

Engineering Counter- measure Toolbox

Appendix

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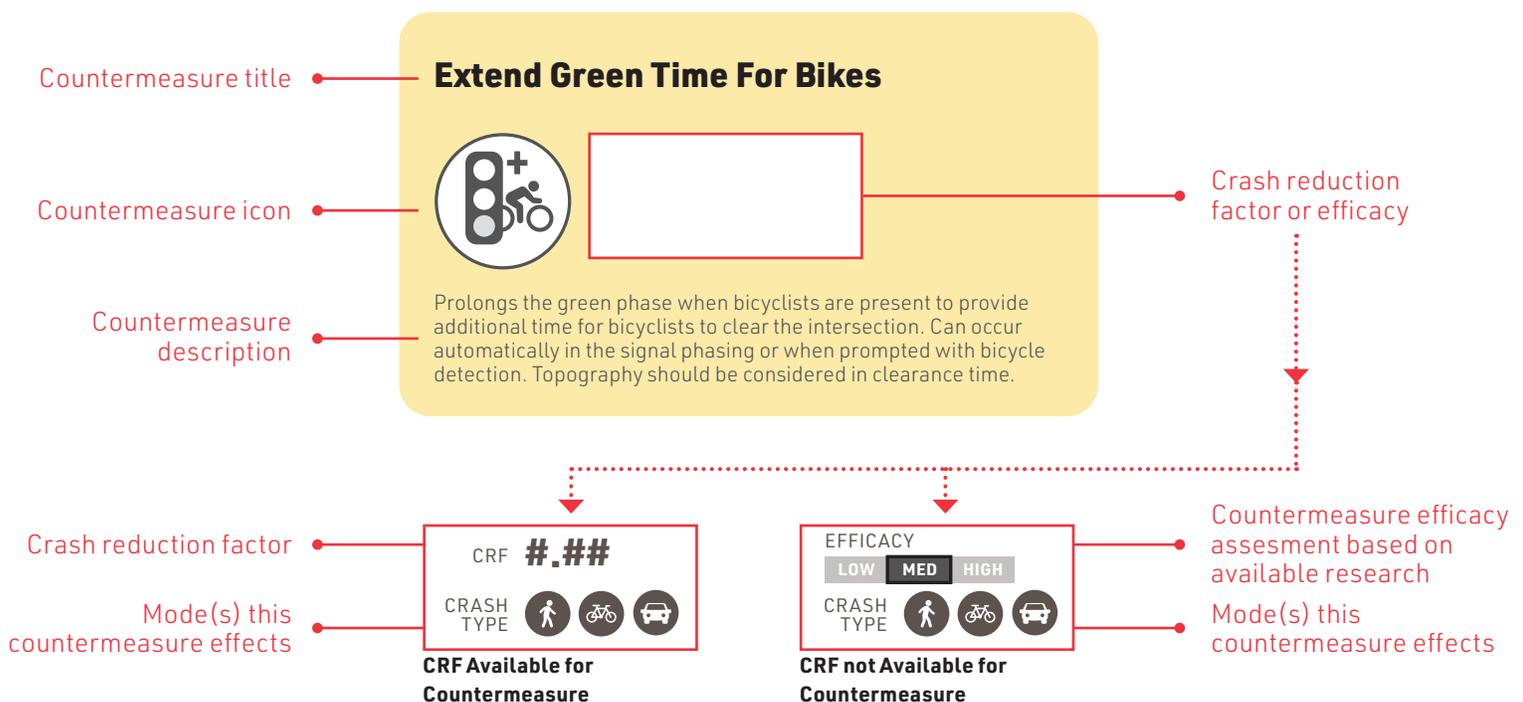


Safety Countermeasures Toolbox

This Toolbox Presents Safety Countermeasures Applicable in Different Roadway Contexts Across Pinellas County

Many of the countermeasures are FDOT-approved, with an associated **Crash Reduction Factor (CRF)** and crash type (i.e., all modes, bicycle and pedestrian crashes only, etc.) as documented by the Federal Highway Administration. The higher the CRF (1 being the highest), the greater the expected reduction in crashes. Countermeasures without a CRF are scored on a “low-medium-high” efficacy scale based on proven safety studies; otherwise, denoted as “N/A” when limited safety studies are available. The higher the efficacy rating, the greater the expected reduction in crashes. Crash Reduction Factors shown here represent an average reduction for comparison purposes. As CRFs can be context specific and new data is continually being added, the user should consult the FHWA’s Crash Modifications Factors Clearinghouse (<http://www.cmfclearinghouse.org/>) for the most current guidance and to identify other potential treatments that may not be documented here.

What You’ll See Inside



Safety Efficacy Sources

- Application of Pedestrian Crossing Treatments for Streets and Highways, NCHRP, 2016.
- Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments, NCHRP, 2017.
- Evaluation of Bicycle-Related Roadway Measures, Pedestrian and Bicycle Information Center, 2014.
- Evaluation of Pedestrian-Related Roadway Measures, Pedestrian and Bicycle Information Center, 2014.
- 2015 FDOT Highway Safety Manual Users Guide
- Highway Safety Manual, AASHTO
- USDOT FHWS Office of Safety

Summary of Countermeasures

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Automatic Recall Signal Timing
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Bike Detection

D. Bikeway Design, Cont.

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G. Low-Cost & Quick-Build

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Left Turn Enhanced Daylighting/Slow Turn Wedge
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Paint and Plastic Median
Paint and Plastic Mini Circle
Paint and Plastic Pedestrian Refuge Area
Paint and Plastic Separated Bikeway
Traffic Diverter

A. SIGNAL TIMING & PHASING

Additional Signal Heads



CRF **0.15**
 CRASH TYPE   

Additional signal heads allow drivers to anticipate signal changes farther away from intersections, decreasing the likelihood of driver error resulting in a collision.

Advanced Dilemma-Zone Detection



CRF **0.39**
 CRASH TYPE 

Enhances safety at signalized intersections by adjusting traffic signal timing on the fly to reduce the number of people driving that may have difficulty deciding whether to stop or proceed during a yellow phase. This may reduce rear-end crashes associated with unsafe stopping and angle crashes due to red-light running.

Automatic Recall Signal Timing



EFFICACY
LOW MED HIGH
 CRASH TYPE   

Signals can be put in "recall" all the time or for key time periods of the day. The "walk" and/or corresponding green signal would be displayed every signal cycle without prompting by a person walking or from vehicle detection. This can ensure bicyclists get a green signal every cycle and discourages red-light running by people biking.

Extend Green Time For Bikes



CRF **0.15**
 CRASH TYPE   

Prolongs the green phase when bicyclists are present to provide additional time for bicyclists to clear the intersection. Can occur automatically in the signal phasing or when prompted with bicycle detection. Topography should be considered in clearance time.

Extend Pedestrian Crossing Time



CRF **0.15**
 CRASH TYPE   

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

Extend Yellow and All Red Time



CRF **0.15**
 CRASH TYPE   

Extending yellow and all red time allows drivers and bicyclists to safely cross through a signalized intersection before conflicting traffic movements are permitted to enter the intersection.

Flashing Yellow Turn Phase



CRF **N/A**
 CRASH TYPE 

Flashing yellow turn arrow alerts drivers to proceed with caution and decide if there is a sufficient gap in oncoming traffic to safely make a turn. To be used only when a pedestrian walk phase is not called. Protected only phases should be used when pedestrians are present.

Green Wave



CRF **0.15**
 CRASH TYPE   

Occurs when a series of traffic signals are coordinated to allow for uninterrupted bicycle traffic flow through those intersections in at least one direction. Coordinating signals to allow for bicyclist progression gives bicyclists and pedestrians more time to safely cross through the 'green wave' intersections.

A. SIGNAL TIMING & PHASING

Leading Pedestrian Interval



CRF **0.15**
 CRASH TYPE   

Gives people walking a head start, making them more visible to drivers turning right or left. "WALK" signal comes on a few seconds before the cars get their green light. May be used in combination with No Right Turn on Red restrictions.

New Traffic Signal



CRF **0.25**
 CRASH TYPE   

New traffic signals can help to organize travel of all modes at an intersection, limiting interactions between vehicles, pedestrians, and bicyclists with conflicting movements.

Pedestrian Phase Recall



EFFICACY
 LOW MED **HIGH**
 CRASH TYPE 

Signals can be put in "recall" for key time periods of day such as peak business hours or school drop-off/pick-up times. During these periods the "WALK" signal would be displayed every signal cycle without prompting by a pedestrian push button.

Pedestrian Scramble



CRF **0.15**
 CRASH TYPE   

This is a form of pedestrian 'walk' phase at a signalized intersection in which all vehicular traffic is required to stop, allowing pedestrians to safely cross through the intersection in any direction, including diagonally, if marked and signed accordingly.

Permissive Lefts to Protected



CRF **0.30-0.55**
 CRASH TYPE   

Provides a protected green arrow phase for left turning vehicles while showing a red light for both on-coming traffic and parallel pedestrian crossings. Eliminates conflicts between pedestrians and left-turning vehicles.

Reduce Cycle Lengths



CRF **0.15**
 CRASH TYPE   

Traffic signal cycles should be kept short (preferably 90 seconds maximum) to reduce pedestrian delay. When delay is significant, pedestrians are more inclined to ignore signal indications.

Separate Right-Turn Phasing



EFFICACY
 LOW MED **HIGH**
 CRASH TYPE   

Provides a green arrow phase for right-turning vehicles. Avoids conflicts between right-turning traffic and bicyclists or pedestrians crossing the intersection on their right.

B. INTERSECTION & ROADWAY DESIGN

Close Slip Lane



EFFICACY

LOW MED HIGH

CRASH TYPE   

Modifies the corner of an intersection to remove the sweeping right turn lane for vehicles. Results in shorter crossings for pedestrians, reduced speed for turning vehicles, better sight lines, and space for landscaping and other amenities.

Convert 2-Way Stop to All-Way Stop



CRF **0.50**

CRASH TYPE   

Converting 2-way stops to all-way stops prevents motorists, bicyclists, and pedestrians from having to cross free-flowing lanes of traffic at a side-street stop-controlled intersection and reduces the risk of collision.

Lane Narrowing



CRF **0.30**

CRASH TYPE   

A reduction in lane width produces a traffic calming effect by encouraging motorists to travel at slower speeds, lowering the risk of collision with bicyclists, pedestrians, and other motorists.

Multi-Lane Roundabout



CRF **varies**

CRASH TYPE   

Similar to a single-lane roundabout but on a multi-lane road. Studies have shown total increases in collisions but decreases in collisions where someone is killed or seriously injured with multi-lane roundabouts.

New Sidewalk

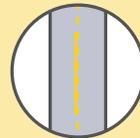


CRF **0.35**

CRASH TYPE  

Sidewalks and walkways are "pedestrian lanes" that provide people with space to travel within the public right-of-way that is separated from roadway vehicles. They are associated with reduced crashes where pedestrians were walking along the roadway.

No Passing Zone



EFFICACY

LOW MED HIGH

CRASH TYPE 

Converting a passing zone (where a vehicle uses the opposing lane of traffic to pass another vehicle) to a no-passing zone may reduce head-on or run-off-the-road crashes.

Partial Closure/Diverter



CRF **0.50**

CRASH TYPE   

A roadway treatment that restricts through vehicle movements using physical diversion while allowing bicyclists and pedestrians to proceed through an intersection in all directions.

Positive Left-Turn Off-Set



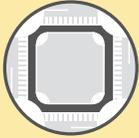
CRF **0.34**

CRASH TYPE 

Sifting left-turn lanes so they are not aligned directly across from the opposing left-turn lane and adjacent to the through travel lane can improve sight distance at intersections where permitted left-turn phasing is employed.

B. INTERSECTION & ROADWAY DESIGN

Protected Intersection



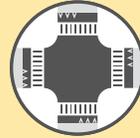
EFFICACY

LOW MED **HIGH**

CRASH TYPE   

Protected intersections use corner islands, curb extensions, and colored paint to delineate the bicycle path across an intersection and allow a two-stage left-turn for bicycles parallel to the crosswalk. Provides space for drivers to yield outside the travel lane.

Raised Intersection



CRF **0.35**

CRASH TYPE  

Elevates the intersection to bring vehicles to the sidewalk level. Serves as a traffic calming measure by extending the sidewalk context across the road.

Raised Median



CRF **0.25-0.50**

CRASH TYPE   

A concrete or landscaped area, between the two directions of travel. Reduces vehicular speeding and discourages risky turning movements.

Realign Intersections to 90 Degrees



EFFICACY

LOW MED HIGH

CRASH TYPE   

By eliminating acute or obtuse angles between intersection roadways, intersection sight distance may be improved, allowing motorists to see pedestrians more easily.

Repurpose Extra Travel Lanes



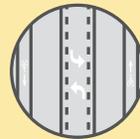
EFFICACY

LOW MED **HIGH**

CRASH TYPE   

Repurposing travel lanes at spot locations, such as extra receiving lanes at an intersection, is a strategy used to make space for other safety improvements such as, widening sidewalks, creating space for bicycle, pedestrian, or transit lanes, and other improvements.

Road Diet



CRF **0.30**

CRASH TYPE   

Depending on the street, road diets may change the number of lanes, turn lanes, center turn lanes, bike lanes, parking lanes, and/or sidewalks. Road diets optimize street space to benefit all users by improving the safety and comfort of pedestrians and bicyclists, and reducing vehicle speeds and the potential for rear end collisions.

Roundabout



CRF **varies**

CRASH TYPE   

Roundabouts are circular intersections designed to eliminate left turns by requiring traffic to travel in a counter-clockwise direction and exit to the right. Installed to manage vehicular speeds, reduce pedestrian exposure, improve safety at intersections through eliminating angle collisions, and help traffic flow more efficiently.

Speed Humps or Speed Tables



EFFICACY

LOW MED **HIGH**

CRASH TYPE   

These traffic calming devices use vertical deflection to raise the entire wheelbase of a vehicle and encourage motorists to travel at slower speeds to avoid damage to the undercarriage of an automobile.

B. INTERSECTION & ROADWAY DESIGN

Splitter Island



CRF **0.25**

CRASH TYPE 

A raised area that separates the two directions of travel on the minor street approach at an unsignalized intersection or roundabout. Helps channelize traffic in opposing directions of travel. Typically installed at skewed intersections or where speeds on minor roads are high.

Two-Stage Gap Acceptance



EFFICACY

LOW MED **HIGH**

CRASH TYPE 

Two-stage gap acceptance provides a refuge in the median for vehicles making a left turn onto a busy street in two stages. This design allows people driving to focus on finding a gap in traffic in one direction of travel instead of both.

Widen Shoulder



CRF **0.30**

CRASH TYPE 

Widened shoulders create a separated space for bicyclists and also provide motor vehicle safety benefits, such as space for inoperable vehicles to pull out of the travel lane.

C. SIGNS & MARKINGS

Advance Stop Bar



CRF **0.15**
 CRASH TYPE  

A stop bar placed 5 to 7 feet ahead of the crosswalk at stop signs and signals reduces instances of vehicles encroaching on the crosswalk.

Advance Warning Sign



CRF **0.36**
 CRASH TYPE   

A sign placed to warn a person driving of an upcoming curve, stop sign, traffic signal, roundabout, pedestrian crossing, or other potential point of conflict where a person driving may need to slow down or use caution. Signs can include flashing beacons to enhance awareness.

Advance Yield Markings



CRF **0.25**
 CRASH TYPE   

Yield lines are placed 20 to 50 feet in advance of pedestrian crossings to increase visibility of pedestrians. Can reduce the likelihood of a multiple-threat crash at unsignalized midblock crossings.

Bicycles May Use Full Lane Sign



CRF **0.15**
 CRASH TYPE   

A sign placed on roads with lanes that are too narrow to allow safe side-by-side passing to indicate that bicyclists may occupy the full lane. This discourages unsafe passing by motorists.

No Right Turn On Red



EFFICACY
 LOW MED **HIGH**
 CRASH TYPE   

Can help prevent crashes between vehicles turning right on red from one street and through vehicles on the cross street, and crashes involving pedestrians. Should be considered where exclusive pedestrian "WALK" phases, LPIs, sight distance issues, or high pedestrian volumes are present.

Parking Restrictions/Daylighting



EFFICACY
 LOW MED **HIGH**
 CRASH TYPE   

By restricting parking at curbs in front of intersection crosswalks, sight lines are cleared between pedestrian crossings and oncoming motorists, reducing the risk of collision.

Speed Feedback Sign



CRF **0.30**
 CRASH TYPE   

A roadway treatment that uses radar to alert drivers to their actual speed relative to the posted speed limit, encouraging drivers who exceed to the speed limit to slow down.

Time-Based Turn Restriction



EFFICACY
 LOW MED **HIGH**
 CRASH TYPE   

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

C. SIGNS & MARKINGS

Turn Prohibition



EFFICACY

LOW **MED** HIGH

CRASH TYPE



Bans left or right turns at locations where a turning vehicle may conflict with pedestrians in the crosswalk or where opposing traffic volume is high. Reduces pedestrian interaction with vehicles when crossing. Important tool when road diets are infeasible and a grid network of streets is present.

Wayfinding



CRF

N/A

CRASH TYPE



A network of signs that highlight nearby pedestrian and bicycle facilities. Can help to reduce crossings at locations with poor sight distance or limited crossing enhancements.

Yield To Pedestrians Sign



CRF

0.15

CRASH TYPE



The "Yield Here to Pedestrians" (e.g. R1-5, R1-5a) signs alert drivers about the presence of pedestrians. These signs are required with Advance Yield Lines. Other sign types (e.g. R1-6) can be placed on the centerline in the roadway.

Variable Message Sign



EFFICACY

LOW **MED** HIGH

CRASH TYPE



Variable message signs are electronic signs that allow for varying messages. Variable message signs can be used to warn people driving of slowdowns ahead, decreasing rear-end crashes.

D. BIKEWAY DESIGN

Bicycle Crossing (Solid Green Paint)



EFFICACY

LOW MED HIGH

CRASH TYPE

Solid green paint across an intersection that signifies the path of the bicycle crossing. Increases visibility and safety of bicyclists traveling through an intersection.

Bicycle Ramps



CRF **N/A**

CRASH TYPE

Connects bicyclists from the road to the sidewalk or a shared use path.

Bicycle Signal/Exclusive Bike Phase



CRF **0.30**

CRASH TYPE

A traffic signal directing bicycle traffic across an intersection. Separates bicycle movements from conflicting motor vehicle, streetcar, light rail, or pedestrian movements. May be applicable for separated or buffered facilities when the bikeway is brought up to the intersection.

Bike Box



CRF **0.15**

CRASH TYPE

A designated area at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase.

Bike Detection



CRF **N/A**

CRASH TYPE

Bike detection is used at signalized intersections, either through use of push-buttons, in-pavement loops, or by video or infrared cameras, to call a green light for bicyclists and reduce delay for bicycle travel. Discourages red light running by bicyclists and increases convenience of bicycling.

Bike Friendly Drains



EFFICACY

LOW MED HIGH

CRASH TYPE

Bike friendly drains avoid placing grating in the right-of-way that may pose a hazard to bicyclists by increasing their risk of falling.

Bicycle Path or Mixed Use Trail



CRF **0.80**

CRASH TYPE

Provides a completely separate right of way that is designated for the exclusive use of people riding bicycles and walking with minimal cross-flow traffic. Paths and trails offer opportunities for the lowest stress bicycle travel.

Bike Lane



CRF **0.35**

CRASH TYPE

Using designated lane markings, pavement legends, and signage, bike lanes provide dedicated street space for bicyclists, typically adjacent to the outer vehicle travel lane.

D. BIKEWAY DESIGN

Separated Bikeway



CRF **0.35**
 CRASH TYPE  

Space on the roadway set aside for the exclusive use of bicycles and physically separated from vehicle traffic. Types of separation may include, but are not limited to, grade separation, flexible posts, physical barriers, or on-street parking.

Floating Transit Island



CRF **N/A**
 CRASH TYPE  

An in-street transit boarding island is used in conjunction with a separated bikeway, separating transit traffic from bicycle traffic, reducing conflict between the two modes and lowering the risk of collision.

Green Bike Lane Conflict Zone Markings



EFFICACY
LOW MED HIGH
 CRASH TYPE 

Green pavement within a bicycle lane to increase visibility of bicyclists and to reinforce bicycle priority. The green pavement can be either as a corridor treatment or as a spot treatment in conflict areas such as frequently used driveways.

Mixing Zone



EFFICACY
 LOW **MED** HIGH
 CRASH TYPE  

Places a suggested bike lane within the inside portion of a dedicated motor vehicle turn lane. Lane markings delineate space for bicyclists and motorists within the same lane and indicate the intended path for bicyclists to reduce conflict with turning motor vehicles.

"On Roadway" Bicycle Sign



CRF **0.15**
 CRASH TYPE   

Street sign that communicates to drivers that bicyclists are on the road. Signs enhance visibility for bicyclists, reminding drivers that they are on the road.

Parking Buffer



CRF **N/A**
 CRASH TYPE  

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

Shared Sidewalk Sign



EFFICACY
LOW MED HIGH
 CRASH TYPE  

Signs communicate to pedestrians that bicyclists may also use the sidewalk and that bicyclists must yield to pedestrians.

Signing and Striping in Support of Bicycle Boulevard



CRF **0.35**
 CRASH TYPE  

Bicycle boulevards are roads that encourage low automobile traffic volumes and speeds through signing and striping while giving bicyclists priority and encouraging non-motorized travel.

D. BIKEWAY DESIGN

Traffic Calming in Support of Bicycle Boulevard



EFFICACY

LOW MED **HIGH**

CRASH TYPE



Traffic calming includes measures that encourage slower speeds to bring automobile speeds closer to those of bicyclists. This has the effect of reducing in-lane passing, improving driver perception and reaction time, and reducing the severity of collisions.

Trail Crossing



CRF **N/A**

CRASH TYPE



A continental crosswalk with a bike stamp in the middle, placed at locations where trails intersect with or cross the roadway.

Two-Stage Turn Queue Bike Box



EFFICACY

LOW MED HIGH

CRASH TYPE



This roadway treatment provides bicyclists with a means of safely making a left or right turn at a multi-lane signalized intersection from a bike lane or cycle track on the opposite side of the lane. In this way, bicyclists are protected from the flow of traffic while waiting to turn.

Widen Sidewalk



CRF **N/A**

CRASH TYPE



Wide sidewalks can provide space for both pedestrians and bicyclists to use a shared facility. Wide sidewalks can be important for locations with high volumes of pedestrians.

E. PEDESTRIAN CROSSINGS

ADA Ramps & Audible Push Button Upgrades



CRF **0.25**
 CRASH TYPE  

Curb ramps and push buttons must comply with Americans with Disability Act (ADA) standards for accessibility. Pushbuttons should be visible and conveniently located for pedestrians waiting at a crosswalk. Accessible pedestrian signals, including audible push buttons, improve access for pedestrians who are blind or have low vision.

Curb Extensions



EFFICACY
 LOW MED HIGH
 CRASH TYPE   

Widens the sidewalk at intersections or midblock crossings to shorten the pedestrian crossing distance, to make pedestrians more visible to vehicles, and to reduce the speed of turning vehicles.

Extended Time Pushbutton



CRF **0.25**
 CRASH TYPE  

A pushbutton that can be pressed to request extra time for crossing the crosswalk, beyond the standard crossing time. Ideal near senior-serving land uses.

High-Visibility Crosswalk



CRF **0.25-0.35**
 CRASH TYPE   

A crosswalk that is designed to be more visible to approaching drivers. Crosswalks should be designed with continental markings, also known as ladder markings, and use high-visibility material such as inlay tape or thermoplastic tape instead of paint.

Pedestrian Countdowns



CRF **0.25**
 CRASH TYPE  

Displays "countdown" of seconds remaining on the pedestrian signal. Countdown indications improve safety for all road users, and are required for all newly installed traffic signals where pedestrian signals are installed.

Pedestrian Detection



CRF **0.25**
 CRASH TYPE  

An intersection treatment that relies on sensors to detect when a pedestrian is waiting at a crosswalk and automatically trigger the pedestrian 'walk' phase.

Pedestrian Hybrid Beacon



CRF **0.55**
 CRASH TYPE  

Pedestrian-activated beacon used at mid-block crosswalks and side-street stop controlled crossing locations to notify oncoming motorists to stop with a series of red and yellow lights.

Pedestrian Lighting

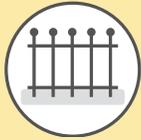


CRF **0.35-0.40**
 CRASH TYPE    NIGHT TIME

At pedestrian crossings, research indicates pedestrian lighting should be placed 10 feet from the crosswalk, in between the approaching vehicles and the crosswalk. At intersections, pedestrian lighting should also be placed before the crosswalk on the approach into the intersection.

E. PEDESTRIAN CROSSINGS

Pedestrian Median Barrier



CRF **0.35**
 CRASH TYPE

Pedestrian median barriers restrict pedestrians from crossing the median at locations where nearby crossings are available and midblock crossings may have poor sight distance or insufficient crossing enhancements for the conditions.

Pedestrian Refuge Island



CRF **0.25-0.45**
 CRASH TYPE

Pedestrian refuge islands provide a protected area for pedestrians at the center of the roadway. They reduce the exposure time for pedestrian crossing the intersection. They simplify crossings by allowing pedestrians to focus in one direction of traffic at a time.

COUNTERMEASURE

Raised Crosswalk



CRF **0.35**
 CRASH TYPE

The crosswalk is elevated to match the sidewalk to make pedestrians more visible to approaching vehicles. Typically located at midblock crossings, they encourage motorists to yield to pedestrians and reduce vehicle speed.

Remove Crossing Prohibition



CRF **0.25**
 CRASH TYPE

Removes existing crossing prohibitions and provides marked crosswalk and other safety enhancements for pedestrians to cross the street.

Restripe Crosswalk



CRF **0.25**
 CRASH TYPE

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

Rectangular Rapid Flashing Beacon



CRF **0.35**
 CRASH TYPE

Pedestrian-activated flashing lights and additional signage enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings.

Straighten Crosswalks



EFFICACY
 LOW MED HIGH
 CRASH TYPE

Straightening crosswalks improves sight lines, making people walking more visible to oncoming people driving, and may shorten the crossing distance, reducing the length of time required for people walking to cross an intersection.

Upgrade Curb Ramp



CRF **N/A**
 CRASH TYPE

Curb ramps must follow Americans with Disabilities Act (ADA) design guidelines. Tactile warning devices must be detectable to visually impaired pedestrians.

F. OTHER

Access Management/Close Driveway



CRF **N/A**
 CRASH TYPE   

Vehicles entering and exiting driveways may conflict with pedestrians and with vehicles on the main road, especially at driveways within 250 feet of intersections. Closing driveways near intersections with high crash rates related to driveways may reduce potential conflicts.

Automated Speed Enforcement



CRF **0.48**
 CRASH TYPE   

Speed cameras are a type of automated enforcement that use cameras as well as radar or in-ground sensors to detect speed and identify the associated vehicle. Speed cameras can substantially reduce speed-related crashes.

Context-Sensitive Speed Limits



CRF **Varies**
 CRASH TYPE   

Reducing speed limits in combination with roadway design changes to encourage lower speeds can help reduce the severity of collisions when they do occur. Arbitrarily reducing speed limits without corresponding roadway design changes can be counterproductive.

Curbside Management



CRF **N/A**
 CRASH TYPE   

Curbside management can better prioritize reliable transit and safe bicycling infrastructure, freight deliveries, passenger pick-ups/drop-offs, green stormwater infrastructure, public spaces, and parking management.

Development-Related ROW Improvements



CRF **N/A**
 CRASH TYPE   

Request or require that developers help fund pedestrian, bicycle, and transit access infrastructure improvements around their developments.

Far-Side Bus Stop



CRF **N/A**
 CRASH TYPE  

Far-side bus stops are located immediately after an intersection, allowing the bus to pass through the intersection before stopping for passenger loading and unloading. Far-side stops encourage pedestrians to cross behind the bus for greater visibility, and can improve transit service reliability. Should be combined with crossing treatments at intersections. Also appropriate for school bus stops.

Incident Management Protocols



EFFICACY
LOW **MED** **HIGH**
 CRASH TYPE 

Use protocols to quickly move queue causing vehicles including those that are disabled or were involved in a minor crash.

Intersection, Street-Scale Lighting



CRF **0.40**
 CRASH TYPE    **NIGHT TIME**

Street and intersection lighting helps make other road users or hazards more visible to motorists at night, improving driver perception and reaction time and reducing the risk of collision.

F. OTHER

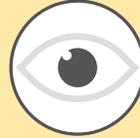
Keep Roadway Clear of Debris



CRF **N/A**
 CRASH TYPE

A smoothly paved surface free of debris enhances safety for vehicles and bicyclists.

Remove Obstructions For Sightlines



CRF **0.20**
 CRASH TYPE

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

Speed Feedback Sign



CRF **0.05**
 CRASH TYPE

A roadway treatment that uses radar to alert people driving to their actual speed relative to the posted speed limit, encouraging people driving who exceed the speed limit to slow down.

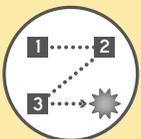
Targeted Enforcement



EFFICACY **LOW MED HIGH**
 CRASH TYPE

Targeted enforcement is used to reduce the most dangerous behaviors (such as speeding, distracted driving, aggressive driving, impaired driving, and red-light and stop sign running), particularly at locations with a history of such behaviors. People driving are less likely to participate in dangerous behaviors when they know there is a higher likelihood they will be caught.

Traffic Incident Management



EFFICACY **LOW MED HIGH**
 CRASH TYPE

Traffic incident management is a planned and coordinated multidisciplinary process to detect, respond to and clear traffic incidents so that traffic flow may be restored as safely.

Variable Speed Limit



EFFICACY **LOW MED HIGH**
 CRASH TYPE

Speed limit signs that can be adjusted depending on roadway conditions. Reducing the speed limit when conditions are less optimal such as during inclement weather, poor road conditions or when there is heavy traffic can reduce the likelihood of severe crashes.

G. LOW-COST & QUICK-BUILD

Hardened Centerline



CRF **0.10**
 CRASH TYPE   

Uses paint to widen left-turn radii and rubber curb with plastic bollards on the receiving roadway's centerline to modify the angle of motorists turning left. Widening the turning radii of left-turning vehicles expands the field of vision for drivers and increases the visibility of pedestrians.

Left Turn Enhanced Daylighting/ Slow Turn Wedge



CRF **0.10**
 CRASH TYPE   

Uses paint and bollards to extend the curb and slow left turns at intersections of one-way to one-way or two-way streets. Widening the turning radii of left-turning vehicles expands the field of vision for drivers and increases the visibility of pedestrians.

Paint and Plastic Curb Extension



EFFICACY
 LOW MED HIGH
 CRASH TYPE   

Widens the sidewalk at intersections or midblock crossings to shorten the pedestrian crossing distance, to make pedestrians more visible to motorists, and to reduce the speed of turning vehicles.

Paint and Plastic Median



CRF **0.25**
 CRASH TYPE   

A painted median with plastic posts, between the two directions of travel. Reduces vehicular speeding and discourages risky turning movements.

Paint and Plastic Mini Circle



EFFICACY
 LOW MED HIGH
 CRASH TYPE   

Mini circles use paint and soft hit posts to replace stop-controlled intersections with a circular design that calms traffic and eliminates left turns. Installed to reduce vehicular speeds, improve safety at intersections by reducing severe collisions, and help traffic flow more efficiently.

Paint and Plastic Pedestrian Refuge Area



CRF **0.25-0.45**
 CRASH TYPE   

Paint and plastic post pedestrian refuge spaces provide a designated area for pedestrians at the center of the roadway. Pedestrian refuge areas constructed from paint and plastic should be implemented in conjunction with additional safety projects, such as an Rectangular Rapid Flashing Beacon (RRFB) or road diet, to reduce pedestrian exposure.

Paint and Plastic Separated Bikeway



CRF **0.35**
 CRASH TYPE  

A lane on the roadway dedicated to bicycles that is physically separated from vehicles by a raised barrier of plastic posts and painted pavement.

Traffic Diverter



EFFICACY
 LOW MED HIGH
 CRASH TYPE   

Traffic diverters use paint, plastic posts, and/or planters to divert auto traffic from a residential street. The diverters do allow bicycles to enter the approach, reducing conflict between bicyclists and vehicles.

