials. It does not provide an exhaustive list of materials as there are many variations and vendors.
- Provides information about a variety of Quick Build countermeasures, including how to identify candidate locations, potential design considerations, and what materials are needed to implement the strategy.

Building on the Engineering Countermeasure Toolkit prepared by MetroPlan Orlando in April 2024, a process to document and evaluate future projects is also provided. Understanding what works and what doesn't is key to widespread implementation of different countermeasures, as well as converting an interim design or pilot Quick Build project to a permanent road feature.

Source: Fehr & Peers

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Abbreviations

- AADT: Average Annual Daily Traffic
- AASHTO: American Association of State Highway and Transportation Officials
- ADA: Americans with Disability Act
- APS: Accessible Pedestrian Signal
- AWSC: All-Way Stop Control
- CMF: Crash Modification Factor
- EMS: Emergency Medical Service
- FDM: Florida Design Manual
- FDOT: Florida Department of Transportation
- FHWA: Federal Highway Administration
- LPI: Leading Pedestrian Interval
- MUTCD: Manual on Uniform Traffic Control Devices
- NACTO: National Association of City Transportation Officials
- PROWAG: Public Right of Way Accessibility Guidelines
- RDG: Roadside Design Guide
- RRFB: Rectangular Rapid Flashing Beacon
- RRR: Resurfacing, Restoration and Rehabilitation
- TEM: Traffic Engineering Manual

Key Terms

- **Systemic Application:** Systemic Application: The systemic approach to safety involves widely implemented improvements based on high-risk roadway features correlated with specific severe crash types. The approach provides a more comprehensive method for safety planning and implementation that supplements and complements traditional **site-specific** analysis. The approach also helps agencies broaden their traffic safety efforts and considers risk as well as crash history when identifying where to make low-cost safety improvements.

- **Spot Application:** Spot application focuses on specific locations with a documented history of safety issues, such as high-crash intersections or segments of roadway. This targeted approach applies safety improvements to address known problems in these high-priority areas. It is reactive, relying on **historical** crash data to determine where interventions are most needed.

- **Context Classification:** Context classification is a framework used in roadway planning and design to align transportation infrastructure with the surrounding land use, **the mix of users of the street** and community character. It categorizes areas based on their physical, social, and functional context, such as natural, rural, suburban, urban, or urban core, to ensure that roadway design supports the intended use of the space. This approach helps balance mobility, accessibility, and safety for all users, including pedestrians, bicyclists, transit riders, and drivers, while preserving the unique character of the area.

- **Safe System Approach:** A guiding safety approach that builds and reinforces multiple layers of protection to both prevent crashes from occurring and minimize the harm caused to those involved when a crash does occur.

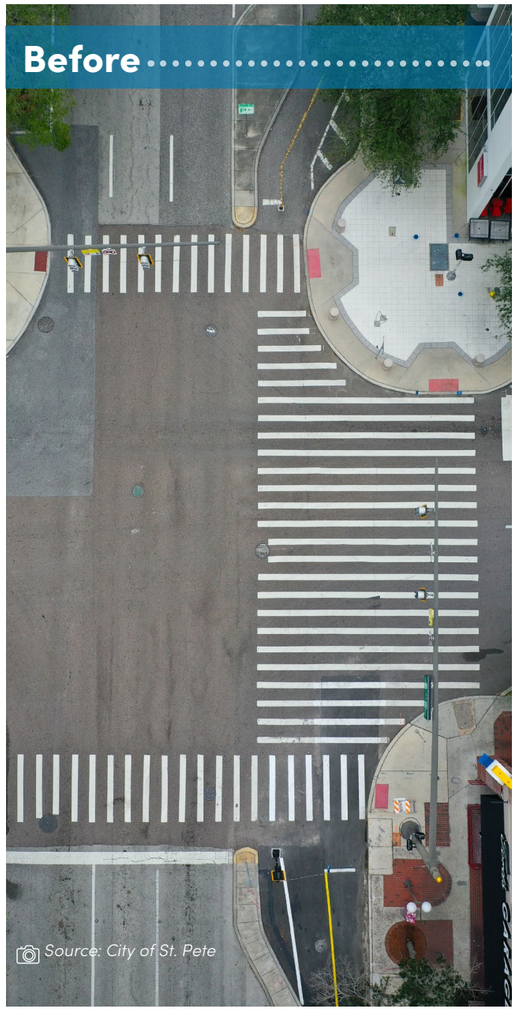
Source: Fehr & Peers

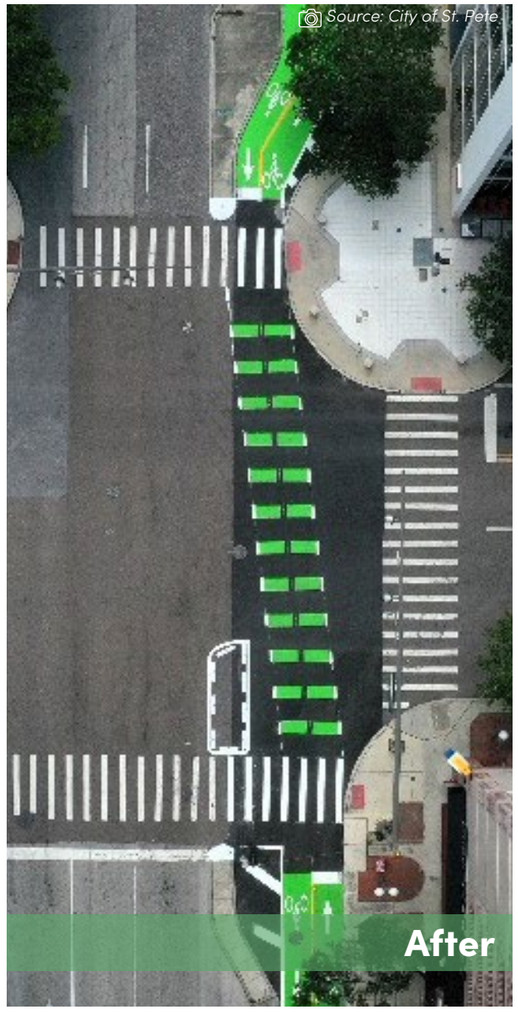
01

WHAT IS A QUICK BUILD PROJECT

Source: Fehr & Peers

WHAT IS A QUICK BUILD PROJECT?





The Pinellas Trail crossing in City of St. Pete lacked physical barriers or dedicated painted elements for bicyclists and pedestrians. This project aims to test safety enhancements using temporary materials to inform future improvements.

This Quick Build project demonstrates a protected intersection using temporary materials including curbing, flex posts, and painted elements to enhance safety for bicyclists and pedestrians in the City of St Pete.

"Quick Build" refers to an accelerated method of project delivery that helps agencies implement infrastructure projects using **low-cost materials** that can be **installed quickly.**

These types of projects can include bike lanes, crosswalks, bus lanes or even intersection modifications. Quick Build projects are also intended to be flexible so that, based on evaluation and public feedback, some elements of the project can easily be changed or even removed.

Quick Build approaches can be used to implement different project types. The main benefit of Quick Build projects is that they allow the community to enjoy the benefits of safety measures immediately, while piloting new treatments, and for proven strategies, quickly deploying the treatment throughout a community. **Figure 1** highlights how a Quick Build process can be used to implement different types of projects.

Quick Build projects are typically identified by the following two characteristics:
Timeline: Implemented within a faster project delivery timeline than typical capital projects (typically, a few months but within a year).
Budget: Typically completed on a small budget using interim, flexible materials, but durable enough to provide the time to evaluate and iterate as necessary.

Figure 1: Types of Quick Build Application

Demonstration Project

TEMPORARY INSTALLATION

FEW HOURS TO A FEW MONTHS

SPRAY CHALK, TAPE, TRAFFIC CONES, PLANTERS, & HAY BALES

EXPERIENCE PROJECT &FEEDBACK

What is it?

Demonstration projects are temporary installations to test new street design improvements.

What is a typical timeline?

Demonstration projects are typically planned over a short period of time, usually as part of a larger planning process, like a corridor plan or active transportation plan, to demonstrate the feasibility of a particular improvement, such as buffered bike lane or curb extension. Treatments are typically left in place for a few hours to a few months.

What are typical materials?

Low cost and readily available materials are typically used for a demonstration project, including spray chalk, tape, traffic cones, planters, and even hay bales. As these demonstration projects are typically only in place for a day, use of reusable and low-cost materials is a large consideration. Demonstration projects are typically done under supervision, meaning that use of portable materials is common.

What type of engagement is typically completed?

Demonstration projects are typically conducted to provide proof of concept for new treatment types in an area, and can help inform the outcome of a planning process. Often, the demonstration project is the outreach, with key stakeholders and decision makers invited to experience the demonstration project and provide feedback.

Pilot Project

INITIAL INSTALLATION

3 MONTHS TO PERMANENT

PAINT, BOLLARDS, DELINEATOR POSTS & RUBBERIZED DEVICES

BEFORE AND AFTER INSTALLATION

What is it?

Pilot projects are an initial installation of new street design improvements.

What is a typical timeline?

Pilot projects are constructed using materials that are intended to be in place for at least 3 months, and potentially converted to a permanent installation.

What are typical materials?

Pilot projects typically do not involve reconstructing roads or relocating curb and gutter. Low-cost materials are typically used, including paint, bollards, delineator posts, and rubberized devices. As the treatments are expected to be in place for at least several months, they need to be durable under typical weather conditions. As pilot projects will be left without supervision, use of portable materials, like cones, is not recommended. Minor signalization changes could also be incorporated into a pilot project.

What type of engagement is typically completed?

Engagement is typically conducted before and after installation, with detailed data collection both before and after to help inform a permanent installation. Feedback from the pilot project is used to determine if the project would be removed, reconfigured with more permanent materials, or left as originally constructed.

Interim Design

Source: City of Orlando

PHASED INSTALLATION

SEVERAL MONTHS-FEW YEARS

PAINT, BOLLARDS, DELINEATOR POSTS & RUBBERIZED DEVICES

BEFORE AND AFTER INSTALLATION

What is it?

An interim design can be implemented quickly while longer-term solutions are designed and constructed. For example, on a corridor where a protected bike facility has been identified for construction, a buffered bike lane using paint and bollards could be installed quickly while the detailed engineering is conducted to address other engineering issues that could emerge with installation of a physical barrier between the bike facility and travel lane.

What is a typical timeline?

An interim design is typically operational for several months to a few years. It can also be used as part of a construction management plan to maintain facilities during construction.

What are typical materials?

Low-cost materials are typically used, including paint, bollards, delineator posts, and rubberized devices. As the treatments are expected to be in place for at least several months, they need to be durable under typical weather conditions. Minor signalization changes could also be incorporated into an interim design.

What type of engagement is typically completed?

Engagement is typically conducted before and after installation, with detailed data to help inform the final project, which is typically under design after implementation of the interim design project.

Permanent Installation

Source: University of Manitoba

PERMANENT INSTALLATION

YEARS

PAINT, BOLLARDS, DELINEATOR POSTS & RUBBERIZED DEVICES

BEFORE INSTALLATION

What is it?

Permanent installations are intended to be in place indefinitely.

What is a typical timeline?

As these installations are intended to be permanent, they make take slightly longer to plan and design, but are still constructed within a year. A maintenance plan should be developed, especially if there are significant painted elements that could fade or wear over time.

What are typical materials?

Using a quick build process, low cost and readily available materials are used, including paint, bollards, delineator posts, and rubberized devices. As these installations are expected to be permanent, a maintenance schedule should be developed and successful installations considered for conversion to more durable materials, including relocation of curb and gutter, and other street elements.

What type of engagement is typically completed?

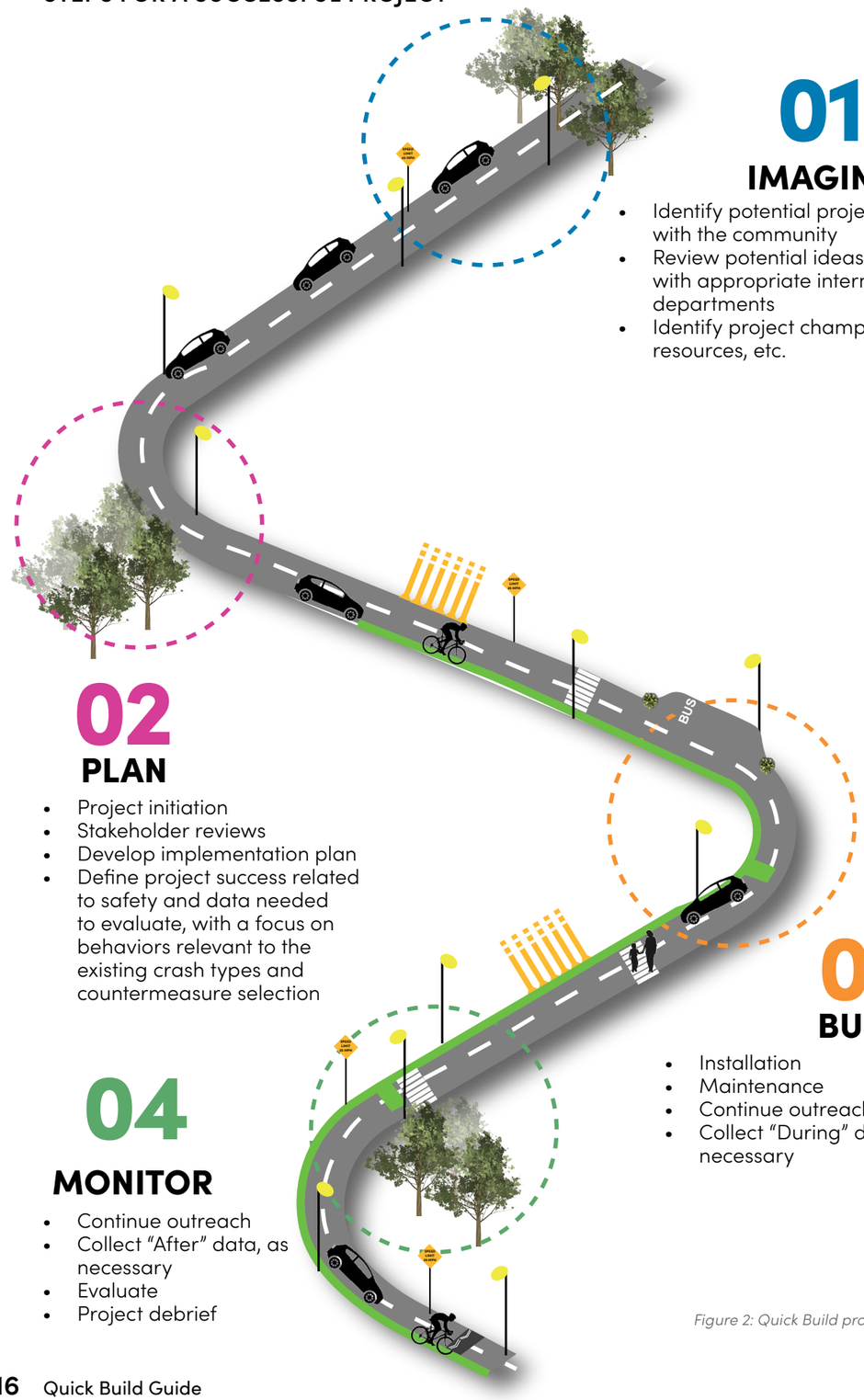
Engagement is typically conducted before. Depending on the treatment, observations of road user behavior may be conducted after installation to determine if the treatment had the desired effect.

02

STEPS FOR A SUCCESSFUL PROJECT

Source: Fehr & Peers

STEPS FOR A SUCCESSFUL PROJECT



01
IMAGINE

- Identify potential projects with the community
- Review potential ideas with appropriate internal departments
- Identify project champion, resources, etc.

02
PLAN

- Project initiation
- Stakeholder reviews
- Develop implementation plan
- Define project success related to safety and data needed to evaluate, with a focus on behaviors relevant to the existing crash types and countermeasure selection

03
BUILD

- Installation
- Maintenance
- Continue outreach
- Collect "During" data, as necessary

04
MONITOR

- Continue outreach
- Collect "After" data, as necessary
- Evaluate
- Project debrief

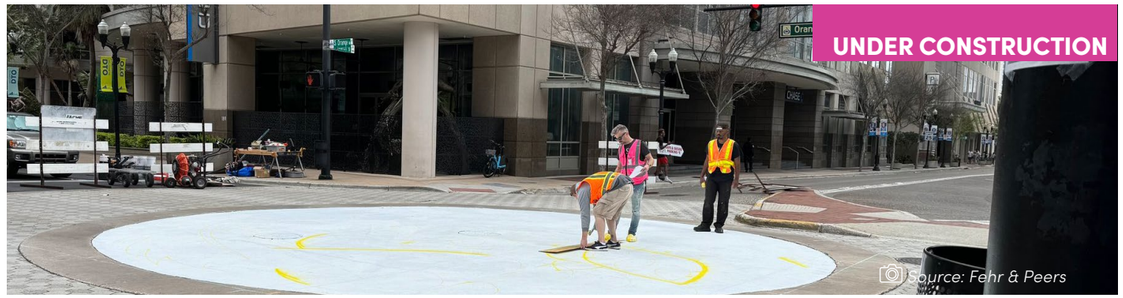
4-6 WEEKS

2-6 MONTHS

1 DAY+

1 DAY -1 YEAR AFTER INSTALLATION

Figure 2: Quick Build project timeline



Construction in action of an intersection mural in Downtown Orlando (Intersection of Orange Avenue at Church Street) as part of a Quick Build project.

03

GENERAL DESIGN GUIDELINES AND MATERIALS

Source: Fehr & Peers

This chapter provides an overview of general design considerations and materials that are commonly used in Quick Build projects, along with potential applications.

Emergency Access:
To accommodate emergency vehicles, a minimum street clearance of 20 feet should be provided on all streets. Additionally, a fire hydrant should have a clearance of 15 feet minimum. In some cases, additional clearance may be needed depending on the type of roadway, aerial ladder access requirements, or building context. This clearance should be coordinated with Fire Department staff as part of the planning process.

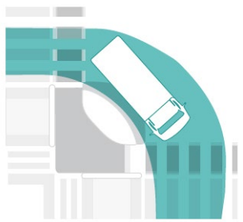
Choice of Materials:
Quick Build projects typically use inexpensive materials that can be installed rapidly.

Compliance with State & National Guidelines:
Projects should comply with the Manual on Uniform Traffic Control Devices (MUTCD), Public Right of Way Accessibility Guidelines (PROWAG) and Americans with Disabilities Act (ADA). Design guidance for many Quick Build project types is provided in the Florida Design Manual (FDM) and other guidance documents.

Maintenance:
A maintenance plan and schedule should accompany any project that lasts more than 30 days in duration, along with a removal/dissemination plan in case the project is to be removed. The agency should identify which department(s) will be responsible for ensuring the project remains intact for its intended duration.

The following design specifications should be standard practice when implementing design changes as part of a Quick Build project.

1. DESIGN VEHICLE

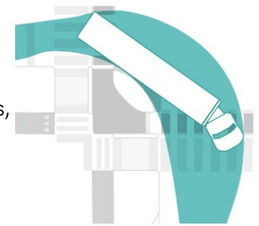


Design vehicle is the least maneuverable vehicle that routinely uses a street or a facility. The design vehicle's turning characteristics should be used to size the turn radius and lane width.

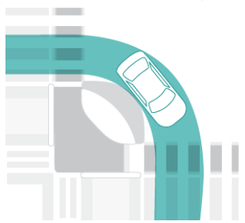
Where emergency vehicles are much larger than the design vehicle, they can be permitted to make turns by using all areas of the right-of-way, including mountable corner islands or median strips, where necessary.

Source: National Association of City Transportation Officials (NACTO): Dont Give Up at the Intersection

Control vehicle is the least maneuverable vehicle that is ever planned to use a street, but potentially at very low speeds or with multipoint turns. It's common that the control vehicle, at times, may encroach into adjacent travel lanes, the gutter pan and use the full curb-to-curb width.



Managed vehicle most common vehicle to use the street. It is typically smaller than the design vehicle which means it is capable of higher speeds and greater maneuverability. In protected intersections, the goal for a managed vehicle is to keep turn speeds below 10 mph.



The type of design vehicle is influenced by the modal emphasis of the road, the role of the road in the network, and the land uses served. The selected Design Vehicle affects:

- Horizontal and vertical alignments
- Lane widths and lane assignments
- Roundabout inscribed circle diameter
- Intersection turning radii and sight distance
- Auxiliary lane storage length, and acceleration and deceleration lengths

American Association of State Highway and Transportation Officials (AASHTO)'s A Policy on Geometric Design of Highways and Streets provides general guidance on the selection of a design vehicle. AASHTO also provides the dimensions and turning characteristics for a variety of standard design vehicles, e.g., P, SU, WB-40, WB-62. The following design vehicles are typically found in the MetroPlan Orlando area and should be a consideration of every design:

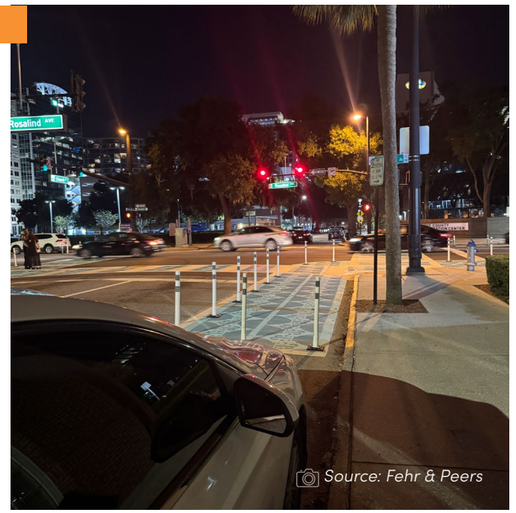
- Neighborhood Streets: DL-23
- Downtown and Commercial Streets: SU-30
- Multi-lane Streets with Transit: BU-45

Source: City of Goshen

2. CROSSWALK DESIGN

High-visibility crosswalks (made up of thick parallel lines) are more visible to drivers than conventional transverse lines alone and should be used at all locations where crosswalks are being proposed.

The width of the crosswalk should be a minimum of 6 feet for intersections and 10 feet for midblock locations, measured from the inside of the transverse crosswalk markings. In urban contexts, wider crosswalks to accommodate a greater volume of pedestrians is appropriate to consider.



Source: Fehr & Peers

3. INTERSECTION VISIBILITY

At all approaches of an intersection, with priority for implementation at uncontrolled approaches (legs of intersections that do not have stop signs or signals), parking should be set back a minimum of 20' to expand sight lines. This allows people crossing the street (as well as vehicular cross traffic) to be visible to drivers.

Additional parking setbacks may be required on all approaches at intersections with significant crash history or where physical conditions deem it necessary for safety and to meet sight distance requirements. White diagonal stripes and "No Parking" signs should be used to designate no-parking areas.

The following highlights materials that can be used as part of Quick Build projects; however, this section does not provide an exhaustive list of potential materials. Where possible, align material color with the traffic control device it is being placed on, for example, yellow for median materials and white for bike lane edges.

Some of the treatments highlighted in this section are:

- Low profile delineators and lane separators
- Planter boxes
- Delineator posts
- K-71 bollards
- Parking stops
- Quick Curb+ delineator posts
- Floating transit island
- Raised pavement markers
- Pavement surface coatings
- Rubberized devices
- Signs

Material selection should consider maintenance activities, such as street sweeping, as new equipment might be needed to clean and maintain facilities.

LEGEND

The following legend for installation timeline and anticipated maintenance requirements is provided for each treatment on the following pages.

INSTALLATION TIME

Minutes | Hours | Day

MAINTENANCE REQUIREMENT

Rare | Occasional | Frequent

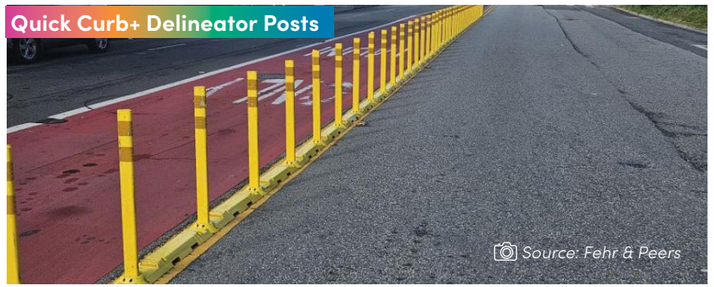


Figure 2: Quick Build Materials

1. LOW PROFILE DELINEATORS AND LANE SEPARATORS


Source: Delaware County


Source: Neka-Europe

Uses

Used for spatial separation.

Installation Time

Maintenance

Potential Project Types

- Protected Bike Lane
- Curb Extension
- Bicyclist/Pedestrian Refuge Island
- Chicane/Pinch Point
- Mini-Roundabout/Neighborhood Traffic Circle

Implementation Considerations

ACCESS
- Ensure placement does not obstruct ADA accessibility or any pathways required for mobility devices.
- Mountable profile ensures emergency and city service vehicle access, and minimal/no stormwater obstruction.

AESTHETICS
- Some vendors offer a less visually obtrusive option (compared to vertical delineator posts).

SAFETY
- The low visual profile may lead to decreased safety perception for people walking or biking (compared to more vertical barrier elements like planters or delineator posts etc.).
- Low profile delineators can pose a crash hazard for bicyclists and a trip hazard for pedestrians crossing the bikeway. Installation should consider adequate operating spaces and clear zone for bicyclists, and visibility of the devices for crossing pedestrians.

VERSATILITY
- Can be combined with other treatments, like delineator posts and high visibility paint.

2. PLANTER BOXES

Source: Fehr & Peers

Source: Fehr & Peers

Uses

Used for spatial separation.

Installation Time

Maintenance

Potential Project Types

- Protected Bike Lanes
- Curb Extension
- Bicyclist/Pedestrian Refuge Island
- Parklets
- Partial or full street closures

Implementation Considerations

ACCESS
- Ensure placement does not obstruct accessibility/ADA compliance or stormwater flow.

MAINTENANCE
- Identify a maintenance/stewardship partner who can water and maintain plants.

VISIBILITY
- Consideration to adjacent travel lanes and turning movements should be given to ensure these treatments are visible and have the appropriate end treatments.

VERSATILITY
- Planters may be paired with other vertical barriers (e.g. delineator posts) to enhance visibility/sense of enclosure.

SAFETY
- Vertical sight lines should be considered as children and those using recumbent bicycles are shorter and more easily hidden from view.

3. DELINEATOR POSTS

Source: Fehr & Peers


Source: City of Minneapolis

Uses

Used for spatial separation and increased awareness.

Installation Time

Maintenance

Potential Project Types

- Protected Bike Lanes
- Curb Extension
- Bicyclist/Pedestrian Refuge Island
- Chicane/Pinch Point
- Mini-Roundabout/Neighborhood Traffic Circle
- Centerline Hardening
- Slow Turn Wedges

Implementation Considerations

SAFETY
- Posts can pose a crash hazard for bicyclists and a trip hazard for pedestrians. Installation should consider adequate operating spaces and clear zone for bicyclists, and visibility of the devices for pedestrians.

AESTHETICS
- To improve aesthetics and help create a sense of separation, pair delineator posts with other vertical elements such as planters.
- Diminishing aesthetic quality/durability of delineator posts can present maintenance challenges for Quick Build design projects in some contexts.
- Delineator posts are available in a variety of colors and heights.

COST
- Monitor replacement rate and decide whether a more robust vertical barrier element is appropriate/cost-effective for the context, especially if capital funding has not yet been programmed.

FLEXIBILITY
- Spacing between delineator posts may be greater if paired with other types of vertical barrier elements, such as planters.
- Turning movements at driveways and intersections should be considered when placing them adjacent to these roadway features.
- These are made to be driven over, if needed, in cases of emergency vehicle access.

4. K-71 BOLLARDS


Source: City of Orlando


Source: CalBike

Uses

Used for spatial separation and increased awareness.

Installation Time

Maintenance

Potential Project Types

- Protected Bike Lanes
- Curb Extension
- Bicyclist/Pedestrian Refuge Island

Implementation Considerations

ACCESS
- Collapsible profile ensures emergency and city service vehicle access, minimal/no stormwater obstruction, and may sustain impacts up to 65 MPH.

COST
- Diminishing aesthetic quality/durability can present challenges for some Quick Build design projects; monitor replacement rate and decide if a more robust vertical barrier element is appropriate/cost-effective for the context.

AESTHETICS
- A larger diameter helps reinforce the design intent and enhances comfort for pedestrians and cyclists.
- The K-71 Bollard is available in a wide variety of colors.

SAFETY
- Bollards can pose a crash hazard for bicyclists and a trip hazard for pedestrians. Installation should consider adequate operating spaces and clear zone for bicyclists, and visibility of the devices for pedestrians.

5. PARKING STOPS


Source: Fehr & Peers


Source: Fehr & Peers

Uses

Used for spatial separation.

Installation Time

Maintenance

Potential Project Types

- Protected Bike Lanes
- Curb Extension
- Bicyclist/Pedestrian Refuge Island
- Chicane/Pinch Point
- Mini-Roundabout/Neighborhood Traffic Circle
- Centerline Hardening
- Slow Turn Wedges

Implementation Considerations

MATERIALS
- Parking stops are available in various sizes; commonly used are around 4"-6".
- Parking stops are available in a variety of materials: plastic, rubber, or concrete.
- Use plastic curb stops for demonstration projects only; use rubber or concrete for Quick Build or interim design projects.

ACCESS
- Ensure parking stop placement does not interfere with stormwater flow or accessibility.

VISIBILITY
- Delineator posts may be placed atop parking stops for enhanced visibility.

SAFETY
- Parking stops can pose a crash hazard for bicyclists and a trip hazard for pedestrians crossing the bikeway. Installation should consider adequate operating spaces and clear zone for bicyclists, and visibility of the devices for crossing pedestrians.

6. QUICK CURB + DELINEATOR POSTS


Source: Qwick Kurb


Source: Fehr & Peers

Uses

Used for spatial separation and increased awareness.

Installation Time

Maintenance

Potential Project Types

- Protected Bike Lanes
- Bicyclist/Pedestrian Refuge Island
- Mini-Roundabout/Neighborhood Traffic Circle
- Centerline Hardening
- Slow Turn Wedges

Implementation Considerations

FLEXIBILITY
- Modular quick curb spacing may be customized for local conditions (e.g., driveways, short blocks) and to maintain stormwater flow.

COST
- Diminishing aesthetic quality/durability can present challenges for some Quick Build design projects; monitor replacement rate and decide if a more robust vertical barrier element is appropriate/ cost-effective for the context.

SAFETY
- Use 28" delineator posts along protected bikeways or where application may conflict with bicycle handlebars.

VERSATILITY
- Quick curb and delineator posts may be paired with other vertical barriers, such as circular or rectangular planter boxes.

7. FLOATING TRANSIT ISLANDS


Source: Portland.gov

Source: Fehr & Peers

Definition

Floating transit islands prioritize transit by allowing buses to proceed immediately after picking up passengers, without having to wait to merge back into traffic. Floating transit islands provide space for passengers to wait on a non-slip, elevated surface, visible to bus drivers, and separate from the sidewalk.

Uses

Used to safely transition pedestrians from the sidewalk to transit vehicles, and across bike facilities.

Installation Time

Maintenance

Potential Project Types

- Bus/Bike network overlaps
- Transit stops where vehicle conflicts reduce safety or increase transit delay and an in-lane transit stop is desirable

Implementation Considerations

PLACEMENT
- Floating transit islands can be placed in existing on-street parking lanes or wide bike lane buffers.
- The access ramp allows floating transit islands to be installed quickly where curb cuts do not currently exist.

SAFETY
- Through bike lanes help minimize the need for passengers to cross the bike lane when boarding the bus, creating a more predictable path for both cyclists and pedestrians.
- Through bike lanes prevent the bus from encroaching on the bike lane, unlike conventional shared spaces where the bus pulls to the curb.

8. RUBBERIZED DEVICES

Source: Qwick Kurb


Source: Trafficlogix

Uses

Traffic calming and channelization.

Installation Time

Maintenance

Potential Project Types

- Speed Hump
- Speed Table
- Raised Crosswalk
- Speed Cushion
- Speed Bump
- Traffic Circles
- Curb Extensions
- Separated Bike Lane

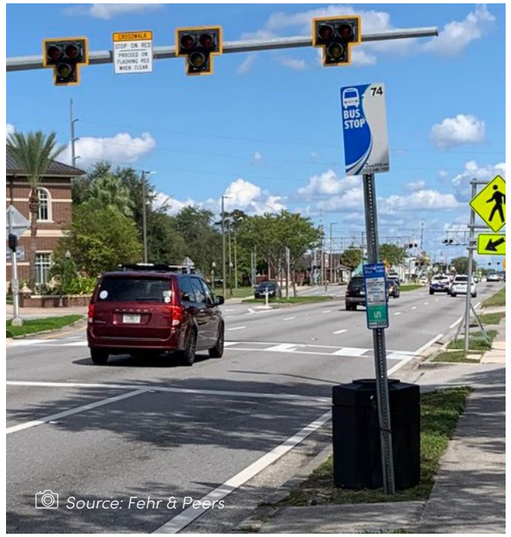
Implementation Considerations

PLACEMENT
- Speed humps (and speed tables) may be applied on one-way or two-way streets when used independently as a traffic calming device.

SAFETY
- Vertical speed control elements (like speed humps and speed tables) should be accompanied by a sign warning drivers of the upcoming device.
- Consider gaps for bicyclists in situations where bicyclists would need to traverse the application.

FLEXIBILITY
- Vulcanized rubber units may be removed for road resurfacing or to test the product at various locations.

9. RAISED PAVEMENT MARKERS



Uses

Increased awareness and reinforcement of pavement striping.

Installation Time

Maintenance

Potential Project Types

- Curb extensions
- Median island/refuge
- Chicane
- Lane lines

Implementation Consideration

VISIBILITY
- Markers come in a variety of colors and can be reflective or non-reflective.

PLACEMENT
- Typically used in tandem with a vertical device like delineator post, warning signs, etc.
- Do not place in openings or areas intended for pedestrian use.
- Typically not used for right edge lines unless engineering judgment indicates the benefit would outweigh potential impacts to cyclists.

SAFETY
- Raised pavement markers can present a hazard for bicyclists, particularly ones with narrower tires traveling at higher speeds.

10. PAVEMENT SURFACE COATINGS

Uses

Increased awareness.

Installation Time

Maintenance

Potential Project Types

- Variety of applications, including bike facilities, crosswalks, curb extensions, intersections, bus only lanes, and pedestrian facilities.

Implementation Consideration

MAINTENANCE
- Acrylic water-based products may not withstand repeated pressure washing or routine street sweeping.
- Epoxy and polymer-based products offer greater durability but require more specialized professional experience for proper installation.

FLEXIBILITY
- Can be coupled with preformed thermoplastic markings and tape.

SAFETY
- Some materials can become slippery when wet; high-friction materials should be used in areas where people will travel over the materials.

VISIBILITY
- Retroreflectivity be incorporated into the treatment but should not be used when the surface coating is purely for aesthetic purposes.

11. SIGNS

Source: Road Traffic Signs


Source: Fehr & Peers

Uses

To communicate regulatory, warning, guidance or wayfinding information.

Installation Time

Maintenance

Potential Project Types

- Multiple
- MUTCD provides guidance on locations/ situations that warrant the use of signs (i.e crossing treatments)

Implementation Consideration

CUSTOMIZATION
- Some agencies may have their own sign shops.

PLACEMENT
- Care should be taken to avoid sign clutter.

COMPLIANCE
- MUTCD standard signs and mounting criteria should be used to ensure road users understand/anticipate the meaning of the sign.
- Proper offset from the edge of the road and mounting height should be considered as to not obstruct pedestrians and cyclists.


Source: Fehr & Peers

04

QUICK BUILD TREATMENTS

- SIGNALS
- SIGNING AND STRIPING
- BIKEWAYS
- PEDESTRIAN FACILITIES
- INTERSECTION AND ROADWAYS
- SPEED MANAGEMENT
- OTHER STRATEGIES

This chapter provides additional information about various safety treatments that have Quick Build opportunities, building on the information provided in the Engineering Countermeasures Toolkit.

Information in this chapter is organized around different categories of treatments, including **signals, signing and striping, bikeways, pedestrian facilities, intersections and roadways, speed management, and other.**

For each treatment, a description is provided, the expected crash reduction effectiveness, and what types of crashes the treatment can address. Information about how to identify candidate locations, what should be considered in the design, and what materials are needed to implement the strategy are provided for all treatments. For select treatments, additional design guidance and information is provided.

The list of potential Quick Build treatments included in this guide are summarized in **Table 1**, which also highlights if treatments should be considered for:

- **Spot application** (at a location based on the crash history),
- **Systemic application** (at multiple similar locations based on a systemic analysis) or
- **Both.**

For example, modifying a traffic signal to include Leading Pedestrian Intervals should be considered as a systemic application at all signalized intersections within a jurisdiction.

LEGEND

CRASH REDUCTION EFFECTIVENESS

LOW MED HIGH

CMF Available

Modal Safety Emphasis

APPLICABLE FACILITY

URBAN RURAL

SUBURBAN

ALL ROADWAYS

COST

$	$$	$$$
Less than $10,000	Between $10,000-$100,000	More than $100,000

A Crash Modification Factor (CMF) is a multiplicative factor used to estimate the expected change in crash frequency after implementing a specific countermeasure. It is essential for assessing the effectiveness of safety improvements on roadways. More information can be found at the CMF Clearinghouse (Federal Highway Administration, 2023)

TABLE 1 QUICK BUILD TREATMENTS AND APPLICATION TYPE

TREATMENT NAME	SPOT APPLICATION	SYSTEMIC APPLICATION
Signals		
Extend Pedestrian Crossing Time	X	X
Extend Yellow and All Red Time	X	X
Leading Pedestrian Interval	X	X
Pedestrian Recall		X
Pedestrian Only Phase	X	
Prohibit Right Turn on Red	X	X
Shorten Cycle Lengths	X	X
Retroreflective Signal Backplates	X	X
Emergency Vehicle Signal Preemption	X	
Signing and Striping		
Advance Stop Bar	X	X
Advance Yield Markings	X	X
Chevron Signs on Horizontal Curves	X	X
Advance Curve Warning Sign	X	X
Stop for Pedestrian Sign	X	
LED Enhanced Sign	X	
Painted Centerline and Raised Pavement Markers at Curves	X	X
Pavement Speed Legends	X	
Prohibit Left Turn	X	
Time-Based Turn Restrictions	X	
Striping through Intersection	X	X
Upgrade Intersection Pavement Markings	X	X
Upgrade signs with Fluorescent Sheeting	X	X
Upgrade Striping	X	X
Upgrade to Larger Warning Signs	X	
Bikeways		
Bicycles Allowed Use Full Lane Sign	X	X
Bike Lane/Buffered Bike Lane	X	X
Separated Bikeway	X	
Parking Buffer	X	
Extend Bike Lane to Intersection	X	X
Mixing Zone	X	
Bike Box	X	

TREATMENT NAME	SPOT APPLICATION	SYSTEMIC APPLICATION
Two-Stage Turn Queue Bike Box	X	
Floating Transit Island	X	
Bicycle Crossing (Solid Green Paint)	X	
Green Conflict Striping	X	X
Pedestrian Facilities		
High Visibility Crosswalk	X	X
Co-locate Bus Stops and Pedestrian Crossings	X	X
Mark Pedestrian Crossings	X	
Curb Extensions	X	X
Rectangular Rapid Flashing Beacon	X	
Restripe Crosswalk	X	X
Intersections and Roadways		
All-Way Stop Control	X	
Centerline Hardening	X	
Curb Return Radius Reduction	X	
Delineators, Reflectors or Object Markers	X	X
Double-up Oversized Stop Signs	X	
Enhanced Daylighting/Slow Turn Wedge	X	X
Gateway Treatments	X	
Lane Repurposing	X	
Hardened Median Nose Extension	X	
Median Barrier	X	
On-Street Parking	X	
Paint and Plastic Median	X	
Paint and Plastic Mini Circle/Mini Roundabout	X	
Refuge Island	X	
Protected Intersection	X	
Partial Closure/Diverter	X	
Speed Management		
Chicane	X	
Lane Narrowing	X	X
Speed Feedback Sign	X	
Speed Humps/Speed Cushions/Raised Crosswalks	X	
Other Strategies		
Remove Obstructions for Sightlines		X

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

SIGNALS

Quick Build signalization strategies can provide almost immediate benefit with no capital costs, with the potential to combine with other strategies for increased benefit.

1. Extend Pedestrian Crossing Time

Focus Crash Type: Pedestrian crashes at signalized intersection.

Safe System Strategy: Manage conflicts in time.

Considerations: May need to be implemented as part of an overall retiming project.

Definition

Increases time for pedestrian walk phases, especially to accommodate vulnerable populations, such as children and the elderly.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

How to identify candidate locations?

This strategy can be implemented on a spot location basis or systemically. For a spot location application, identifying land uses that might have populations with a need for increased crossing time, such as senior centers, assisted living facilities, schools and community centers. For a systemic application, identify neighborhoods or districts within the jurisdiction where additional crossing time is appropriate based on the surrounding land use context.

What should be considered in the design?

The MUTCD specifies use of a walking speed of 3.5 feet/second to calculate pedestrian crossing time. The MUTCD also states that a slower walking speed can be used if people who walk more slowly or use wheelchairs "routinely use the crosswalk". In those cases, a slower walking speed of 3.0 feet/second can be used to calculate pedestrian crossing time. Changes to the minimum pedestrian crossing times may also require other signal timing modifications and care should be taken to not increase the overall cycle length.

What materials are needed to implement this strategy?

Extension of the pedestrian crossing time requires reprogramming of the traffic signal, with the strategy implemented by the agency who maintains the traffic signal. Some signal equipment does allow for an extension of the pedestrian walking time upon user request (like pushing the pedestrian call button twice in quick succession or holding for two seconds), but that may require additional hardware and software.

2. Extend Yellow and All Red Time

Definition

Extending yellow and all red time provides additional time for drivers, bicyclists and pedestrians to cross through a signalized intersection before conflicting traffic movements are permitted.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Angle crashes and red light running crashes.

Safe System Strategy: Manage conflicts in time.

Considerations: May need to be implemented as part of an overall retiming project. If extensions are applied during every cycle, behavior may adjust in response.

How to identify candidate locations?

Locations with a history of red light running crashes should be reviewed as candidate locations, and if an agency has not reviewed their yellow and all red time protocols recently, they should refer to the latest published guidance to apply this treatment systemically.

What should be considered in the design?

Red-light running is a leading factor in severe and fatal crashes at signalized intersections in the region, and proper yellow and red time clearance intervals can reduce the frequency of red light running and crashes. Too brief an interval may result in drivers being unable to stop safely and cause unintentional red-light running. Too long of 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 and turning vehicles, driver perception-reaction time, vehicle deceleration, and intersection geometry should all be considered in the timing calculation. Guidance is provided in the Florida Department of Transportation (FDOT) Traffic Engineering Manual (TEM) and Manual on Uniform Traffic Control (MUTCD). This is a Federal Highway Administration (FHWA) proven safety countermeasure.

What materials are needed to implement this strategy?

Extension of the yellow and all red time requires reprogramming of the traffic signal, with the strategy implemented by the agency who maintains the traffic signal.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

3. Leading Pedestrian Interval

Definition

Signal timing that allows pedestrians to enter intersections before vehicles are given a green indication allowing them to better establish their presence in the crosswalk and increase their visibility.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Pedestrian struck by turning vehicle.

Safe System Strategy: Manage conflicts in time.

Considerations: The length of the LPI should consider the crossing length and the amount and type of pedestrian traffic (age, ability, etc.).

How to identify candidate locations?

Leading pedestrian intervals (LPIs) can be implemented throughout an area with pedestrian activity, like a downtown area or near schools or shopping areas, or it can be implemented at intersections with a history of crashes involving pedestrians. Other selection factors include presence of vulnerable populations, one-way streets or T-intersections where left-turning vehicles do not have to yield to on-coming vehicles, and where the geometry of the intersection can limit the visibility of pedestrians.

What should be considered in the design?

A LPI should be at least 3 seconds long, and typically no longer than 7 seconds, and should be timed to allow pedestrians to cross at least one lane of traffic or, in the case of a large corner radius, to travel far enough for pedestrians to establish their position before the turning traffic is released.

LPIs can be used in combination with other strategies, including right-turn on red prohibitions. The use of accessible pedestrian signals (APS) should be considered when implementing a LPI to provide audible cues to visually impaired as they may not realize the benefit of the LPI. Adding a LPI may require other signal timing modifications and care should be taken to not increase the overall cycle length. See TEM section 3.11.5.2 for additional design considerations. This is a FHWA proven safety countermeasure.

What materials are needed to implement this strategy?

LPI installation requires reprogramming of the traffic signal, with the strategy implemented by the agency who maintains the traffic signal.

4. Pedestrian Recall

Definition

Pedestrian recall is a traffic signal timing function that results in a pedestrian phase to be automatically activated every cycle.

Crash Reduction Effectiveness

LOW | MED | HIGH

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Pedestrian struck by turning vehicle.

Safe System Strategy: Manage conflicts in time.

Considerations: If intersection is part of a coordinated system, consideration should be given to signal timing changes at upstream and downstream intersections. Can be paired with a LPI for increased effectiveness.

How to identify candidate locations?

Pedestrian recalls are typically implemented throughout an area with high levels of pedestrian demand, like a downtown area or shopping district. Pedestrian recalls can be implemented for all times of day, or during specific time periods when high levels of pedestrian activity typically occur.

What should be considered in the design?

The amount of pedestrian activity, number of pedestrian calls, and pedestrian compliance with using the pedestrian push buttons should be considered in the identification of candidate locations. The context of the roadway and overall levels of travel demand through the intersection should be considered in the operation time period, as there can be a negative impact on transportation system performance if not used appropriately. Should the minimum pedestrian crossing time be higher than the minimum green time for a specific phase, the overall traffic signal timing may need to be reviewed. When possible, upgrading to APS is still a benefit even when set to pedestrian recall. See TEM section 3.11 for additional design considerations.

What materials are needed to implement this strategy?

Pedestrian recall installation requires reprogramming of the traffic signal, with the strategy implemented by the agency who maintains the traffic signal.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

5. Pedestrian Only Phase

Definition

A form of pedestrian "WALK" phase at a signalized intersection in which all vehicular traffic is required to stop, allowing pedestrians to cross in any direction.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Pedestrian and bicyclist crashes.

Safe System Strategy: Manage conflicts in time.

Considerations: Significant Levels of crossing activity may be required to justify phasing type.

How to identify candidate locations?

Pedestrian only phases, also known as a Barnes Dance, should be used in locations where a high level of crossing activity occurs in all directions. Most installations of pedestrian only phases allow for diagonal crossings. High levels of crossing demand are a key consideration in the use of this treatment.

What should be considered in the design?

The amount of pedestrian and bicyclist activity throughout the day/week, the turning vehicle volume, and overall crash history are key considerations. See TEM section 3.11.3 for additional design considerations.

What materials are needed to implement this strategy?

Pedestrian only phase installation requires reprogramming of the traffic signal, with the strategy implemented by the agency who maintains the traffic signal. In addition to reprogramming of the traffic signal, upgrades to the crosswalk markings, pedestrian signal heads for diagonal crossing and the addition of signage to prohibit right-turns on red would also be required.

6. Prohibit Right Turn on Red

Definition

Prohibiting right-turn-on-red movements can be used in locations where obstructions prevent right-turning vehicles from seeing oncoming traffic or where high pedestrian volumes are present.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Pedestrian struck by turning vehicle, and motorist failed to yield at signalized intersection.

Safe System Strategy: Manage conflicts in time.

Considerations: May require provision of right-turn-only lane if there are conflicts between right-turning vehicles and pedestrians and operations analysis may be necessary to identify develop treatment plan.

How to identify candidate locations?

Right-turn on red prohibitions can be implemented at all intersections within an area of high pedestrian demand, or on an intersection-by-intersection basis considering roadway obstructions that might result in right-turning drivers not being able to see opposing traffic, or at specific locations of high pedestrian demand, such as a trail crossing.

What should be considered in the design?

The amount of pedestrian activity, crash history, volume of right-turning vehicles and physical layout of the intersection should be considered in the identification of candidate locations. Some installations may be for all times of day, like in the case of a physical obstruction, while other installations may be for a specific time period only, like around school bell times when students are expected to be walking to or from school. Depending on the level of right-turning volumes, additional signal timing adjustments might need to be made.

The relative number of right-turn on red and right-turn on green vehicles, as well as the speed of vehicles turning right on green should be considered prior to implementation.

What materials are needed to implement this strategy?

This strategy requires the installation of signs which can be ground mounted, and/or mounted on existing signal poles. Blank out or dynamic no right-turn on red signs can also be used depending on the specific circumstances of an intersection.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

7. Shorten Cycle Length

Definition

Shorter cycle lengths can reduce the frequency of violations of the traffic control device.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Dart/dash.

Safe System Strategy: Manage conflicts in time.

Considerations: Should be implemented as part of a corridor or area wide traffic signal retiming program. Short cycle lengths of 60–90 seconds are ideal for urban areas.

How to identify candidate locations?

Long cycle lengths are typically found on major arterials with coordinated traffic signal systems. Along a coordinated system, the same cycle length is typically used for all intersections to aid in coordination, with the operations of a critical intersection typically dictating the cycle length along the corridor. While long cycle lengths can result in reduced delays for the main roadway, they can encourage higher speeds and increased delay for minor street movements, and people crossing the street. Signal timings should be reviewed on a corridor or area wide basis to balance the travel demands of all roadway users in the specific area.

What should be considered in the design?

The agency that maintains the traffic signal should review the cycle lengths at each of the signalized intersections within the jurisdiction to identify traffic signals with long cycle lengths, considered to be 60-90 seconds in urban areas (C4, C5 and C6 roadways), and greater than 120 seconds in more suburban contexts (C3C and C3R). Based on the size of typical intersections and the amount of pedestrian crossing time needed, potential opportunities to reduce overall cycle lengths should be identified. At non-coordinated, low volume intersections, it may be feasible to implement timing changes with limited data collection and operations analysis. For complex corridors, data collection and a retiming study may need to be conducted to identify a more appropriate timing plan with shorter cycle lengths. See section 3.11.4 of the TEM for additional design considerations.

What materials are needed to implement this strategy?

Reductions in cycle length requires reprogramming of the traffic signal, with the strategy implemented by the agency who maintains the traffic signal.

FDOT's Context Classification system aligns roadway design with the surrounding environment to improve safety, mobility, and livability (FDOT, 2022).

8. Retroreflective Signal Backplates

Focus Crash Type: Angle crashes and left turn crashes.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: When an entire backplate is added, structural analysis may be required due to the added wind load.

Definition

Backplates added to a traffic signal head improve the visibility of the illuminated face of the signal by introducing a controlled-contrast background, which can be retroreflective.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

How to identify candidate locations?

This countermeasure should be implemented at all signalized intersections, with priority for intersections on high-speed multilane roadways. FDOT requires that all new or reconstructed traffic signals have rigid retroreflective backplates.

What should be considered in the design?

The treatment can be installed as a retroreflective tape added to an existing backplate, or by adding a new retroreflective backplate. A structural analysis may be needed due to added wind load if it is a new rigid backplate. The retroreflective boarder is typically between 1 and 3 inches. The back plates impacts the wind load and speed limit of the roadway. This is a FHWA proven safety countermeasure. See section 3.9 of the TEM and section 232.1.5 of the Florida Design Manual (FDM).

What materials are needed to implement this strategy?

Retroreflective tape, flexible retroreflective backplates or rigid retroreflective backplates are required to implement this treatment. If existing back plates are in poor condition (faded, bent, etc.), it is desirable to replace them when implementing the reflective element.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

9. Emergency Vehicle Signal Preemption

Focus Crash Type: All; strategy decreases emergency response time.

Safe System Strategy: Manage conflicts in time.

Considerations: The ability of existing traffic signal technologies to accommodative preemption is a primary consideration for implementation within a Quick Build process.

Definition

Allows an authorized operator to override the normal operation of traffic signals to reduce conflicts and decrease emergency vehicle response time.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$$

How to identify candidate locations?

Emergency vehicle signal preemption should be implemented on primary routes to Level 1 trauma centers, and along designated primary emergency vehicle routes. Preemption is typically installed for the length of a corridor for maximum benefit.

What should be considered in the design?

Existing signalized intersection with emergency vehicle preemption should be mapped and compared to the location of Level 1 trauma centers and designed primary emergency vehicle routes. Response times to high crash locations can also be considered. Based on this analysis, candidate locations for new emergency vehicle preemption can be identified and prioritized. Collaboration is needed between participating agencies--including law enforcement, fire, emergency medical services, and jurisdictions that maintain the traffic signal.

What materials are needed to implement this strategy?

To implement emergency vehicle preemption, equipment needs to be installed on emergency vehicles, signal upgrades are needed to receive the preemption request, and software upgrades to process and implement the request. On a corridor where the technology is already employed, it may be feasible to add additional intersections as part of a Quick Build process.

1. Advance Stop Bar

Focus Crash Type: Multiple threat/trapped.

Safe System Strategy: Increase attentiveness and separation in space.

Considerations: Can be paired with other treatments, like Rectangular Rapid Flashing Beacon (RRFBs) and/or high visibility crosswalks.

Definition

Stop lines placed in advance of pedestrian crossings increasing visibility of pedestrians and reducing crossing encroachment.

Crash Reduction Effectiveness

LOW

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

How to identify candidate locations?

Advanced stop bars are required at all signalized and stop controlled locations with a marked crosswalk.

What should be considered in the design?

Controlled locations without advance stop bars should be identified through an inventory of crossing locations in the community and systemic improvements made. Advance stop bars are located at least 4 feet from the crosswalk at stop controlled and signalized intersections.

Since road user detection at traffic signals is based on the location of the stop line, consideration should be given to whether or not modifications are needed when adjusting the location of the stop line. See section 230.6 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy requires paint.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

2. Advance Yield Markings

Focus Crash Type: Multiple threat/trapped.

Safe System Strategy: Increase attentiveness and separation in space.

Considerations: Can be paired with other treatments, like Rectangular Rapid Flashing Beacon (RRFBs) and/or high visibility crosswalks.

Definition

A yield line placed in advance of pedestrian crossings to indicate where a vehicle yield is intended, increasing visibility of pedestrians and reducing crossing encroachment.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

How to identify candidate locations?

Advanced yield markings should be installed at all uncontrolled marked crossings.

What should be considered in the design?

Uncontrolled marked crosswalks without advance yield markings or stop bars should be identified through an inventory of crossing locations in the community and systemic improvements made. Advance yield markings are typically located 20 to 50 feet from uncontrolled marked crossings. See section 230.6 of the FDM for additional design considerations .

What materials are needed to implement this strategy?

This strategy requires paint and signs.

3. Chevron Signs on Horizontal Curves

Definition
Signs that warn drivers of an approaching curve and provide tracking information.

Crash Reduction Effectiveness
LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility
RURAL

SUBURBAN

Cost
$

Focus Crash Type: Collision with fixed objects, and run off the road crashes.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: Can be paired with other treatments, like rumble strips.

How to identify candidate locations?
Agencies should maintain an inventory of sign locations and road network characteristics that can be used to identify if there are roadway curves without sufficient warning signs. Based on the existing sign inventory, locations with run off road or other crash patterns indicative of people driving too fast around a curve can be prioritized for additional signage. Also see to upgrade to larger warning signs and advanced curve warning sign strategy.

What should be considered in the design?
The placement of signs should consider the design speed of the roadway and the sight distance to the curve or other hazard. This is a FHWA proven safety countermeasure. See section 4.5.4 of the TEM for additional design considerations.

What materials are needed to implement this strategy?
This strategy requires signs.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

4. Advance Curve Warning Signs

Definition
Signage that notifies drivers of an approaching curve providing additional reaction time to slow down.

Crash Reduction Effectiveness
LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility
SUBURBAN

RURAL

Cost
$

Focus Crash Type: Collision with fixed objects and run off the road crashes.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: This warning sign is ideally combined with other infrastructure that alerts drivers of the curve, such as chevron signs, delineators, and flashing beacons.

How to identify candidate locations?
Agencies should maintain an inventory of sign locations and road network characteristics that can be used to identify if there are roadway curves without sufficient warning signs. Based on the existing sign inventory, locations with run off road or other crash patterns indicative of people driving too fast around a curve can be prioritized for additional signage.

What should be considered in the design?
The placement of signs should consider the design speed of the roadway and the sight distance to the curve. This is a FHWA proven safety countermeasure. See section 2.41.3 of the TEM for additional design considerations.

What materials are needed to implement this strategy?
This strategy requires signs. Can also be paired with larger warning signs and chevron sign on horizontal curves.

5. Stop for Pedestrian Sign

Definition

"Stop for Pedestrians" signs alert drivers about the presence of pedestrians. These signs are required with advance stop lines. Other sign types can be placed on the centerline in the roadway.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Through vehicle at unsignalized intersection, motorist failed to yield at unsignalized intersection.

Safety System Strategy: Increase attentiveness and awareness.

Considerations: May need to be paired with education and enforcement.

How to identify candidate locations?

Locations that are not controlled by stop signs or traffic signals where drivers are not stopping for pedestrians.

What should be considered in the design?

In road signs are intended to be used in uncontrolled locations. Signs can be installed systematically, prioritizing areas with a history of pedestrian crashes, near schools, and other pedestrian generators. See section 2.39 of the TEM for additional design considerations.

What materials are needed to implement this strategy?

A sign is needed.

6. LED Enhanced Sign

Definition

Signage with LED lights embedded in the outline increasing sign visibility and are most effective at locations with visibility limitations or with a documented history of drivers failing to see or obey the sign.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Angle crashes, motorist failed to yield at unsignalized intersection, and through vehicle at unsignalized intersection.

Safety System Strategy: Increase attentiveness and awareness.

Considerations: The Light Emitting Diodes (LED)s may be set to flash or operate in a steady mode.

How to identify candidate locations?

LED-Enhanced signs can be used in locations where additional conspicuity is needed for driver awareness or frequent weather conditions, such as fog or decrease sign visibility. Candidate locations include locations where people are not observing or obeying traffic control devices. LED Enhanced lighting can be used both on regulatory and warning signs.

What should be considered in the design?

The surrounding context and behavior patterns should be considered, as most systems can be programmed to be active during certain times of day, like at night, or at all times. Consideration should be given to nearby residences if used in residential area.

What materials are needed to implement this strategy?

A new sign with built-in LEDs or a LED retrofit kit. Most systems are solar powered and do not require an electrical connection.

7. Painted Centerline and Raised Pavement Markers at Curves

Definition

A raised pavement marker is a small device attached to the road and used as a positioning guide for drivers.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Typical Applicable Facility

RURAL

Cost

$

Focus Crash Type: Head on, collision with fixed objects, and run off the road crashes.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: Consider pairing with retroreflective paint and advance warning signs. Delineator posts could also be incorporated.

How to identify candidate locations?

Undivided roadways with a history of head-on crashes, collision with fixed objects and run off road crashes should be evaluated. Crash history should be reviewed along with road characteristics to identify and prioritize locations for installation.

What should be considered in the design?

The spacing of raised pavement markers depends on the type of line and curve radius, with a typical minimum of 40-foot intervals. The spacing can be reduced for sharper curves. The length of the solid double line should consider sight distances and speeds.

What materials are needed to implement this strategy?

This strategy requires paint and pavement markers. Consider pairing with retroreflective paint and warning signs.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

8. Pavement Speed Legends

Definition

Speed legends are numerals painted on the roadway indicating the current speed limit in mph, usually placed near speed limit signposts.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Speed related crashes.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: In high traffic areas, a maintenance plan should be developed to monitor paint condition.

How to identify candidate locations?

Pavement speed limits are commonly installed in locations where there is a transition zone between speed limits or a history of speeding related crashes. Candidate locations include those where the speed limit transitions and a high frequency of speeding related crashes occur.

What should be considered in the design?

For a change in speed limit, the placement should consider the perception reaction time to the changed condition. The surrounding land use context and placement of regulatory signs should also be considered in the placement of pavement markings. See section 202.3.10 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy requires paint. Consider pairing with retroreflective paint and some agencies may place them adjacent to the speed limit signs.

9. Prohibit Left Turn

Focus Crash Type: Left turn crashes, pedestrian struck by turning vehicle, and motorist turned left in path of bicyclist.

Safe System Strategy: Manage conflicts in time.

Considerations: May need to be implemented as part of an overall retiming project. If signage alone is not sufficient, this strategy may need to be paired with physical treatments.

Definition

Prohibitions of left turns at locations where a turning vehicle may conflict with pedestrians in the crosswalk or where opposing traffic volume is high and there is not sufficient room for a separate turn lane.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

How to identify candidate locations?

Turns can be prohibited when there are conflicts between turning vehicles and people crossing the road or when the turn movement volume is high and there is not sufficient room for a turn lane – and split phase signal operations are not viable. Identify locations without left-turn lanes but with left-turn related crashes, and consider whether creating space for a left-turn lane could allow for a protected left-turn signal or if left-turns should be prohibited.

What should be considered in the design?

Increased left-turn capacity or provisions for U-turn movements may need to provided along the corridor. Enforcement mechanisms should also be considered in the design and coupled with a physical barrier.

What materials are needed to implement this strategy?

This strategy requires signage.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

10. Time-Based Turn Restrictions

Focus Crash Type: Pedestrian struck by turning vehicle, motorist turned left in path of bicyclist, and motorist turned right in path of bicyclist.

Safe System Strategy: Manage conflicts in time.

Considerations: If not enforced, could limit effectiveness.

Definition

Restricts left-turns or right-turns during certain time periods when there may be increased potential for conflict (e.g: peak periods, school hours).

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

How to identify candidate locations?

Turns can be prohibited when there are conflicts between turning vehicles and people crossing the road or when the turn movement volume is high and there is not sufficient room for a turn lane – and split phase signal operations are not viable. Identify locations without left-turn lanes but with left-turn related crashes, and consider whether creating space for a left-turn lane could allow for a protected left-turn signal.

What should be considered in the design?

Analysis should be conducted to identify the times of day for prohibition. Where the left-turn demand will be accommodated, and enforcement mechanisms should also be considered in the design. Time based turn restrictions can be paired with a dynamic sign.

What materials are needed to implement this strategy?

This strategy requires signage.

11. Striping through Intersection

Focus Crash Type: Sideswipes.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: Consider left or right edge lines as a way of clarifying paths of travel through an intersection.

Definition

Pavement markings that guide vehicles through intersections which helps drivers remain in their lanes throughout an intersection.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

How to identify candidate locations?

Large intersections, intersections with an offset or uniquely oriented intersections are candidate locations. A history of sideswipe crashes or near misses may indicate drivers are not staying in their proper lane alignment.

What should be considered in the design?

The vehicle path, receiving lane location, and number of receiving lanes should be considered in the design. See section 230 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy requires paint.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

12. Upgrade Intersection Pavement Markings

Focus Crash Type: Angle crashes, through vehicle at unsignalized intersection, and motorist failed to yield at unsignalized intersection.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: Upgrading intersection pavement marking can include "Stop Ahead" markings and the addition of centerlines and stop bars.

Definition

Upgrading intersection pavement markings can improve safety by increasing the visibility of intersections for drivers approaching and at the intersection.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

How to identify candidate locations?

Candidate locations include those that have an upcoming Resurfacing, Restoration and Rehabilitation (RRR) where upgrading the pavement markings can be included or where the pavement markings are worn or nonexistent. Candidate locations can also be identified during a field review to determine locations where the existing paint is worn or faded, or where there is a crash history related to failure to yield or distraction.

What should be considered in the design?

If certain intersection pavement marking elements have degraded faster than others, upgrades may want to consider the pavement conditions as well as wheel track locations. Modifications to pavement marking layouts or using more durable materials could be considered to increase the lifecycle of markings.

What materials are needed to implement this strategy?

This strategy requires paint. It can also be coupled with signs.

13. Upgrade Signs with Fluorescent Sheeting

Definition

Upgrading to signs with retroreflective sheeting increasing visibility of signs to drivers at night.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Nighttime crashes.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: Depending on sign locations, a structural/wind analysis may need to be conducted.

How to identify candidate locations?

Corridors with a high frequency of nighttime crashes as compared to the jurisdiction overall.

What should be considered in the design?

A sign retroreflectivity analysis should be conducted to determine if the signs are visible at nighttime. This analysis should consider the level of lighting along the corridor and if retroreflectivity standards are met.

What materials are needed to implement this strategy?

This strategy requires new signs with retroreflective sheeting.

14. Upgrade Striping

Definition

Restripe lanes with reflective striping to improve striping visibility and clarify lane assignment, especially where the number of lanes changes.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Sideswipes.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: Consider upgrading stripings to clearly define lane assignment.

How to identify candidate locations?

Corridors with a high frequency of nighttime crashes as compared to the jurisdiction overall. A history of sideswipe crashes or near misses may indicate drivers are not staying in their proper lane alignment due to poor visibility.

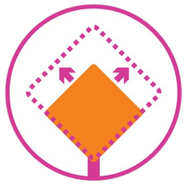
What should be considered in the design?

The design should consider vehicle placement in the travel lane, and the turning movement of vehicles if implemented at intersections or along curves.

What materials are needed to implement this strategy?

This strategy requires retroreflective paint and may include raised reflective pavement markers where appropriate.

15. Upgrade to Larger Warning Signs



Definition

Upgrading to larger warning signs improves safety by increasing visibility of the information provided, particularly for older drivers.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Crashes involving older drivers.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: Sign placement should avoid blocking other signs or other road users.

How to identify candidate locations?

Locations where there is a high percentage of aging drivers and/or where there is a high-speed limit and drivers need to be able to see warning signs from a farther distance to take the appropriate action. A history of crashes involving aging drivers or inattentiveness can be used to prioritize locations. Designer should consult the MUTCD for guidance on how to select an appropriate size sign for the context.

What should be considered in the design?

The prevailing travel speed, sight distance, and surrounding land use context should be considered in the design.

What materials are needed to implement this strategy?

This strategy requires signs. Can be paired with retroreflective or LED enhanced signs.

1. Bicycles Allowed to Use Full Lane Sign

Definition

Signage that indicates cyclists may use the full lane, discouraging unsafe motorist passage.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Vehicle overtakes bicycle, motorist turns right in path of bicyclist, and bicycle crashes at driveways.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: Volumes and number of conflicts need to be considered in the selection of this treatment. Consult FHWA Bikeway Selection Guide.

How to identify candidate locations?

The higher the motorist speed, the more important it is that bicyclists control the lane, because motorists are farther away when they need to decide on their passing strategy. A bicyclist using lane control makes it clear from a greater distance that the motorist needs to make a full lane change to pass safely. MetroPlan Orlando data shows the risk for overtaking crashes increases with posted speed.

Locations where there is not room for a dedicated bicycle facility, but the road is part of an overall bike network are candidate locations. A review of the jurisdiction's bike facility network and locations where bicyclist crashes or near misses occur should be considered.

What should be considered in the design?

Traffic volumes and speed data should be reviewed to determine if this treatment is appropriate for the context, or if it needs to be implemented with other strategies to slow vehicle traffic. Based on the FHWA Bikeway Selection Guide, this type of treatment is applicable to low volume (3,000 vehicles/day or less) and low speed (25 MPH or less) streets. See section 2.11.3 of the TEM.

What materials are needed to implement this strategy?

This strategy requires signs and often includes pairing with shared lane markings.

2. Bike Lane/Buffered Bike Lane

Focus Crash Type: Vehicle overtakes bicycle.

Safe System Strategy: Remove severe conflicts.

Considerations: Consult FHWA Bikeway Selection Guide.

Definition

Lanes marked with symbols and signs specifically for bicycles, reducing bike/vehicle conflicts and slowing vehicle speeds via the road-narrowing effect. May or may not include a painted buffer space.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$$

How to identify candidate locations?

Locations where there is an existing on-street bike lane adjacent to wide vehicle lanes that could be narrowed are candidate locations. Can be implemented as part of a RRR process.

What should be considered in the design?

Traffic volumes and speed data should also be reviewed to determine if this treatment is appropriate for the context, or if it needs to be implemented with other strategies to slow vehicle traffic. A minimum buffer width of 3 feet is preferred if adjacent to parking, with a minimum bike lane width of 5 feet for one-way bicycle travel. The strategy could be difficult to implement on a road with a high density of driveways that require numerous breaks in the buffer.

Based on the FHWA Bikeway Selection Guide, this type of treatment is applicable for roadways with a speed of less than 35 miles per hour and traffic volumes less than 7,000 vehicles a day. This is a FHWA proven safety countermeasure. See section 223.2.1 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy requires paint. Depending on the extent of lane narrowing, traffic signal indications and/or detection at intersections may need to be modified.

** Quick Build designs for two way cycle tracks are not shown in this document as those facilities typically require construction of curb and other physical barriers as well as signal modifications that typically cannot be completed within a Quick Build time frame or with Quick Build materials.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

3. Separated Bikeway

Focus Crash Type: Vehicle overtakes bicycle.

Safe System Strategy: Manage conflicts in time.

Considerations: A raised barrier of plastic posts and painted pavement is a low-cost/Quick Build option. Additional treatments may be needed at driveways/intersections.

Definition

A bikeway with physical separation (horizontal and vertical) from vehicle traffic, designated lane markings, pavement legends, and signage, which reduces conflicts between bicycles and vehicles on the road.

Crash Reduction Effectiveness

LOW MED HIGH

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$$ - $$$

Cost depends on the type of material used for separation.

How to identify candidate locations?

Locations where there is an existing on-street bike lane adjacent to wide lanes that could be narrowed or where a travel lane can be removed, i.e. road diet. Evaluate driveway spacing to identify potential for adding separated bikeway elements as frequent driveways or conflict zones could limit the effectiveness. Can be implemented as part of a RRR process.

What should be considered in the design?

Traffic volumes and speed data should be reviewed to determine if this treatment is appropriate for the context, or if it needs to be implemented with other strategies to slow vehicle traffic. A minimum buffer width of 3 feet is preferred if adjacent to parking, with a minimum bike lane width of 5 feet for one-way bicycle travel and the driveway spacing should be considered in the design, with additional treatments added in driveway areas.

Based on the FHWA Bikeway Selection Guide, this type of treatment is applicable for roadways with a speed of less than 35 miles per hour and traffic volumes less than 7,000 vehicles a day. This is a FHWA proven safety countermeasure. See section 223.2.4 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy requires horizontal separation which can be accomplished with paint and vertical separation which could include delineator posts, tubular markers, or quick curb combined with tubular markers. As traffic volumes and speeds increase, more durable barriers with increasing vertical protection should be selected.

4. Parking Buffer

Focus Crash Type: Dooring.

Safe System Strategy: Remove severe conflicts, manage conflicts in space, and increase attentiveness and awareness.

Considerations: Door zones should be a minimum of 3 feet.

Definition

Pavement markings denoting door zone of parked vehicles to help bicyclists maintain safe positioning on the roadway

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

How to identify candidate locations?

Locations where there is an existing on-street bike lane adjacent to on-street parking and wide travel lanes that could be narrowed. Can be implemented as part of a RRR process.

What should be considered in the design?

A buffer width of 3 feet between the parking lane and bike lane is needed to keep bicyclists out of the door zone. Should also be implemented with daylighting at intersections and parking prohibitions at driveways to provide adequate sight lines for turning and crossing motorists.

This strategy can also be implemented with parking used as a buffer with the bike lane adjacent to the curb and on-street parking between the bike lane and vehicular travel lane. See section 223.4 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy requires paint and signage. Depending on the extent of lane narrowing, signal heads at intersections may need to be modified.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

5. Extend Bike Lane to Intersection

Focus Crash Type: Motorist turns right in path of bicyclist.

Safe System Strategy: Manage conflicts in time.

Considerations: If bike lane does not continue on other side of intersection, alternative treatments should be evaluated with a goal of reducing the potential for right hook crashes and providing bicyclist with appropriate information to navigate the intersection.

Definition

Where a bike lane is dropped due to a right turn lane, the intersection approach is restriped to allow for bicyclists to move to the left side of right turning vehicles ahead of reaching the intersection.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

How to identify candidate locations?

Locations where there is an existing on-street bike lane that ends before an intersection to provide for right-turn turn lanes with insufficient space for a turn lane, through lane and a standard width bike lane. The volume of right-turn demand should be considered, as this treatment may not be appropriate at intersections with a high volume of right-turn vehicle traffic and bicyclist could be directed to the sidewalk if coupled with other treatments.

What should be considered in the design?

The transition zone should be at least 60 feet. A bike lane marking with minimum 4-foot bike lane width can be used if the combined width is 13 feet. See mixing zone for additional options. See section 223.2.4.5 of the FDM for additional information.

What materials are needed to implement this strategy?

This strategy requires paint and signage. Conflict zone markings or dotted lines should be added to indicate to motorists to yield to bicyclists. It may require adjustments to intersection signal indications and detection.

6. Mixing Zone

Definition

Lane markings to delineate space for bicyclists and motorists within the same lane and indicate the intended path for bicyclists to reduce conflict with turning motor vehicles.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Motorist turns right in path of bicyclist.

Safe System Strategy: Manage conflicts in time, and increase attentiveness and awareness.

Considerations: May not be appropriate at intersections with very high peak automobile right turn demand.

How to identify candidate locations?

Locations where there is an existing on-street bike lane that ends before an intersection to provide a right-turn lane and there is not sufficient space for a right-turn lane and a standard width bike lane. The volume of right-turn demand should be considered, as this treatment may not be appropriate at intersections with a high volume of right-turn vehicle traffic and other treatments may need to be considered.

What should be considered in the design?

The mixing zone should be at least 60 feet. A bike lane marking with substandard 4-foot bike lane width can be used if the combined width is 13 feet. Shared lane markings can be used if the combined width of the bike lane and turn lane is less than 13 feet.

1
A dotted 4 inch lane and bicycle lane marking used to indicate bicyclist positioning within the combined lane without excluding cars from suggested bicycle area.

2
Within the combined lane, the bicycle area width is 4 feet minimum

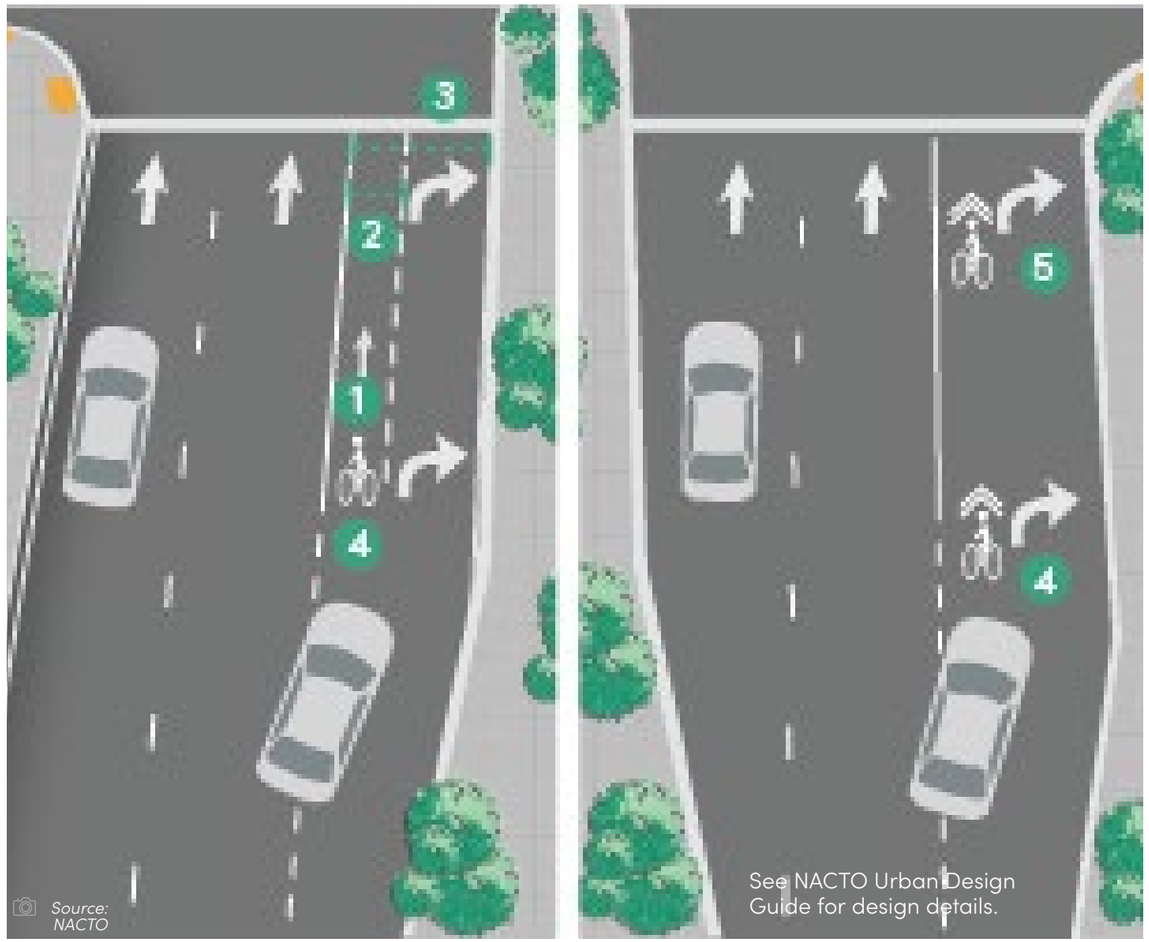
3
Width of combined lane is 9 feet minimum, 13 feet maximum. A full bicycle through lane can be accommodated if the vehicle right turn only lane can be made 14 feet or wider.

4
Bicycle marking used to clarify bicyclist positioning within the combined lane.

5
A shared lane marking used as an alternative to dotted striping to clarify bicyclist position within the combined lane.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies



Source: NACTO

See NACTO Urban Design Guide for design details.

What materials are needed to implement this strategy?

This strategy requires paint and signage. Conflict zone markings or dotted lines should be added to indicate to motorists to yield to bicyclists.

7. Bike Box

Definition

An area at an intersection with a signal where cyclists can move ahead of stopped traffic providing a designated and visible way to get ahead of queuing traffic.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

Cost

$

Focus Crash Type: Motorist failed to yield at signalized intersection and bicyclist turned left into path of motorist.

Safe System Strategy: Manage conflicts in time and increase attentiveness and awareness.

Considerations: In high travel areas, green paint can degrade and a maintenance plan should be developed. This treatment does not address right hook crashes. If there is a high volume of left-turn bicyclist demand, other treatments should be considered.

How to identify candidate locations?

Intersections where there is a bike lane, and high levels of bicycle travel, or a history of bicyclist related crashes.

What should be considered in the design?

The bike box should be at least 10 to 16 feet deep, depending on the volume of bicyclists. Signage, including yield to bikes and no right-turn on red should be incorporated into the design. Green paint and bike stencils should be used to denote the bike box area per MUTCD.

What materials are needed to implement this strategy?

If bicyclist and vehicle detection systems are provided, it may require adjustments to the detection zones. No right-turn on-red signs should be provided.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

1
An egress lane to clearly define the potential area of conflict between motorists and bicyclists in the intersection, when the intersection is operating on a green signal indication. Colored pavement or other markings may be used to define the potential area of conflict.

2
A 'Yield to Bikes' sign mounted in advance of and in conjunction with an egress lane to reinforce that bicyclists have the right of way going through the intersection.

3
A 'Stop Here on Red' sign mounted at the stop line to reinforce observance of the stop line. Additional signs maybe used to clarify signal control.

4
An ingress lane to define the bicycle space. Controlled pavement maybe used, When color is used length is typically 25-50 feet to allow bicycle access to the box.

5
A 'Wait here' legend marking to supplement the stop line and 'Stop Here on Red' sign at the bike box.

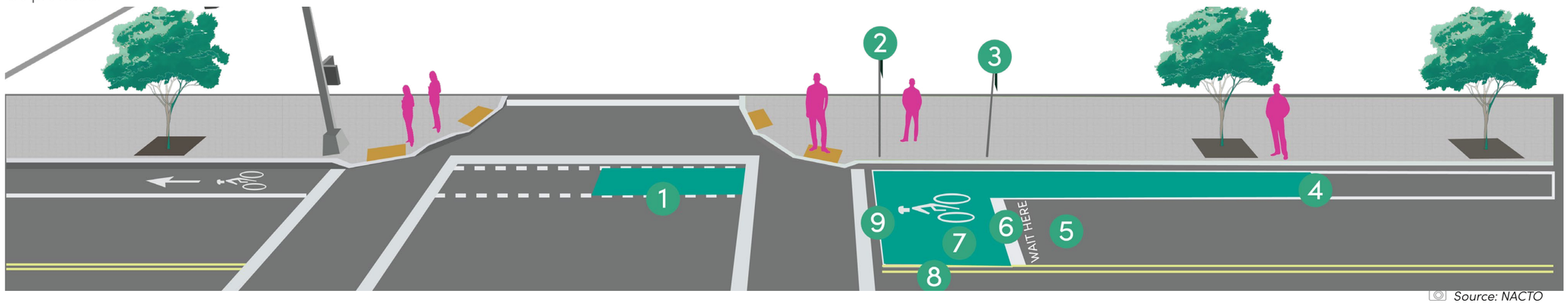
6
Stop line to indicate the point behind which motor vehicles are required to stop in compliance with traffic control signal.

7
Pavement markings to designate the space as a bike box.

8
A box formed by transverse line to hold queuing bicyclists, typically 10-16 feet deep. Deeper boxes show less encroachment by motor vehicles.

9
Colored pavements used within the bike box to encourage compliance by motorists.

See NACTO Urban Design Guide for design details.



Source: NACTO

8. Two-Stage Turn Queue Bike Box

Definition

Roadway treatment for left turns at signalized intersections from the right-side bike lane protecting bicyclists from traffic.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

Cost

$

Focus Crash Type: Motorist failed to yield at signalized intersection, and bicyclist turned left into path of motorist.

Safe System Strategy: Manage conflicts in time and increase attentiveness and awareness.

Considerations: Prohibition of right turns on red may be required. Extensive outreach and education may be necessary, especially if treatment is the first within a community.

How to identify candidate locations?

Along protected bike facilities and bike lanes, a two-stage turn queue box to allow bikes to make left turn from a right-side protected bike facility or bike lane, or right turns from a left-side two-way protected bike facility. Identify bike facilities with high demand for bicyclist turns.

What should be considered in the design?

The box should be of sufficient dimensions to accommodate expected bicyclist demand, including bikes with cargo trailers. The box should be placed to shadow a parking lane, sidewalk or curb extension to provide protection for bicyclists waiting to turn. See section 223.2.1.5 of the FDM and MUTCD for additional information.

1 An area designated to hold queued bicyclists and formalize two stage turn maneuvers.

2 Pavement markings include a bicycle stencil and a turn arrow to clearly indicate proper bicycle direction and positioning.

3 A queue box placed in a protected area. Typically within an on street parking lane or between the bicycle lane and pedestrian crossing.

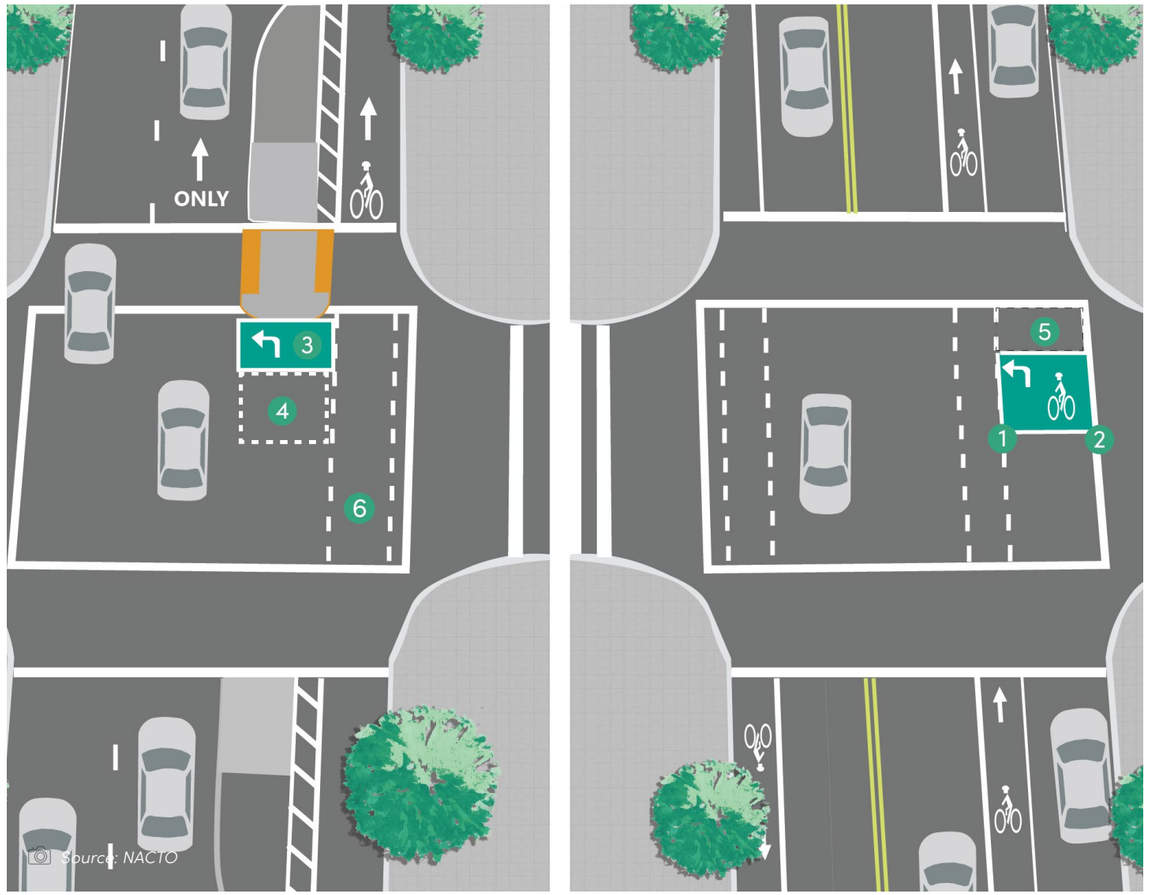
4 The queue box is typically positioned laterally in the cross street, to promote visibility of bicyclists.

5 The queue box may be positioned laterally in the cross street parking lane rather than in front of the travel lane. This may require bicyclists to weave into the travel lane to resume through movement if no dedicated bicycle facility is present since the parking lane ahead will be occupied.

6 Markings across intersections can be used to define through bicyclist positioning.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies



See NACTO Urban Design Guide for design details.

What materials are needed to implement this strategy?

Paint and signs are needed to implement this strategy. If bicyclist and vehicle detection systems are provided, it may require adjustments to the detection zones. Right-turn on-red may need to be prohibited if the turn path overlaps with the box.

9. Floating Transit Island

Focus Crash Type: Bike/pedestrian crashes.

Safe System Strategy: Manage conflicts in space.

Considerations: Drainage and ADA requirements should be considered.

Definition

Separates the bike facility and transit boarding area, reducing conflict between the two modes, and lowering the risk of collision.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$$

How to identify candidate locations?

Locations where there is overlap between on-street bike lanes and transit stops. They increase safety by reducing conflicts between buses and bicyclists, and reduce transit delay as buses do not have to stop in the bike lane to pick up passengers and then merge back into traffic. They can also be used on facilities with on-street parking and bus pullouts.

What should be considered in the design?

Floating bus stops should be a minimum of 9 feet wide (10 feet preferred) and 40 feet long, with a 1-foot offset from the travel lane, and meet minimum ADA standards. Interim Quick Build islands can help refine design features for a more permanent installation. See section 210.3.2.3 of the FDM for additional design considerations.

Source: Fehr & Peers

Source: Fehr & Peers

What materials are needed to implement this strategy?

A platform made from durable materials, such as hard molded plastic, is required. Paint, signage, and railings may also be needed.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

10. Bicycle Crossing (Solid Green Paint)

Focus Crash Type: Motorist turns left in path of bicyclist, motorist turns right in path of bicyclist, and motorist failed to yield at signalized intersection.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: In high travel areas, green paint can degrade and a maintenance plan should be developed.

Definition

Green paint across an intersection that enhances bicycle safety and visibility.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

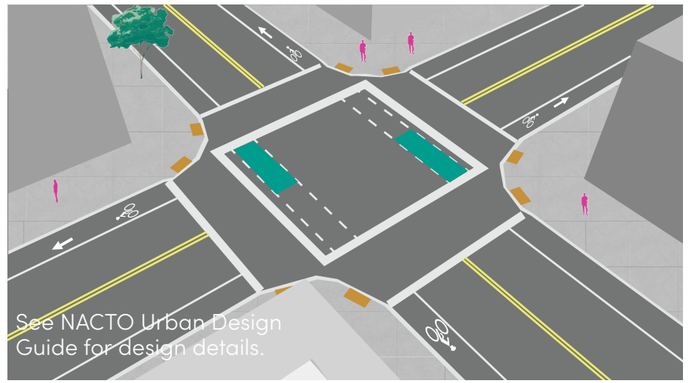
$

How to identify candidate locations?

Roads with bicycle facilities should be evaluated and green paint added across intersections where the bicycle path may be unclear.

What should be considered in the design?

The desired path of the bicyclist should be considered, as well as the potential conflict areas between bicyclists and drivers. This may not apply to crossings where bicycles are expected to yield the right-of-way, such as when the street designated as a bicycle route has a Stop or Yield sign at the intersection. See section 223.2.1.4 of the FDM and section 5.2.7.1 of the TEM for additional design considerations.



Source: NACTO

What materials are needed to implement this strategy?

This strategy requires green paint, which should be skid resistant and retroreflective.

11. Green Conflict Striping

Definition

Dashed green markings in bike lanes near or through intersections increasing bicyclist visibility and identifying potential conflict points so both bicyclists and motorists use caution when traversing the area.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Motorist turns left in path of bicyclist, motorist turns right in path of bicyclist, and motorist failed to yield at signalized intersection.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: In high travel areas, green paint can degrade and a maintenance plan should be developed.

How to identify candidate locations?

Roads with bike lanes should be evaluated and green paint added in high conflict areas, like interchange areas where there may be high volumes of vehicles crossing on-street bike lanes.

What should be considered in the design?

Generally, dashed striping should be used in areas where vehicles are allowed to cross over the bike lane and solid striping should be used to denote where vehicles are not allowed. See section 223.2.1.4 of the FDM for additional design considerations.

1
Color applied within conflict area for increased visibility of bicyclists.

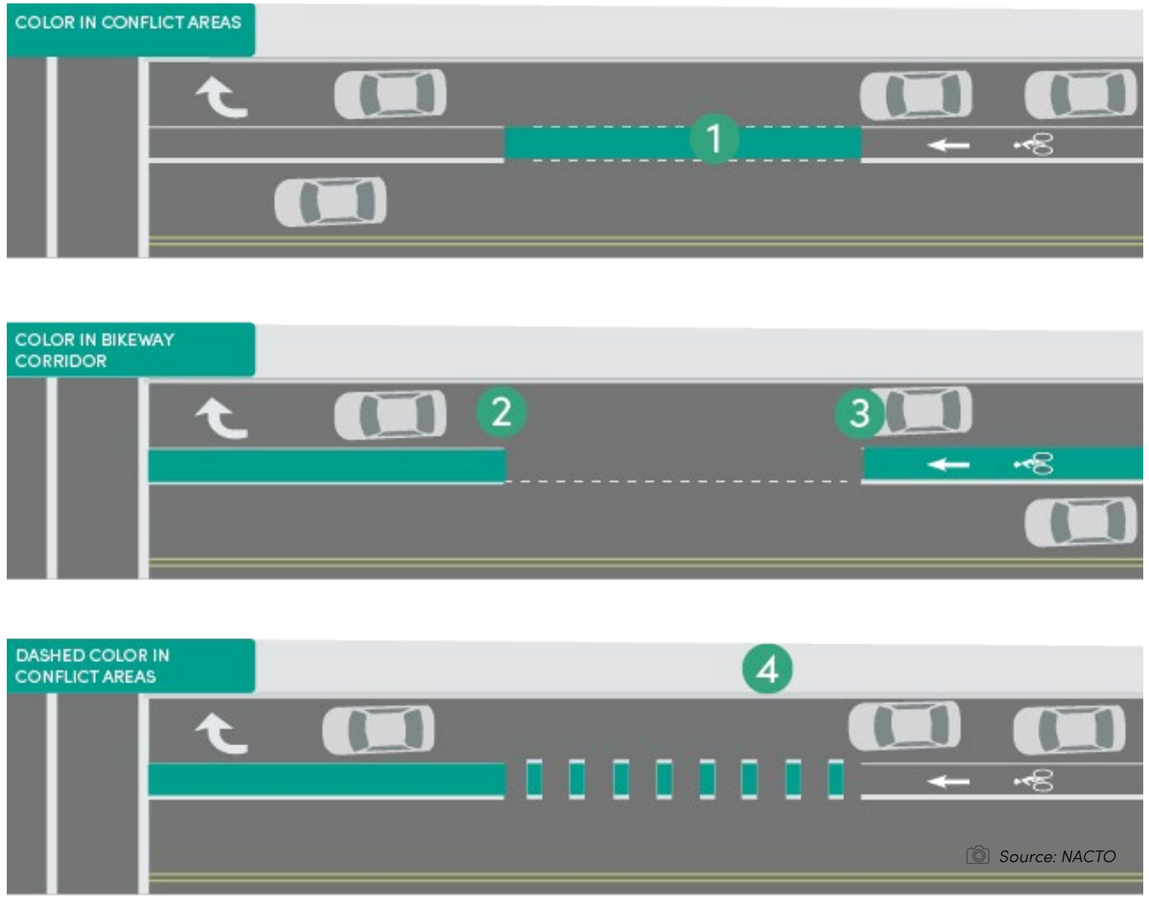
2
Color applied to the road surface to delineate space, increase visibility, and emphasize proper vehicle priority.

3
Colors applied along a corridor, with gaps in coloring to denote crossing areas. When used in this fashion, color can distinguish the bicycle facility along its entire length. This is particularly useful in high traffic situations or areas where traffic may encroach into the bike facility.

4
Color applied along a dashed pattern within a dashed bicycle lane to indicate conflict areas.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies



See NACTO Urban Design Guide for design details.

What materials are needed to implement this strategy?

This strategy requires green paint, which should be skid resistant and retroreflective.

1. High Visibility Crosswalk

Definition

Crosswalks made from high-visibility material, such as pre-formed thermoplastic, instead of paint, improves safety by increasing the visibility of the crossing.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Pedestrian struck by turning vehicle, and through vehicle at signalized intersection.

Safety System Strategy: Increase attentiveness and awareness.

Considerations: Crosswalk treatments should consider wear patterns and maintenance requirements.

How to identify candidate locations?

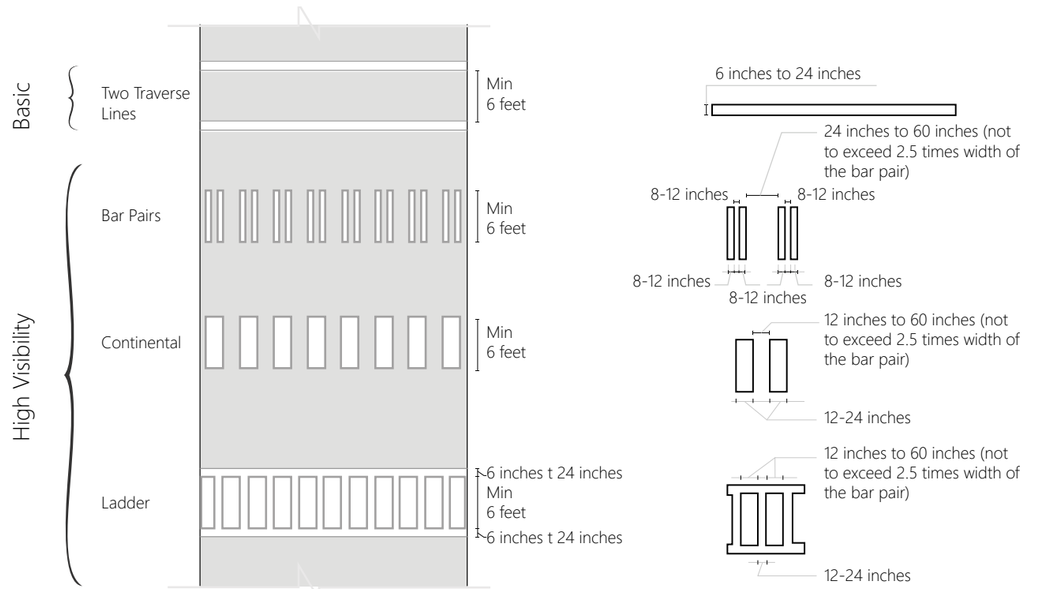
High visibility crosswalks should be considered at all midblock and uncontrolled pedestrian crossings, and prioritized based on pedestrian volume, crash history, and surrounding land use context, like school zones.

What should be considered in the design?

High visibility crosswalks use patterns such as bar pairs, continental and ladder. These are more visible to drivers and pedestrian from a farther distance than traditional traverse lines. On multilane roadways, pair with advanced yield lines and "YIELD Here for Pedestrians" signs 20 to 50 feet in advance of a marked crosswalk to indicate where a driver should yield to pedestrians. To supplement the signing, agencies can also install YIELD markings. See section 230.3.1 of the FDM for additional design considerations.


Source: Fehr & Peers


Source: Fehr & Peers



Note: At a non-intersection uncontrolled pedestrian crossing where the speed limit is greater than 35 mph, the high visibility crosswalk marking, if used, should not be less than 8 feet wide.

Source: MUTCD


Source: Fehr & Peers

What materials are needed to implement this strategy?

This strategy requires paint. This strategy can be paired with other strategies, including signage, curb extensions, rectangular rapid flashing beacons and daylighting. Agencies can also use pre-formed thermoplastic instead of paint for highly reflective crosswalk markings.

2. Co-Locate Bus Stops and Pedestrian Crossings

Definition

Place bus stops and pedestrian crossings in close proximity to allow transit riders to cross the street at a marked locations.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Dart/dash and multiple threat/trapped.

Safe System Strategy: Remove severe conflicts, and increase attentiveness and awareness.

Considerations: Could include relocation of existing bus stops, or installation of new crossing treatments.

How to identify candidate locations?

Transit stops on multilane, high-volume, high-speed roads with land uses and sidewalks on the other side of the street are candidate locations for bus stop relocation or the addition of a new marked and potentially controlled crossing location. Locations with a history of pedestrian involved crashes should be prioritized.

What should be considered in the design?

Transit stops should be placed on the far side (after the intersection) of an intersection whenever possible to improve pedestrian safety and reduce conflicts with turning vehicles. However, near-side stops may be appropriate if there are limiting factors on the far side, or if the bus turns at the intersection. Stop placement should consider the length of the transit vehicle (typically 40-feet) and be placed such that the bus does not extend across the crosswalk. Sidewalk and ADA connections need to be considered in the design. See section 222.2.8 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy requires relocation of existing transit stops. If new pedestrian crossings are needed, paint would also be required. Should transit stops have additional amenities, including trash cans and shelters, the relocation may be more extensive than can be completed under a Quick Build.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

3. Mark Pedestrian Crossings

Definition

Marked crossings can channelize pedestrian travel and alert drivers of a location that people may be crossing the roadway.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Pedestrian struck by turning vehicle, and through vehicle at unsignalized intersection.

Safe System Strategy: Pairing with a traffic signal can manage conflicts in time, and increase attentiveness and awareness.

Considerations: Crossing locations should consider pedestrian destinations on both sides of roadway, pedestrian desire lines, as well as vehicular movement.

How to identify candidate locations?

Unmarked crosswalks where there is pedestrian crossing demand or unmet pedestrian crossing demand, and other marked crossings are at least 400 feet away. Locations can be prioritized based on the land use context, crash history, and existing/potential pedestrian demand.

What should be considered in the design?

The FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing locations can be used to help identify appropriate treatments to supplement the marking of a crosswalk, based on the context of the crossing. See section 222.2.3 of the FDM for additional design considerations.

See design considerations for high visibility crosswalks.

What materials are needed to implement this strategy?

This strategy requires paint. It can be combined with other strategies depending on the context.

4. Curb Extensions

Definition

A traffic calming measure that extends the sidewalk for a short distance at a crossing location to reduces the pedestrian exposure and increase visibility and reduce turning vehicle speeds..

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$-$$

Cost depends on how many crosswalks are upgraded at an intersection and the materials used for the curb extension.

Focus Crash Type: Dart/dash, multiple threat/trapped, pedestrian struck by turning vehicle, through vehicle at unsignalized intersection, and through vehicle at signalized intersection.

Safe System Strategy: Manage vehicular speeds, and increase attentiveness and awareness.

Considerations: Drainage and ADA requirements should be considered. Paint and plastic curb extensions are a low-cost/Quick Build option.

How to identify candidate locations?

Curb extensions are appropriate in areas where pedestrians and motorists interact frequently. Streets with on-street parking are candidate locations as the curb extensions increase pedestrian visibility and decrease the overall pedestrian exposure. Midblock crossings with on-street parking or shoulders are also candidates for curb extensions.

What should be considered in the design?

The design should consider the types of vehicles that turn at the intersection and number of receiving lanes to establish an appropriate corner radius. Curb extensions should also be coupled with high visibility crosswalks. The presence of on-street parking, bus stops or fire hydrants may influence the placement and materials selected for design of the curb extension. See section 202.3.12 of the FDM and section 5.2.7.5 of the TEM for additional design considerations.

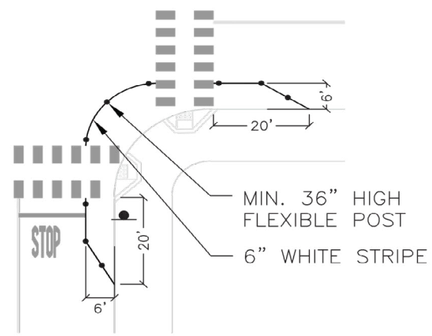
What materials are needed to implement this strategy?

This strategy requires paint and vertical elements. Planters, quick curb, and low-profile lane delineators can be used.

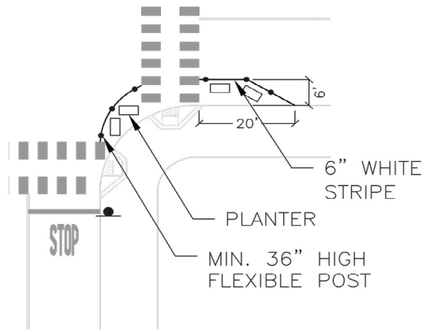
QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

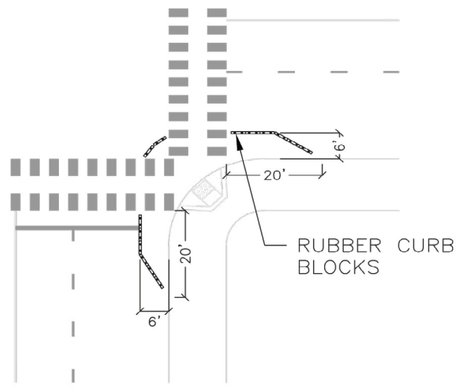
1. Flexible Post without Planter



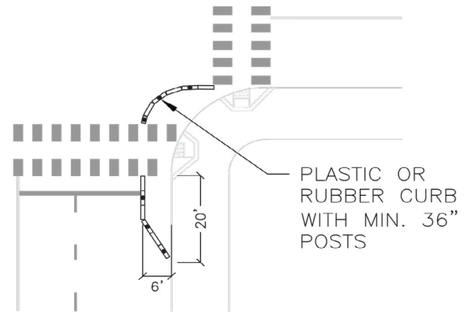
2. Flexible Post with Planter



3. Rubber Curb without Post



4. Rubber Curb with Post



20 0 20 40
GRAPHIC SCALE

Source: Berkeley Quick Build Guide

5. Rectangular Rapid Flashing Beacon

Definition

A rectangular rapid flashing beacon (RRFB) is a pedestrian-activated warning device with signage to alert motorists of a pedestrian crossing. It improves safety by increasing the visibility of marked crosswalks and provides motorists a cue to slow down and yield to pedestrians.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Typical Applicable Facility

URBAN

SUBURBAN

Cost

$$

Focus Crash Type: Through vehicle at unsignalized intersection, dart/dash, and multiple threat/trapped.

Safety System Strategy: Increases awareness.

Considerations: There is not a volume warrant associated with the use of this treatment. RRFBs can be installed on a ground mounted sign post, or light pole, and can be solar or hard wired.

How to identify candidate locations?

Existing marked crossings with low yielding rates of people driving, existing trail crossings, and at new crossing locations where the context suggests crossing enhancements such as an RRFB would be appropriate based on FHWA crossing guide.

What should be considered in the design?

Traffic volumes, speeds, number of lanes, presence of median, pedestrian demand, and location of other marked crossings should be considered in the selection of RRFB as a crossing treatment as well as the design features. The available sight distance should also be considered. RRFB systems that have dual sided systems as well as being installed in the median, have been shown to have higher rates of yielding to pedestrians. The FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations can be used to help identify is appropriate locations for RRFB installation as well as other treatments that should be paired with the RRFB. This is a FHWA proven safety countermeasure. See section 230.2.9 of the FDM and section 5.2.5.2 of the TEM for additional design considerations.

What materials are needed to implement this strategy?

This strategy requires signage, and RRFB equipment with painted crosswalk. Should be paired with enhanced crosswalk markings, advance yield markings, and other treatments appropriate for the context.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

6. Restripe Crosswalk

Definition

Periodic restriping of crosswalks is necessary to ensure the traffic markings are visible. Crosswalk may be restriped with high visibility markings.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Typical Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Pedestrian struck by turning vehicle, through vehicle at signalized intersection, and through vehicle at unsignalized intersection.

Safety System Strategy: Increase attentiveness and awareness.

Considerations: Crosswalk treatments should consider wear patterns and maintenance requirements. In addition to crosswalks, other painted roadway elements could also be considered for upgrades or enhancements.

How to identify candidate locations?

Existing marked crosswalks that are faded. Existing crosswalks on corridors where RRR projects are planned should be evaluated to determine if crosswalk markings should be upgraded.

What should be considered in the design?

At intersections where crosswalk markings seem to degrade quickly from wheel paths, the design of the lines and gaps should consider wheel paths to reduce the interval needed for restriping. Consider more durable treatment in high traffic areas.

See design considerations for marked pedestrian crosswalks and high visibility crosswalks.

What materials are needed to implement this strategy?

This strategy requires paint.

1. All-Way Stop Control (AWSC)

Definition

An all-way stop-controlled intersection requires all vehicles to stop before crossing the intersection and assigns the right-of-way by requiring vehicles at all approaches to come to complete stop before proceesing through the intersection..

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Angle crashes

Safe System Strategy: Manage conflicts in time.

Considerations: Consider incorporating with high visibility crosswalks. Advanced signage may be necessary depending on speed and other roadway characteristics. Installation of unwarranted AWSC can lower stopping compliance.

How to identify candidate locations?

All-way stop control warrants are provided in section 2B.12 of the Manual on Uniform Traffic Control Devices (MUTCD), and includes factors such as crash experience, sight distance, volumes, status as an interim treatment while a traffic signal is being installed, or other factors. Some communities are converting traffic signals that are no longer warranted to all-way stop-control.

What should be considered in the design?

The MUTCD warrant process should be followed based on an engineering study. In new developments, all-way stop-control can be installed on the basis of neighborhood design and projected volumes, including expected pedestrian and bicyclist volumes. See section 212.2.3 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy requires paint and signs, and can be coupled with other treatments, like high visibility crosswalks.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

2. Centerline Hardening

Definition

Physical elements on the centerline, like bollards and rubber curbs, that encourage slower vehicle turns.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Pedestrian struck by turning vehicle.

Safe System Strategy: Manage vehicular speeds.

Considerations: Design should consider truck volumes and resulting wheel track in placement of hardening features.

How to identify candidate locations?

Intersections where left-turns are permitted to travel at the same time as pedestrian movements. Locations with a history of turning vehicle conflicts with pedestrians should be prioritized. Hardened centerlines can be constructed rapidly and inexpensively using markings and flexible delineators.

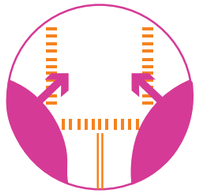
What should be considered in the design?

The types of vehicles expected to turn at the intersection should be considered to minimize the potential for large trucks to damage the treatment. Other treatments could include separating the pedestrian phase from the left-turning phase depending on the level of conflicts or including a leading pedestrian interval (LPI).

What materials are needed to implement this strategy?

Hardened centerlines can be constructed using quick curb and delineator posts or low-profile delineators placed along the yellow centerline at an intersection to block the diagonal path through the intersection and midblock and encourage drivers to turn left at a slower speed.

3. Curb Return Radius Reduction



Focus Crash Type: Speed related crashes, pedestrian struck by turning vehicle, and bicyclist struck by turning vehicle.

Safe System Strategy: Manage vehicular speeds.

Considerations: Can create drainage problems, larger vehicles and emergency vehicle access need to be considered in the design.

Definition

This refers to the curvature of the curb line when two streets intersect. Reducing the size of the curb return radius can decrease the speed of turning vehicles and reduce the length of pedestrian crossings.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$$

How to identify candidate locations?

Intersections with turn radii not appropriate for the current context. Can be prioritized at intersections where there is a history of speed related turning-crashes, especially those involving pedestrians or bicyclists.

What should be considered in the design?

The types of vehicles expected to turn at the intersection should be considered to minimize the potential for large trucks to damage the treatment. Treatment design should also consider emergency vehicle access as well as drainage. See Table 212.12.3 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

Can be constructed using paint and delineator posts, low profile delineators, planters or a combination of materials.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

4. Delineators, Reflectors or Object Markers

Focus Crash Type: Run off the road and collision with fixed objects.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: For surface-mounted delineators, the selection of adhesive should be carefully considered, especially in hot climates where durability may be affected. However, it is important to note that not all object markers require adhesive; many are ground-mounted or affixed to structures such as guardrails or utility poles using other methods.

Definition

Devices that warn drivers of an approaching curve or fixed object providing additional reaction time to slow down.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

How to identify candidate locations?

This treatment can be used in a variety of situations to warn people driving of various hazards, as well as to prevent turns and lane changes.

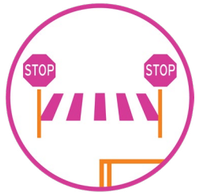
What should be considered in the design?

The type of hazard being addressed should be considered in the design. If being used to prevent turn movements, evaluate if there are other options for turns without resulting in significant out of the way travel. If the delineators are being used to prevent last-minute lane changes, ensure there is advance warning about the lane configuration so drivers can position themselves upstream. Similarly, for a curve or fixed object, confirm the presence of other advance warning signs. See section 230.2.7 of the FDM and MUTCD for additional design considerations.

What materials are needed to implement this strategy?

Delineator posts and potentially quick curb and paint are needed to implement this strategy. Can be paired with signage.

5. Double-Up Oversized Stop Signs



Definition

Treatment provides for left and right, oversized advance intersection warning signs. Retroreflective sheeting on sign posts and enhanced pavement markings that delineate through lane edge lines are typically provided.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

RURAL

Cost

$

Focus Crash Type: Run off the road, collision with fixed objects, angle crashes, and motorist failed to yield at unsignalized intersection.

Safe System Strategy: Increase attentiveness and awareness.

Considerations: Can also be paired with flashing beacons.

How to identify candidate locations?

High speed rural roads with infrequently placed traffic control devices.

What should be considered in the design?

The need for advanced intersection warning signs should be based on sight distance and other contextual factors. The need for stop bar relocation should also be evaluated. This is a FHWA proven safety countermeasure. The MUTCD provides guidance on advanced sign placement, based on speed and the type of condition.

What materials are needed to implement this strategy?

Upgraded signage is needed, which can be paired with flashing beacons and retroreflective sign treatments.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

6. Enhanced Daylighting/Slow Turn Wedge

Definition

Paint and bollards that extend the curb help increase safety by reserving space at intersections, preventing parking and loading activities that often block sight lines. This improves visibility for drivers and pedestrians while also slowing vehicle turns and travel speeds.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Pedestrian struck by turning vehicle and motorist turns left in path of bicyclist.

Safe System Strategy: Increase attentiveness and awareness.

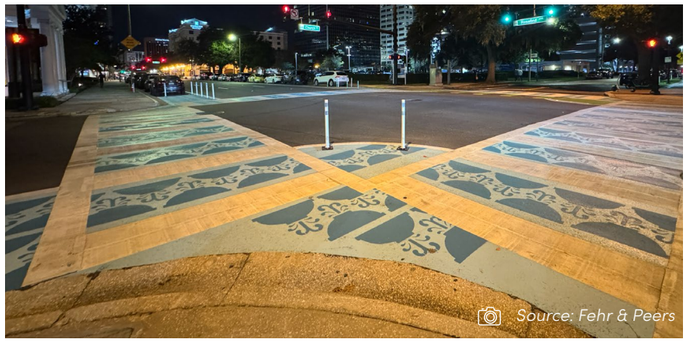
Considerations: Quick curb and other treatments can be used with minor impacts to drainage under Quick Build conditions.

How to identify candidate locations?

Locations with high levels of pedestrian and/or bicyclist crossings, coupled with higher-speed vehicle turns, may also experience improper parking or loading that obscures sight distance. In such cases, slow turn wedges, commonly installed at one-way street intersections, can help improve visibility and enhance safety by discouraging these activities and preserving clear sight lines.

What should be considered in the design?

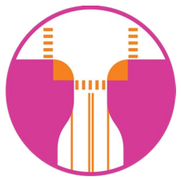
The types of vehicles that need to make the turn and the number of receiving lanes should be considered in the design.
See protected intersection for additional design considerations.


Source: Fehr & Peers

What materials are needed to implement this strategy?

The strategy requires paint. It can be coupled with quick curb, flexible delineator posts, or K-71 Bollards.

7. Gateway Treatments



Definition

Gateway treatments are intended to alert roadway users that they are entering a different context and that they should expect pedestrians/bicyclists.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Vehicle/pedestrian crashes and vehicle/bicyclist crashes.

Safe System Strategy: Increase attentiveness and awareness, and implement enforcing features to slow traffic.

Considerations: Consider the context of the area, including roadway geometry, traffic volumes, and the presence of pedestrians and bicyclists. Ensure the design elements, such as signage or curb extensions, effectively communicate the change in conditions without creating confusion or obstructing visibility. Additionally, prioritize materials and features that align with maintenance capabilities and community aesthetics. Examples of gateway treatments include signage, delineators, curb extensions, roundabouts, textured pavements, or other treatments intended to visually signal a changed condition to drivers.

How to identify candidate locations?

Locations where the context changes, like between a high-speed rural road and rural town where bicyclist and pedestrian activity is expected, or at the entrance to a residential street.

What should be considered in the design?

Gateway treatments can include a combination of vertical and horizontal elements, aimed at getting drivers attention and slowing their speeds. Treatments can include signage, speed tables, raised crossings, curb extensions, in-road signage, archways, and other features.

What materials are needed to implement this strategy?

The selection of materials will depend on the selected gateway treatment, but could include paint, quick-curb and flexible delineator posts.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

8. Lane Repurposing

Definition

Lane narrowing can encourage motorists to travel at slower speeds, which can reduce the severity of crashes.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Speed related crashes.

Safe System Strategy: Manage vehicular speeds and implement enforcing features to slow traffic.

Considerations: Lane narrowing through restriping can provide opportunities to widen bike lanes and provide additional buffers, or include on-street parking.

How to identify candidate locations?

Roads where there is excess capacity for vehicle travel, and lane repurposing could provide space for other road users and improve safety outcomes.

What should be considered in the design?

Existing and projected vehicle volumes should be a consideration, but are not the only consideration. Community feedback is a critical component of a lane repurposing project to inform the need for enhanced on-street bike lanes, vehicle parking, transit amenities, or other features specific for the community context. The FDOT lane repurposing guide should be consulted for lane repurposing on state roads. This is a FHWA proven safety countermeasure. See section 202.1.1 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy can be implemented with paint. Depending on the intersection traffic control, relocation of signal heads and adjustments to detection may be needed.

9. Hardened Median Nose Extensions

Definition

An extension of the median nose can reduce pedestrian exposure and can improve the crossing experience of multi-lane roadways.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Vehicle/pedestrian crashes, vehicle/bicyclist crashes, and left-turn crashes.

Safety System Strategy: Manage conflicts and increase attentiveness and awareness.

Considerations: Design should consider truck volumes and resulting wheel track in placement of median nose extension. Also, should evaluate U-turn paths if U turn is allowed.

How to identify candidate locations?

Intersections where left-turns are permitted to travel at the same time as pedestrian movements, or locations with long pedestrian crossing distances where hardening of the median nose provides some protection for people crossing the street. Locations with a history of turning vehicle crashes with pedestrians should be prioritized.

What should be considered in the design?

The types of vehicles expected to turn at the intersection should be considered to minimize the potential for large trucks to damage the treatment. Other treatments could include separating the pedestrian phase from the left-turning phase depending on the level of conflicts. See section 210.3.3 of the FDM for additional design considerations.

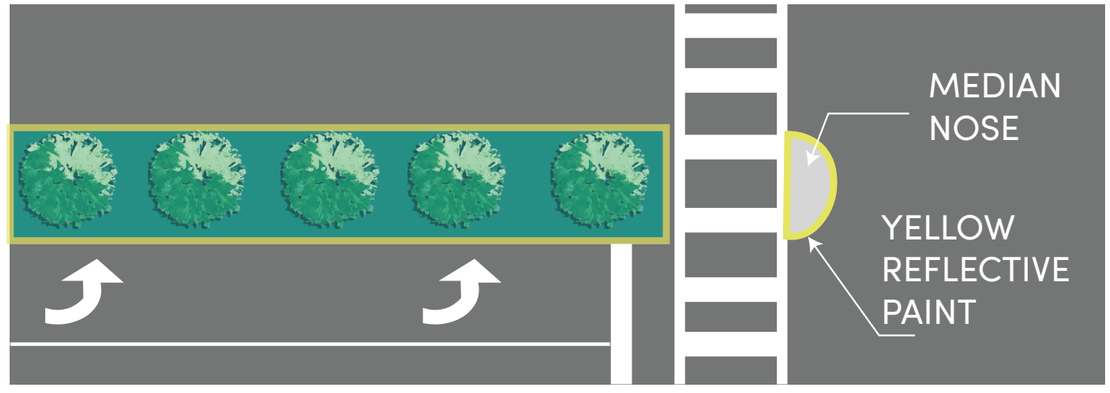
What materials are needed to implement this strategy?

This strategy can be implemented with paint and tubular markers.

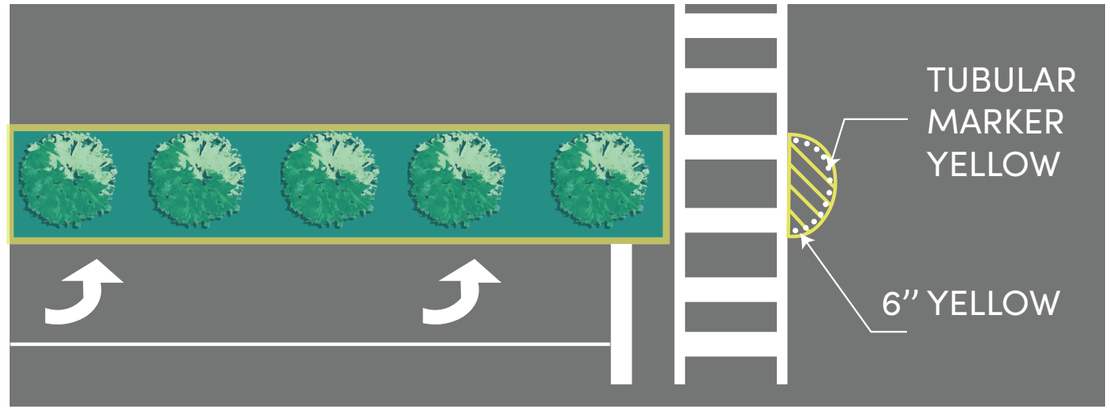
QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

For new and reconstruction projects with depressed crossings

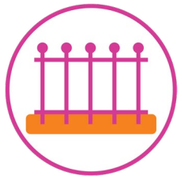


For RRR Projects where concrete median nose is not constructible in constrained conditions



Source: FDOT Standard Plans

10. Median Barrier



Definition

Barrier in the center of the roadway that physically separates opposing vehicular traffic and controls access to and from side streets and driveways, reducing conflict points. This may or may not have the intent of preventing pedestrian crossings. The potential for pedestrian diversion should be a primary factor in determining if this is an appropriate treatment.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$$

Cost vary widely depending on the length of treatment and materials used.

Focus Crash Type: Run off the road, collision with fixed objects, head-on, and median crossover crashes.

Safe System Strategy: Remove severe conflicts.

Considerations: Median breaks should be identified to allow maintenance and emergency vehicles to cross the median at appropriate locations.

How to identify candidate locations?

Median barriers are typically longitudinal barriers that separate opposing traffic on a divided highway and are designed to redirect vehicles striking either side of the barrier. Locations with head-on and median crossover crashes are candidate locations. Median fencing could be considered on corridors with high levels of pedestrian involved crashes.

What should be considered in the design?

AASHTO's Roadside Design Guide (RDG) provides guidelines for the use of median barriers based on speed, access controls, median width, and crash history. Median barriers are commonly cable, metal-beam, or concrete.

- Cable barriers are flexible barriers, made from steel cables mounted on weak steel posts, resulting in less occupant impact force as it absorbs energy from the crash, capturing or redirecting the vehicle.
- Metal-beam guardrails are considered semi-rigid barriers, where the W-beam or box-beam is mounted to steel or timber posts. When impacted, they are designed to deform and deflect, absorbing some of the crash energy and redirecting the vehicle.
- Concrete barriers are usually rigid and result in little to no deflection. They redirect rather than absorb energy from the impact. Rigid concrete barriers seldom require repair or maintenance. Some agencies have used portable concrete barriers as median barriers.

For corridors with high levels of pedestrian related crashes, median fencing coupled with the provision of more frequent marked and controlled crossings can be considered based on the road context. This is a FHWA proven safety countermeasure. See section 215.4.6.4 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

Concrete barriers could be used for a quick build on a high-speed arterial, while quick curb and delineator posts could channelize pedestrian travel to a safer location. These treatments should include regulatory signs to communicate prohibited pedestrian movements.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

11. On-Street Parking

Definition

On-street parking can provide a buffer between pedestrians/bicyclists and the travel lane, increasing safety and comfort. It can also be used to manage speeds when adjacent to a travel lane as parking maneuvers and driving next to parked vehicles creates friction that slows drivers.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Vehicle/pedestrian crashes.

Safe System Strategy: Implement enforcing features to slow traffic.

Considerations: If there are bike lanes or other bike facilities, a minimum of 3 feet should be provided to prevent "dooring". Providing the appropriate separation between the bicycle facility, travel lane, and parking lane is critical.

How to identify candidate locations?

Roads with wide curb lanes or where a lane repurposing is being considered.

What should be considered in the design?

The adjacent land uses and potential parking demand should be considered. The road type and vehicular volume should also be considered. If parking spaces will be marked, typically the minimum width of a parallel parking space is 8 feet. If there are bike lanes, a buffer between the parking lane and bike lane of at least 3 feet should be provided to prevent dooring. Consider the need for accessible parking as well as angle of parking based on available spaces. See section 202.3.2 and 210.2.3 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy can be implemented with paint and signage if there are any parking restrictions (time limits, street sweeping, etc.).

12. Paint and Plastic Median

Definition

A painted median with plastic posts between the two directions of travel, reducing vehicular speeding and discourages risky turning movements and manages pedestrian conflict points.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Pedestrian struck by turning vehicle and motorist turns left in path of bicyclist.

Safe System Strategy: Increase attentiveness and awareness, and implement enforcing features to slow traffic.

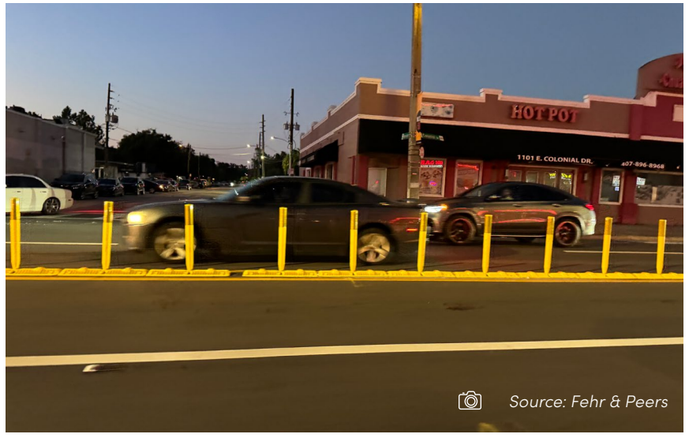
Considerations: If posts are routinely being knocked down, a different treatment may be warranted.

How to identify candidate locations?

Corridors where the left-turn demand extends beyond adjacent intersection/driveways and there is a desire to prevent turn movements in advance of the intersection. Can also be used when there is not an area outside the travel lane for left turns to wait for a gap in opposing travel.

What should be considered in the design?

Delineator posts should be spaced approximately 2 to 3 feet apart.



Source: Fehr & Peers

What materials are needed to implement this strategy?

This strategy can be implemented with quick curb and delineator posts.

13. Paint and Plastic Mini Circle/Mini Roundabout

Definition

Mini circles use paint and soft hit posts to replace stop-controlled intersections with a circular design that slows traffic and eliminates left turns and reduces conflicts. Mini roundabouts use curb treatments for a more permanent installation.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$-$$

Depending on the size of intersection and combination of materials used.

Focus Crash Type: Angle crashes and left turn crashes.

Safe System Strategy: Remove severe conflicts and implement enforcing features to slow traffic.

Considerations: These should only be considered on low volume, low speed streets where trucks are not routinely expected to be.

How to identify candidate locations?

Unsignalized intersections where there is a history of angle or left-turn crashes, as well as a desire to slow the speed of vehicle travel. Low volume residential streets are primary candidates.

What should be considered in the design?

The design should consider the types of vehicles including emergency vehicle access that routinely use the corridor to minimize vehicle wheel path traversing the treatment.

What materials are needed to implement this strategy?

This strategy can be implemented with a combination of paint, signage, quick curb and delineator posts, low profile delineators, and/or planter boxes.

Source: Planet Bike

14. Refuge Island

Definition

It provides a raised barrier in the center of the roadway, reducing pedestrian exposure by offering a place to wait if they are unable to finish crossing. While it does not reduce the number of conflict points, it helps reduce pedestrian exposure to potential hazards.

Crash Reduction Effectiveness

LOW | MED | HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$$

Focus Crash Type: Dart/dash, through vehicle at signalized intersection, and through vehicle at unsignalized intersection.

Safety System Strategy: Manage conflicts in time, and increase attentiveness and awareness.

Considerations: Pedestrian refuge areas can be constructed from paint and plastic as part of a low-cost/Quick Build project.

How to identify candidate locations?

Midblock multilane pedestrian crossings or crossings at large multilane intersections. Roads with a median or center left-turn lane are ideal candidates. Can be coupled with curb extensions to further reduce the pedestrian exposure.

Refuge islands should be prioritized for midblock pedestrian crossings on roads with four or more travel lanes, especially where speed limits are 35 mph or greater and/or where annual average daily traffic (AADT) is 9,000 or higher. They are also a candidate treatment option for uncontrolled pedestrian crossings on 3-lane or 2-lane roads that have high vehicle speeds or volumes. When installed at a midblock crossing, the island should be supplemented with a marked high-visibility crosswalk.

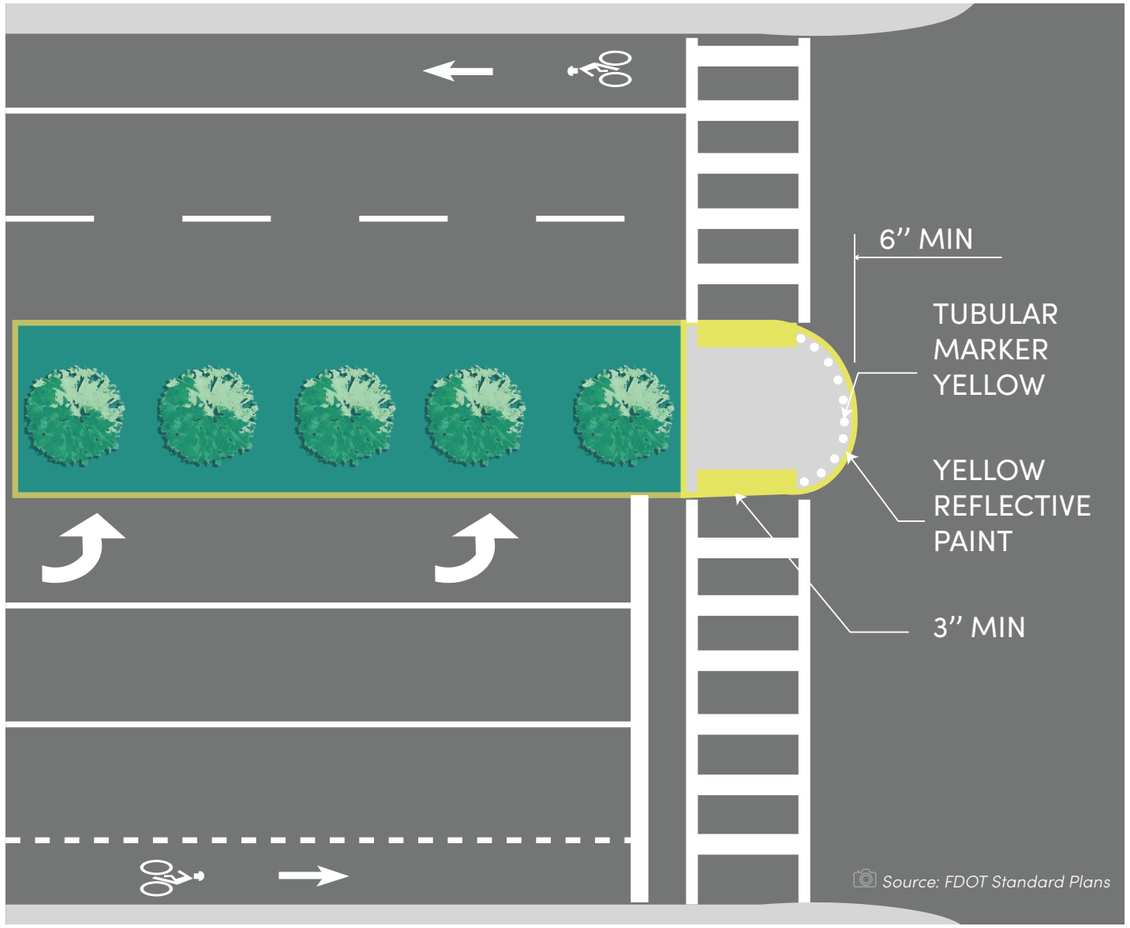
What should be considered in the design?

The minimum length of a refuge island is 4 feet, with 8 feet preferred and width is 5 feet. If bicyclists are expected, the minimum length should be 8 feet with 10 to 12 feet preferred. The island should provide sufficient length and width to accommodate the expected user types, including people with bike trailers.

This countermeasure can be paired with high visibility crosswalks, curb extensions, rectangular rapid flashing beacons. Curb ramps should provide detectable warning tiles where the island meets the roadway. This is a FHWA proven safety countermeasure. See section 210.3.2.3 of the FDM and section 5.2.7.5 of the TEM for additional design considerations.

QUICK BUILD TREATMENTS

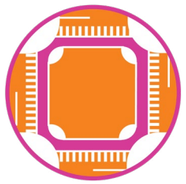
Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies



What materials are needed to implement this strategy?

For a low cost/Quick Build application, a combination of materials, such as ceramic markers, planters, paint, tubular markers and/or delineators may be used.

15. Protected Intersection



Definition

Protected intersections use corner islands, curb extensions, and colored paint to delineate bicycle and pedestrian movements across an intersection, slowing driving speeds and providing shorter crossing exposure.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Cost reflects paint and bollards only.

Focus Crash Type: Pedestrian struck by turning vehicle, motorist turns right in path of bicyclist, and motorist failed to yield at signalized intersection.

Safe System Strategy: Remove severe conflicts, manage vehicular speeds, manage conflicts in time, and increase attentiveness and awareness.

Considerations: Drainage, turning vehicle paths and ADA requirements should be considered.

How to identify candidate locations?

Protected intersections are most effective at locations with high volumes of bicyclists and motorists, or medium to high volumes of bicyclists, pedestrians and motorists, and can also be installed where enhanced bicyclist comfort is desired. They are typically provided on roads with parking protected bike lanes, protected bike lanes or two-way separated bike lanes.

What should be considered in the design?

There are numerous interacting design elements of a protected intersection with the most important including:

1 **No Stopping/No Standing Zone:** Motor vehicle parking and stopping are prohibited on the approach to the intersection.

2 **Bike Yield Line (optional):** Depending on the level of potential conflict between pedestrians and bicyclist.

3 **Pedestrian Islands:** Islands reduce crossing exposure and improve visibility by keeping the intersection clear. Wider islands support high volumes of people walking and biking, raising the capacity of the intersection. In some cases, islands can reduce the signal timing when pedestrian ramps and signals are adjusted.

4 **Bike Queue Area:** People biking can wait ahead of the crosswalk for a green signal or a gap in traffic. This shortens crossing distances and accommodates the natural positioning of people biking. Bike detection should be incorporated.

QUICK BUILD TREATMENTS

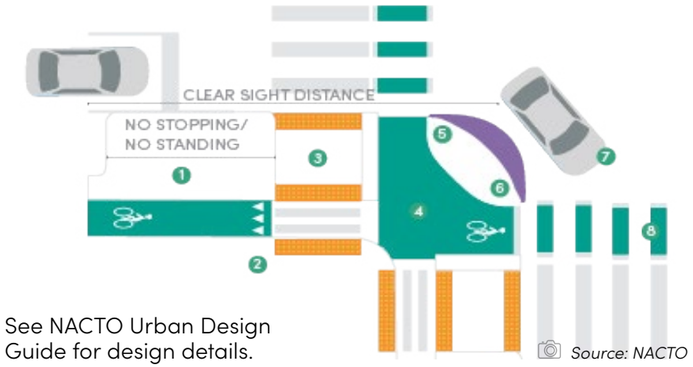
Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

5 **Bikeway Setback:** The setback determines how much room will be available for drivers to wait and yield, and the angle at which they cross the bikeway. Larger setbacks provide better visibility and give people bicycling more time to notice and react to turning vehicles.

6 **Corner Island:** A corner island separates bikes from motor vehicles, prevents motor vehicles from encroaching on the bikeway, and creates a protected queuing area for people on bikes waiting to turn.

7 **Motorist Waiting Zone:** The space between the motor vehicle lane and the crossbike provides a place for motor vehicle drivers to wait before turning across the bike's path of travel

8 **Intersection Crossing Markings:** Markings provide conspicuity and directional guidance to bikes in the intersection. They are marked with dotted bicycle lane line extensions and may be supplemented with green color or bike symbols between these lines



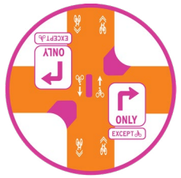
Source: NACTO

See NACTO Urban Design Guide for design details.

What materials are needed to implement this strategy?

This strategy requires quick curb and deineator posts. For Quick Build application, can be paired with enhanced crosswalk markings, advance stop bars, and other treatments appropriate for the context.

16. Partial Closure/Diverter



Definition

A roadway treatment that restricts select vehicle movements using physical diversion while allowing bicyclists and pedestrians to proceed.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Pedestrian and bicycle crashes.

Safe System Strategy: Remove severe conflicts and implement enforcing features to slow traffic.

Considerations: Should be implemented as part of a larger traffic calming plan to minimize effects of diverted traffic to residential streets.

How to identify candidate locations?

Neighborhood streets where cut-through traffic is a documented issue and traffic calming or other measures have not significantly reduced cut-through travel, or issues associated with cut-through travel, like speeds excessive for the context. Traffic diversion should be used as a last resort, and in conjunction with area wide analyses to identify how vehicle diversion might affect other roads.

What should be considered in the design?

A diverter is typically an island built at a residential street intersection that prevents certain through and/or turning movements. Typically, pedestrian and bicyclist access is maintained and consider emergency vehicle access. There are four general types of diverters:

- **Diagonal:** breaks up cut-through movements and forces right or left turns in certain directions.
- **Star:** consists of a star-shaped island placed at the intersection, which forces right turns from each approach.
- **Forced turn:** island diverters can be placed on one or more approach legs to prevent through and left-turn movements and force vehicles to turn right.
- **Truncated:** a diverter with one end open to allow additional turning movements.

A full street closure requires the provision of a turn-around area

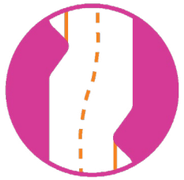
QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

What materials are needed to implement this strategy?

For a low cost / Quick Build application, a combination of materials, including paint, signage, quick-curb, delineator posts, and planters can be used.

1. Chicane



Definition

Uses centerline deflection within existing curb by placing vertical barriers (e.g., curbs, on-street parking) to require vehicle operators to make frequent horizontal movements, which typically reduces vehicular speeds.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$$

Focus Crash Type: Speed related crashes.

Safe System Strategy: Manage vehicular speeds, and implement enforcing features to slow traffic.

Considerations: Can create drainage problems, potential for head-on collisions increases depending on context, and may be difficult for large trucks to navigate.

How to identify candidate locations?

Chicanes are a traffic calming device that are typically installed on low volume/low speed two-lane streets or one-lane one-way streets. Local streets with high speed vehicle traffic are candidate locations.

What should be considered in the design?

There are numerous design considerations depending on the roadway context and existing design parameters, including:

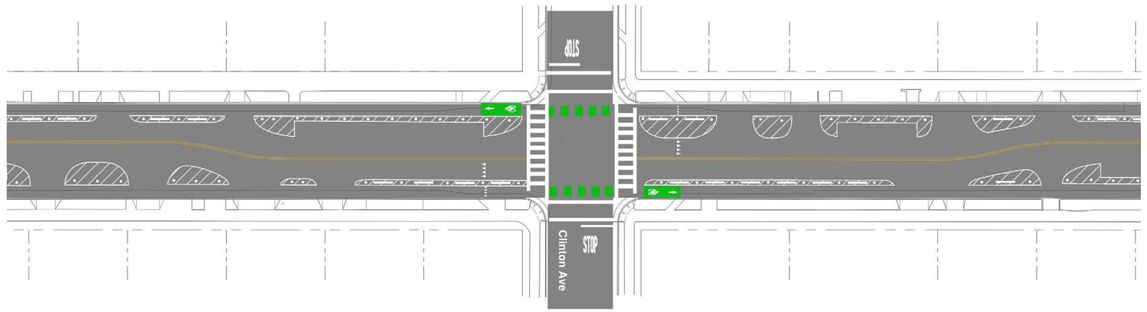
- **Alternating parking:** On streets with parking on one side, chicanes can be created by alternating parking from side to side. If the parking is not well utilized, the treatment may not have the desired effect.
- **Curb extensions:** Curb extensions can be used to create a curved one-lane segment of roadway by alternating from one side of the street to the other.
- **Return angle:** Chicanes can be designed with a 45 degree return angle.
- **S-shaped roadway:** A more gradual taper and transition can be used to create an S-shaped roadway.

Chicanes can also be coupled with bike lanes. See section 202.3.3 of the FDM for additional design considerations.

QUICK BUILD TREATMENTS

Signal | Signing & Striping | Bikeways | Pedestrian Facilities | Intersection & Roadways | Speed Management | Other Strategies

Source: Fehr & Peers



Source: Fehr & Peers

Source: Fehr & Peers

Source: FDOT

What materials are needed to implement this strategy?

For a low cost/Quick Build application, a combination of materials, such as ceramic markers, planters, paint, tubular markers and delineators.

2. Lane Narrowing

Focus Crash Type: Speed related crashes.

Safe System Strategy: Manage vehicular speeds and implement enforcing features to slow traffic.

Considerations: Lane narrowing through restriping can provide opportunities to widen bike lanes.

Definition

Lane narrowing can encourage motorists to travel at slower speeds, which can reduce the severity of crashes.

Crash Reduction Effectiveness

UNKNOWN

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

How to identify candidate locations?

Multilane roads with lanes wider than the required minimums, typically 10-12 feet depending on the context classification and posted speed limit.

What should be considered in the design?

Roads that have an upcoming RRR project should be evaluated for the potential to narrow lanes as a part of that process. Multilane roads with bike lanes should also be evaluated for the potential to narrow travel lanes and increase the width of the bike lane or add a buffer. See section 202.3.4 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

This strategy requires paint. Depending on the extent of the lane narrowing, signal head locations and detection may need to be adjusted.

3. Speed Feedback Sign

Focus Crash Type: Speed related crashes.

Safe System Strategy: Create awareness about features to slow traffic.

Considerations: Some units can collect data to identify the most prevalent times of day/week for speeding to inform law enforcement activities.

Definition

Notifies drivers of their current speed, usually followed by a reminder of the posted speed limit, providing a cue for drivers to check their speed and slow down.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

How to identify candidate locations?

Speed feedback signs are most commonly installed in school zones, at curves, and on roads where people are reported to drive in excessive of the posted speed limit. Temporary speed feedback signs can be installed in work zones.

What should be considered in the design?

Locations where people routinely drive in excess of the posted speed limit can be identified using connected vehicle data. This data can be paired with crash data to identify an overlap in locations with high rates of speeding and speed related crashes. Contextual information can also be considered, such as speeding around school zones, parks, on local streets, or other contexts where higher levels of pedestrian and bicyclist activity might be expected. See section 202.3.9 of the FDM for additional design considerations.

What materials are needed to implement this strategy?

A speed feedback unit or speed feedback sign is required. These can either be permanent installations or mobile units that can be moved between corridors. Most are solar powered, eliminating the need to run power. Some units are able to collect data for further analysis.

4. Speed Humps/Speed Cushions/Raised Crosswalks

Definition

Vertical deflection device to raise the entire wheelbase of a vehicle and encourage motorists to travel at slower speeds.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

URBAN

SUBURBAN

Cost

$

Focus Crash Type: Speed related crashes.

Safe System Strategy: Manage vehicular speeds and implement enforcing features to slow traffic.

Considerations: Drainage and emergency vehicle access will need to be considered. Speed cushions may be more appropriate on roadways with frequent emergency response vehicles.

How to identify candidate locations?

Locations where speed management is being considered, typically at midblock crossing locations.

What should be considered in the design?

Road function and context, target speed and prevailing speed, and level of pedestrian/bicyclist activity should be considered in the design. If the corridor is used as a primary route for emergency vehicles, speed cushions should be considered. Raised crosswalks can be considered at pedestrian crossing locations. Consultation with first responders should be conducted, depending on the road context and function.

Source: Traffic Logix

What materials are needed to implement this strategy?

Temporary traffic calming materials, including rubber cushions, lumps, crosswalks, and humps.

1. Remove Obstruction from Sightlines

Definition

Remove objects that may prevent drivers and pedestrians from having a clear sightline, such as installing red curb at intersection approaches to remove parked vehicles (also called "daylighting"), trimming or removing landscaping, or removing or relocating large signs.

Crash Reduction Effectiveness

LOW MED HIGH

CMF Available

Modal Safety Emphasis

Applicable Facility

ALL ROADWAYS

Cost

$

Focus Crash Type: Angle crashes, pedestrian struck by turning vehicle, motorist failed to yield at unsignalized intersection, motorist failed to yield at signalized intersection, and bicycle sidewalk crashes.

Safety System Strategy: Increase attentiveness and awareness.

Considerations: Landscaping obstructions may require more routine maintenance.

How to identify candidate locations?

Locations include areas with on-street parking, high levels of landscaping utility corridors where utility pole could block sightlines, areas around interchanges and bridges where structures could block sightlines, and in areas with curves and hills where the physical landscape could block sightlines.

What should be considered in the design?

A high-level crash analysis can be conducted to screen candidate locations based on focus crash types. Field investigations are necessary to document obstructions.

What materials are needed to implement this strategy?

Materials will depend on the type of obstruction. For a parked vehicle obstruction, paint at a minimum is required to mark a no-parking zone. For landscaping obstructions, additional maintenance is required. For other obstructions, it may require sign relocation to remove the obstruction or sign installation to note the presence of an obstruction, or prohibition of turns on red in the case of a physical barrier that cannot be moved.

05

DOCUMENTATION AND EVALUATION

Source: Fehr & Peers

At the outset of the Quick Build process, identification of the appropriate level of documentation and analysis are key pieces of project implementation. The documentation and analysis should focus on the project goals. For example, if a Quick Build project is being installed as a temporary measure to gain community consensus and inform the design features of a permanent installation, the documentation and analysis may be different than for the blanket application of low cost/Quick Build systemic strategies.

This chapter provides considerations for project evaluation, stakeholder engagement, and other project documentation. This information should be used to supplement other local jurisdiction requirements or grant requirements.


Source: City of Orlando

All treatments are intended to reduce the frequency and severity of crashes to improve crash outcomes.

A project evaluation plan should be established for each project based on data that is relatively easy to obtain. In many instances, it will be critical to have before data to compare the project condition.

Treatments included in this document are generally intended to reduce the frequency and severity of crashes. However, most crash evaluations are based on years of data, and it may be necessary to develop safety proxies for each type of treatment such that the after evaluation can occur within months of implementation, not years.


Source: City of Orlando

Project evaluation should include the following general steps:

01 Selection of appropriate performance metrics based on crash history, project context, and project goals, including road user behaviors the treatment is aiming to change

02 Before data collection, including public feedback

03 After data collection, including public feedback

04 Evaluation

05 Documentation and sharing of lessons learned

Source: Fehr & Peers

In some instances, the before and after data will include a component of public sentiment and should be coordinated with the public engagement plan for the project.

The performance measures and metrics shown in **Table 2** are not intended to be all-encompassing and additional metrics may be identified in consultation with project stakeholders and the public.

Safety/crash outcomes should be considered a key performance metric for all treatments, with the metrics below focused on data that can be collected through a limited data collection effort.

Field observations should capture the same general time periods during the before and after data collection periods, and should aim to collect a statistically significantly number of observations.

TABLE 2 POTENTIAL COUNTERMEASURE EVALUATION METRICS

TREATMENT NAME	POTENTIAL PERFORMANCE MEASURE	DATA/METRIC
Signals		
Extend Pedestrian Crossing Time	Change in close calls Increase % of pedestrians crossing completed within allocated time	Field observations Survey of population within project vicinity
Extend Yellow and All Red Time	Change in red-light running Increase road user signal compliance	Near Miss assessment Field observation
Leading Pedestrian Interval	Change in close calls Increase yielding rates Increase % of pedestrians crossing	Field observations Survey of population within project vicinity
Pedestrian Recall	Reduce close calls Increase yielding rates Increase % of pedestrians crossing with the signal	Field observations
Pedestrian Only Phase	Reduce close calls Increase % of pedestrians and bicyclists crossing with the signal	Field observations Survey of population within project vicinity
Prohibit Right Turn on Red	Reduce Close Calls Increase yielding rates Increase % of pedestrians crossing with the signal	Field observations Near Miss analysis
Shorten Cycle Lengths	Red-light running Increased signal compliance for all road uses Overall intersection operations	Near Miss Analysis Intersection operations analysis Field observations
Retroreflective Signal Backplates	% of drivers disobeying the traffic control device	Field Observations Near Miss Analysis
Emergency Vehicle Signal Preemption	Change in emergency response time	Feedback from first responders
Signing and Striping		
Advance Stop Bar	Change in percent of drivers stopping within the crosswalk	Field Observations Survey of population within project vicinity
Advance Yield Markings	Change in yielding rates	Field Observations Survey of population within project vicinity
Chevron Signs on Horizontal Curves	Speed of vehicles approaching and through the curve	Percentage of drivers traveling above the advised speed
Advance Curve Warning Sign	Speed of vehicles approaching and through the curve	Percentage of drivers traveling above the advised speed

TREATMENT NAME	POTENTIAL PERFORMANCE MEASURE	DATA/METRIC
Stop for Pedestrian Sign	Change in yielding rates	Field observation
LED Enhanced Sign	Compliance with applicable sign	Field observations
Painted Centerline and Raised Pavement Markers at Curves	Speed of vehicles approaching and through the curve	Percentage of drivers traveling above the advised speed
Pavement Speed Legends	Change in vehicle speeds	Percentage of drivers traveling above the posted speed
Prohibit Left Turn	Compliance with prohibition Change in close calls	Field observation Enforcement reports
Time-Based Turn Restrictions	Compliance with prohibition Change in close calls	Field observation Enforcement reports
Striping through Intersection	Change in close calls	Field observation Positioning of vehicles traveling through intersection
Upgrade Intersection Pavement Markings	Change in yielding rates	Field observations
Upgrade signs with Fluorescent Sheeting	Compliance with applicable sign	Field observations
Upgrade Striping	Change in yielding rates	Field observations
Upgrade to Larger Warning Signs	Compliance with applicable sign	Field observations
Bikeways		
Bicycles Allowed Use Full Lane Sign	Decrease in unsafe passing behavior Position of bicyclist in lane Change in contraflow bike travel	Field observation Feedback from bicyclists who ride the corridor
Bike Lane/Buffered Bike Lane	Increased bike ridership Change in vehicle speed Increased comfort for bicyclists Change in contraflow bike travel	Field observation Speed survey Feedback from bicyclists who ride the corridor
Separated Bikeway	Change in bike ridership Change in comfort for bicyclists Change in yielding rates Change in contraflow bike travel Change in vehicle speeds	Field observation Speed survey Feedback from bicyclists who ride the corridor
Parking Buffer	Change in vehicle speeds Change in contraflow bike travel	Speed survey Field observation

TREATMENT NAME	POTENTIAL PERFORMANCE MEASURE	DATA/METRIC
Extend Bike Lane to Intersection	Change in bike ridership Change in comfort for bicyclists Change in near misses	Field Observation Feedback from bicyclists who ride the corridor
Mixing Zone	Change in bike ridership Change in comfort for bicyclists Change in yielding rates	Field Observation Feedback from bicyclists who ride the corridor
Bike Box	Change in bike ridership Change in comfort for bicyclists Change in yielding rates	Field Observation Feedback from bicyclists who ride the corridor
Two-Stage Turn Queue Bike Box	Change in bike ridership Change in comfort for bicyclists Change in yielding rates	Field Observation Feedback from bicyclists who ride the corridor
Floating Transit Island	Reduction in conflicts between bikes and buses Reduction in transit delay	Field observations Feedback from transit operators
Bicycle Crossing	Change in bike ridership Change in comfort for bicyclists Change in yielding rates	Field Observation Feedback from bicyclists who ride the corridor
Green Conflict Striping	Change in bike ridership Change in comfort for bicyclists Change in yielding rates	Field Observation Feedback from bicyclists who ride the corridor
Pedestrian Facilities		
High Visibility Crosswalk	Change in yielding rates Change in pedestrian activity	Field observations
Co-locate Bus Stops and Pedestrian Crossings	Change in pedestrian walking distance to nearest crossing location from transit stops Change in use of designated pedestrian crossing locations Feedback from transit riders	Field measurement Field Observation Feedback from people who use transit in the corridor
Mark Pedestrian Crossings	Change in yielding rates Change in pedestrian activity	Field observations
Curb Extensions	Change in crossing distance Change in yielding rates Change in pedestrian activity	Field measurements Field observations
Rectangular Rapid Flashing Beacon	Change in yielding rates Change in crossing activity	Field observations
Restripe Crosswalk	Change in yielding rates Change in crossing activity	Field observations
Intersections and Roadways		
All Way Stop Control	% of drivers disobeying the traffic control device	Field observation Enforcement reports

TREATMENT NAME	POTENTIAL PERFORMANCE MEASURE	DATA/METRIC
Centerline Hardening	Change in speed of turning vehicle Change in yielding rates Change in reported near misses	Speed survey Field observation Community feedback
Curb Return Radius Reduction	Change in speed of turning vehicle Change in yielding rates Change in reported near misses	Speed survey Field observation Community feedback
Delineators, Reflectors or Object Markers	Change in speed of turning vehicle Change in yielding rates Change in reported near misses	Speed survey Field observation Community feedback
Double-up Oversized Stop Signs	Change in compliance with traffic control device	Field observation
Enhanced Daylighting/Slow Turn Wedge	Change in speed of turning vehicle Change in yielding rates Change in reported near misses	Speed survey Field observation Community feedback
Gateway Treatments	Change in speed of turning vehicle Change in reported near misses	Speed survey Community feedback
Lane Repurposing	Change in multimodal volumes Change in vehicle speeds Change in yielding rates Change in vehicle traffic on parallel routes Feedback from the community	Speed survey Traffic counts Field observation Community feedback
Hardened Median Nose Extension	Change in speed of turning vehicle Change in yielding rates Change in reported near misses	Speed survey Field observation Community feedback
Median Barrier	Reduction in near misses Change in pedestrians crossing at undesignated locations	Field observations Community feedback
On-Street Parking	Change in vehicle speeds	Speed survey
Paint and Plastic Median	Change in near-misses Change in travel speed	Field observations Speed survey
Paint and Plastic Mini Circle/Mini Roundabout	Change in vehicle speeds	Speed survey
Refuge Island	Change in comfort for people walking/biking	Community feedback Field observations
Protected Intersection	Change in vehicle turn movement speeds Change in comfort for people walking/biking Change in yielding rates Change in multimodal travel	Speed survey Community feedback Field observations Multimodal traffic counts

PROJECT EVALUATION

TREATMENT NAME	POTENTIAL PERFORMANCE MEASURE	DATA/METRIC
Partial Closure/Diverter	Change in vehicle speeds Change in cut-through traffic Change in multimodal volumes in general area	Speed survey Community feedback Field observations Multimodal traffic counts
Speed Management		
Chicane	Change in vehicle speeds	Speed survey
Lane Narrowing	Change in vehicle speeds	Speed survey
Speed Feedback Sign	Change in vehicle speeds	Speed survey
Speed Cushion/Speed Table/Speed Humps	Change in vehicle speeds	Speed survey
Other Strategies		
Remove Obstructions for Sightlines	Change in near-misses	Field observations

At the outset of project development, a list of potential stakeholders should be identified to solicit feedback about the project and aid in the development of performance measures. At the outset of the project, the agency should determine the extent to which feedback will be incorporated.

For example, in a community-led project where key community stakeholders can greatly influence the outcome, the level of community engagement will need to be extensive.

A lane repurposing project may require a greater level of community involvement than the modification of an intersection to provide a median refuge or the addition of a speed feedback sign.

A pilot project using Quick Build materials can be essential for controversial projects and can be used to build consensus and identify design features that should be incorporated into a permanent installation.


Source: Fehr & Peers


Source: City of Orlando

ENGAGEMENT PLAN

The engagement plan should consist of the following elements:

01

Establish project purpose and need, and identify key stakeholders

02

Establish overall project schedule and how each potential stakeholder will contribute to the projects success

03

Determine methods to conduct outreach to public, including workshops, field reviews, and online engagement

Project stakeholders could include:

CITY DEPARTMENTS

- Planning
- Public Works
- Parks and Recreation
- Traffic
- Economic Development
- Legal
- Procurement

EMERGENCY SERVICES

- Police
- Fire
- Emergency Medical Services (EMS)

OTHER AGENCIES

- FDOT
- County
- LYNX
- Utility companies

COMMUNITY GROUPS

- HOAs
- Neighborhood Groups
- Faith Based Groups
- School Communities
- Main Streets
- Transportation Disadvantaged
- Users of a corridor


Source: Fehr & Peers

06

REFERENCES

Source: Fehr & Peers

Source: City of Orlando

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