STEP

Safe Transportation for Every Pedestrian

EDC





Rectangular Rapid Flashing Beacons

Duane Thomas, Federal Highway Administration
Megan McCarty Graham, Toole Design

October 30, 2018

U.S. Department of Transportation
Federal Highway Administration

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What is “Every Day Counts”(EDC)?

State-based model to identify and rapidly deploy proven but underutilized innovations to

- shorten the project delivery process
- enhance roadway safety
- reduce congestion
- improve environmental sustainability

EDC-5 STEP: The Spectacular Seven

- Leading Pedestrian Interval
- Crosswalk Visibility Enhancements
- Raised Crosswalks
- Pedestrian Refuge Island
- Rectangular Rapid-Flashing Beacon
- Pedestrian Hybrid Beacon
- Road Diets





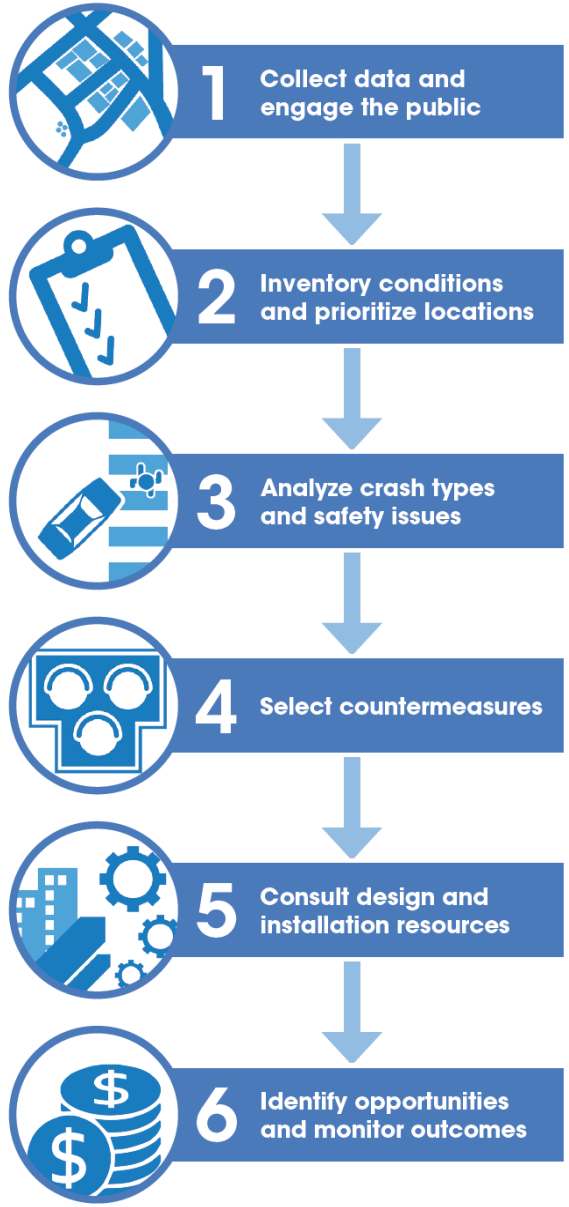


Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

Follows a 6-step process

Guides the selection of countermeasures to improve pedestrian safety

Supported by a "Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations"



4 Select countermeasures

July 2018 version includes RRFB

Highlights situations where a marked crosswalk *alone* is not sufficient

Presents *options* for countermeasure selection

Table 1. Application of pedestrian crash countermeasures by roadway feature.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	❶ 2 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6 7 9	① 5 6 7 9	① 5 6 ❾
3 lanes with raised median (1 lane in each direction)	❶ 2 3 4 5	❶ ❸ 5 7 9	① ❸ 5 ❼ ❾	① 3 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❼ ❾	① ❸ 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❾
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	❶ 2 3 4 5 6 7 9	❶ ❸ 5 6 7 9	① ❸ 5 6 ❾	① 3 4 5 6 7 9	① ❸ 5 6 ❼ ❾	① ❸ 5 6 ❾	① ❸ 4 5 6 7 9	① ❸ 5 6 ❾	① ❸ 5 6 ❾
4+ lanes with raised median (2 or more lanes in each direction)	❶ ❸ 5 7 8 9	❶ ❸ 5 7 8 9	① ❸ 5 8 ❾	① ❸ 5 7 8 9	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 ❼ 8 ❾	① ❸ 5 6 8 9	
4+ lanes w/o raised median (2 or more lanes in each direction)	❶ ❸ 5 6 7 8 9	① ❸ 5 ❻ 7 8 9	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ 7 8 9	① ❸ 5 ❻ ❼ 8 ❾	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ ❼ 8 ❾		

Given the set of conditions in a cell,

- # Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- ● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
- ○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1 High-visibility crosswalk markings, parki… crosswalk approach, adequate nighttime lighting levels, and crossing warning sign
2 Raised crosswalk
3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
4 In-Street Pedestrian Crossing sign
5 Curb extension
6 Pedestrian refuge island
7 Rectangular Rapid-Flashing Beacon (RRFB)**
8 Road Diet
9 Pedestrian Hybrid Beacon (PHB)**

*Refer to Chapter 4, "Using Table 1 and Table 2 to Select Countermeasures," for more information about using multiple countermeasures.
**The PHB and RRFB are not both installed at the same crossing location.

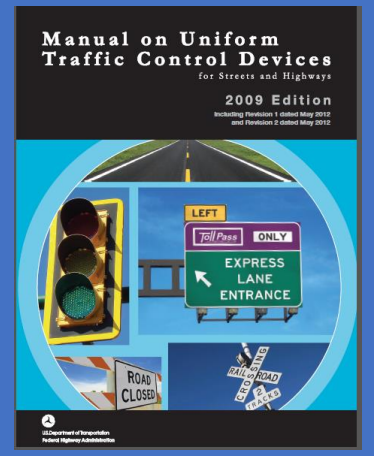
Rectangular Rapid-Flashing Beacons (RRFBs)

Duane H. Thomas, P.E.

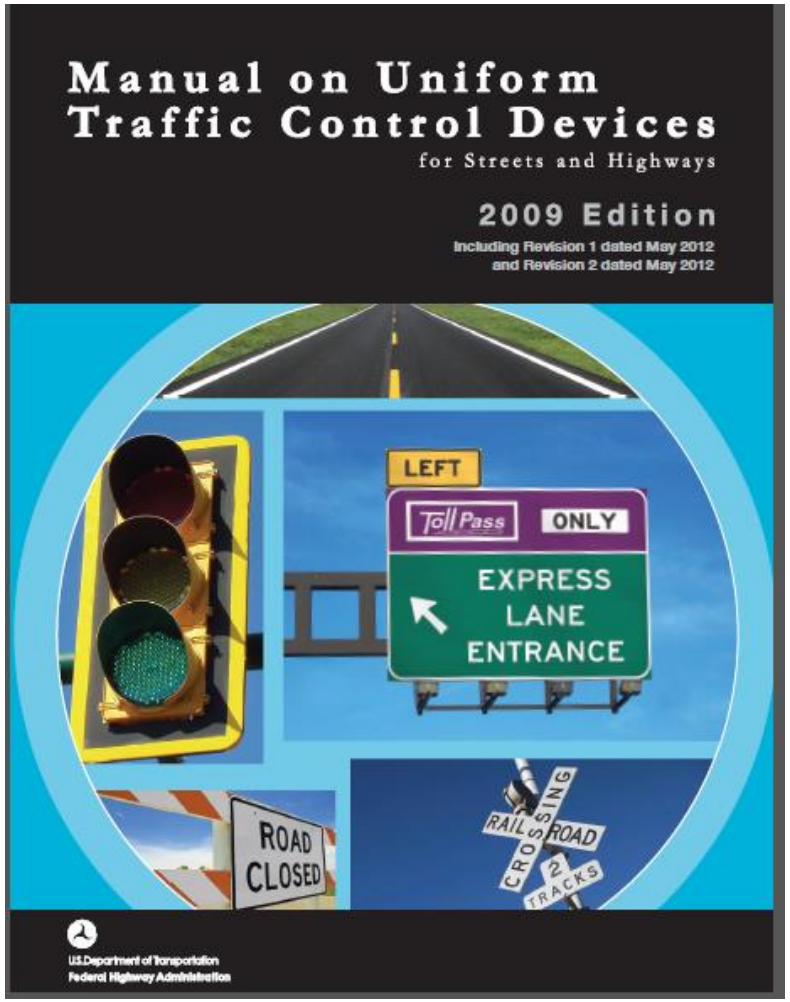
Federal Highway Administration

MUTCD Team

October 30, 2018



The 2009 MUTCD with Revisions 1 and 2 Incorporated



2009 MUTCD
Effective Date:
January 15, 2010

MUTCD w/ Rev 1 and 2
Effective Date:
June 13, 2012

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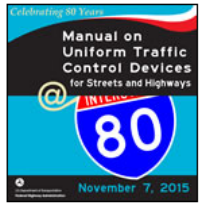
Manual on Uniform Traffic Control Devices for Streets and Highways

Your MUTCD — Guiding You for Over 80 Years

On November 7, 2015, the U.S. celebrated 80th birthday of the MUTCD. Whenever you see an easy-to-read sign, a bright edgeline marking on a foggy night, the countdown timer at a crosswalk, or a well-placed bike lane, take a moment to reflect on the more than eighty years of progress and innovation that the MUTCD embodies. This progress has resulted in safer, more efficient travel on our Nation's roads. Over the years, the MUTCD has unknowingly become the traveler's best friend and silent companion, guiding us on our way along the streets, bikeways, back roads, and highways. As the direct means of communication with the traveler, traffic control devices speak to us softly, yet effectively and authoritatively. From glass "cat's-eye" reflectors to glass beads to microprismatic sheeting, nighttime sign visibility has advanced significantly. Active devices at rail crossings save lives by giving us a positive message about train traffic. And countdown timers on pedestrian signals help us cross a busy street. So the next time you hit the pavement, the path, or the pedals, you can be sure that the MUTCD, through our dedicated professionals who make complex decisions on what devices to install, will help you get where you want to go safely, efficiently, and comfortably! The MUTCD...it's all about *you*!



What's New

UPDATED March 20, 2018

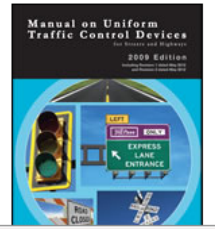
Check out the **MUTCD News Feed** for up-to-the-minute information on new items such as Interim Approvals, Official Interpretations, Policy Statements, Federal Register notices—everything you need to make the most of your MUTCD and keep road users on the move!

Current Edition of Manual on Uniform Traffic Control Devices for Streets and Highways

The ***Manual on Uniform Traffic Control Devices for Streets and Highways***, or **MUTCD** defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public travel. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F.

The MUTCD, which has been administered by the FHWA since 1971, is a compilation of national standards for all traffic control devices, including road markings, highway signs, and traffic signals. It is updated periodically to accommodate the nation's changing transportation needs and address new safety technologies, traffic control tools, and traffic management techniques.

On December 16, 2009 a final rule adopting the 2009 Edition of the MUTCD was published in the Federal Register with an effective date of January 15, 2010. States must adopt the 2009 National MUTCD as their legal State standard for traffic control devices within two years from the effective date. The Federal Register notice, which provides detailed discussion of the FHWA's



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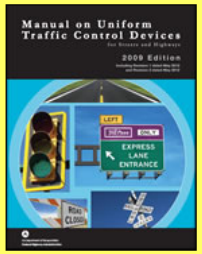
2009 MUTCD with Revisions 1 and 2, May 2012

Current MUTCD Edition



The **PDF version of the 2009 MUTCD with Revision Numbers 1 and 2 incorporated, dated May 2012** is the official current edition.

The most current version of the MUTCD is the **2009 Edition with Revision Numbers 1 and 2 incorporated, dated May 2012**. The official version of the **2009 MUTCD with Revision Numbers 1 and 2 incorporated** is the PDF version.

The 2009 MUTCD with Revision Numbers 1 and 2 incorporated may also be viewed in HTML format, which is accessible to individuals with disabilities, per Section 508 of the Rehabilitation Act. **Disclaimer:** While every effort has been made to assure consistency between the PDF and HTML files posted on the MUTCD Web site, it is possible that the HTML files may not be totally identical in content to the PDF files. The PDF files constitute the official version of the MUTCD and always take precedence over any potentially conflicting MUTCD text or figures that may occur in the HTML files.

Interim Approvals Issued by FHWA

Changes from the 2009 Edition

A document describing how the 2009 Edition with Revisions 1 and 2 incorporated (May 2012) differs from the 2009 Edition (December 2009) is available in PDF (19KB) and HTML.

List of Known Errors in the 2009 MUTCD with Revisions 1 and 2 Incorporated

List of Known Errors in the 2009 MUTCD with Revisions 1 and 2 Incorporated, updated 1/12/2017 (PDF version) (165KB)
List of Known Errors in the 2009 MUTCD with Revisions 1 and 2 Incorporated, updated 1/12/2017 (HTML version)

NOTE: FHWA intends to correct these errors via a future rulemaking action. This list of known errors is provided solely for the information of MUTCD users and does not constitute changes to the MUTCD at this time.

Previous MUTCD Editions

To view previous editions of the MUTCD, including the 2009 Edition without Revisions 1 and 2, please visit Previous Editions of the MUTCD. For historical reference and to know what was in effect for a given date, these previous versions will be maintained on this Web site.

PDF files can be viewed with the Acrobat® Reader®

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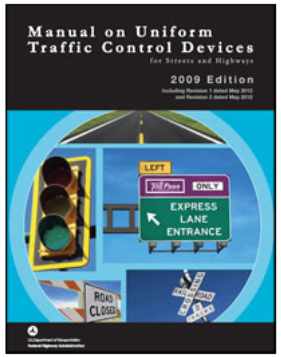
2009 Edition with Revision Numbers 1 and 2 incorporated, dated May 2012 (PDF)



This is the official current edition.

Viewing the MUTCD
If you have difficulty viewing the MUTCD sections (in PDF format), you may need to download the latest version of the Adobe Acrobat Reader.

The 2009 MUTCD, 2003 MUTCD, and certain Chapters of the MUTCD Millennium Edition (those affected by Revision No. 1 changes) may be viewed in HTML format, in addition to PDF format. Earlier editions of the MUTCD are available in PDF format only on this Web site. HTML formatted chapters are accessible to individuals with disabilities, per Section 508 of the Rehabilitation Act.

Printing the MUTCD
The manual is set up for double-sided, offset printing to be placed in a three-ring binder. The first 3 pages include a cover page and a spine. If you are having trouble printing the MUTCD, you may need to adjust settings in "File > Page Setup" menu, in Adobe Acrobat. A high-grade ink-jet or laser printer is recommended for a quality hard copy.

Certain chapters and sections of the MUTCD have very large file sizes due to the large page count, number of illustrations, or both, contained within (example, 2009 Edition Part 6, 184 pages with 62 illustrations). These large files can present problems when printing, depending on the printer used. This is often due to the amount of memory within the printer itself, which is often minimal, especially with the printers sold through office supply outlets. If the printer will not print the file, or prints it with errors, sending the file to the printer in smaller sections (10-20 pages at a time) often solves the problem.

If you are still experiencing difficulties after making the suggested adjustments, please submit your problem to the Operations Feedback, and you will receive a reply.

Learn How To Extract PDF Images from the PDF version of the MUTCD.

Complete 2009 MUTCD with Revisions 1 and 2 (30MB)

- Revision 2 Pages Only (4.6MB)
- Revision 1 Pages Only (4.7MB)

Hotlinks Version (June 21, 2017) (31MB)

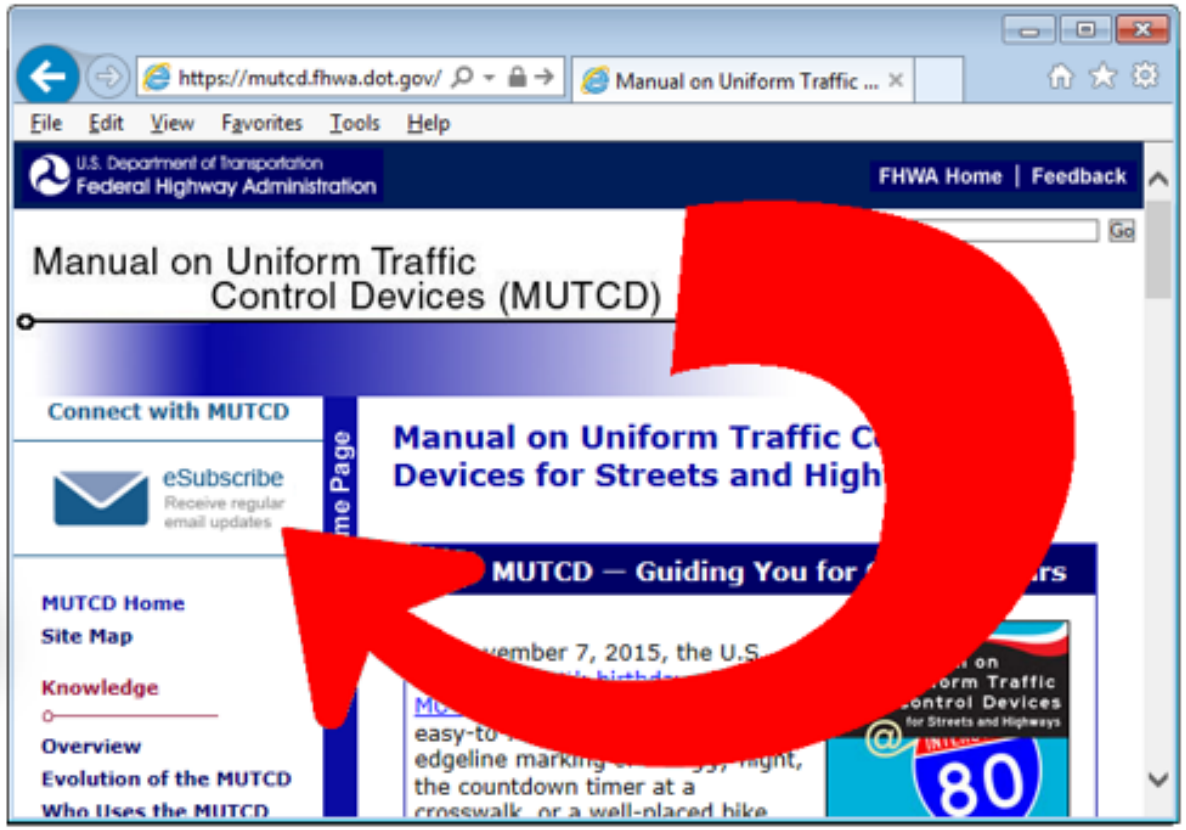
- Instructions for Using the Hotlinks Features

The MUTCD Website: mutcd.fhwa.dot.gov

e-Subscribe Service (GovDelivery)

- Receive notice when new info on MUTCD Web site

Over 1,000 subscribed!!



Pedestrian Treatment Toolbox

- *Pedestrian-activated Flashing LEDs in the Border of a Warning Sign*
- *Enhanced Conspicuity of Pedestrian Crossing Signs*
- *YIELD/STOP Here to Pedestrians signs* **(multi-lane approaches)**
- *Overhead Pedestrian Crossing Signs*
- *In-street Pedestrian Crossing Signs*
- *High-visibility Crosswalk Markings*
- *Midblock Pedestrian Signals*
- *Pedestrian Hybrid Beacons*
- *Pedestrian-activated Warning Beacons*
- *Rectangular Rapid-Flashing Beacons (RRFBs)*
- *In-roadway Warning Lights*
- *Curb Extensions (bulb-outs, neckdowns)*
- *Pedestrian Refuge Islands (median islands)*
- *Raised Crosswalks*
- *Crosswalk Lighting*

Rectangular Rapid-Flashing Beacons

- **An RRFB is a pedestrian-actuated conspicuity enhancement to supplement standard pedestrian, school, and trail crossing warning signs at uncontrolled marked crosswalks.**

- **Uncontrolled means the approach to the crosswalk is not controlled by a YIELD sign, STOP sign, traffic control signal, or pedestrian hybrid beacon.**

Rectangular Rapid-Flashing Beacons

RRFB - History

- **Interim Approval (IA-11)** issued July 16, 2008
  - Based on experiments and research in St. Petersburg, Florida
  - Terminated on December 21, 2017 due to patent issues
- **Interim Approval (IA-21)** issued March 20, 2018
  - Included several changes based on additional research by the Texas Transportation Institute and field experience from IA-11.

RRFB – Cost and Benefits

- **FHWA Research on RRFBs:**
  - **Average cost is approximately $22,500**
  - **Pedestrian crashes reduced by 47%**
  - **Wide range of driver yielding rates**
    - **St. Petersburg study: 4% before to 76% after**
    - **TTI study: with RRFBs yielding rate ranged from 19% to 98% depending on multiple factors**

Source: FHWA-HRT-10-0421, July 2010 and FHWA-HRT-16-040, July 2016

IA-21: RRFB Allowable Uses

- RRFBs approved only for use with W11-2 (Pedestrian), S1-1 (School), or W11-15 (Trail) crossing warning sign (not allowed for other applications without experimental approval)
- Post-mounted with a diagonal downward arrow (W16-7P) plaque or an overhead-mounted W11-2, S1-1, or W11-15 crossing warning sign
- Must be on the approach to an uncontrolled, marked crosswalk
- Can use in advance of crosswalk with less than desired sight distance to supplement the RRFB at the crosswalk (advance RRFB does not have to be dual-mounted)
- Can be installed at intersections if approach is uncontrolled
- Can be installed for crosswalks at roundabouts

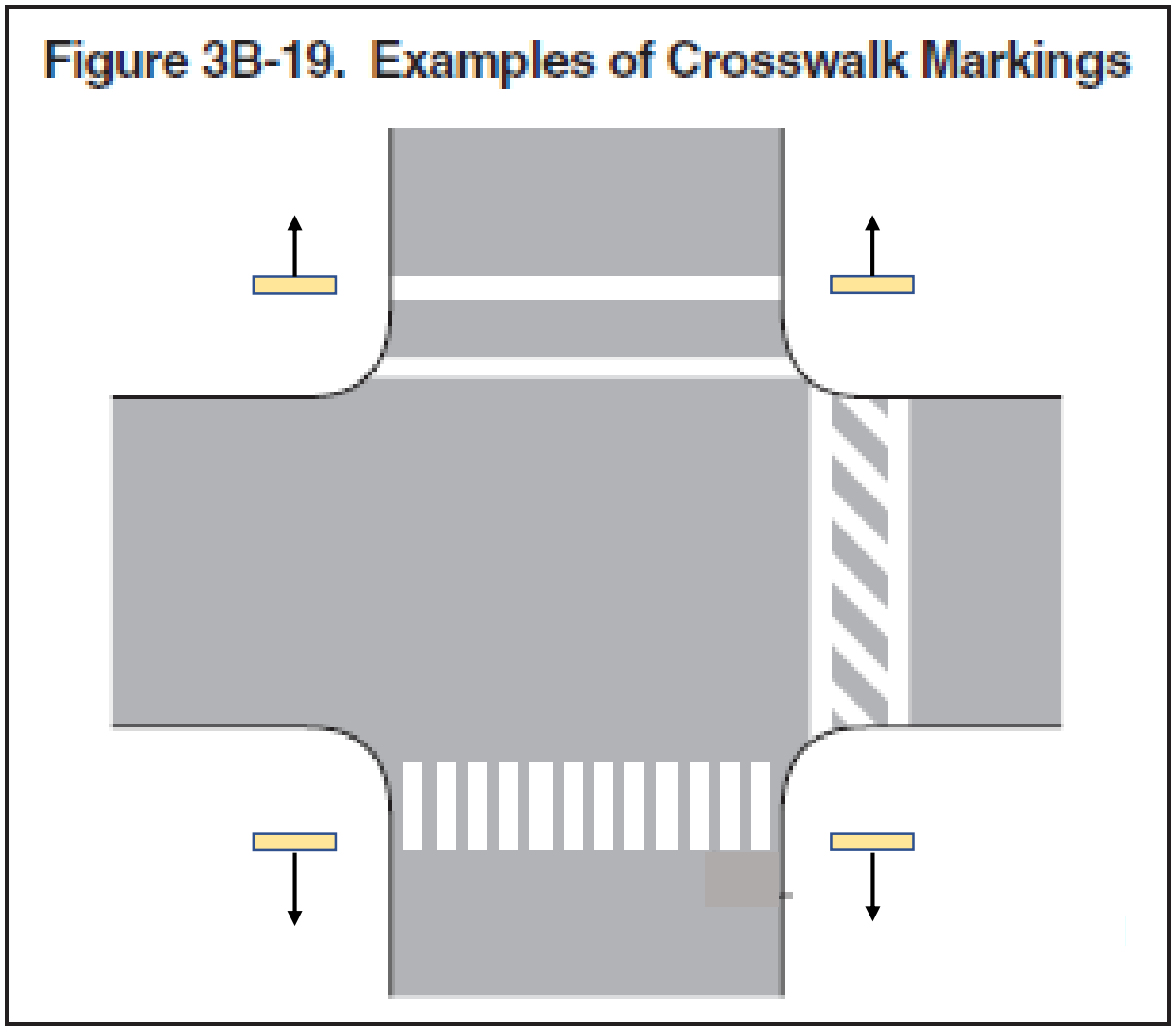
IA-21: RRFB Sign/Beacon Assembly Locations

- Two RRFBs in each direction
- Left-hand and right-hand side of the roadway

- For divided highways, install left-hand side RRFB in median - if practical

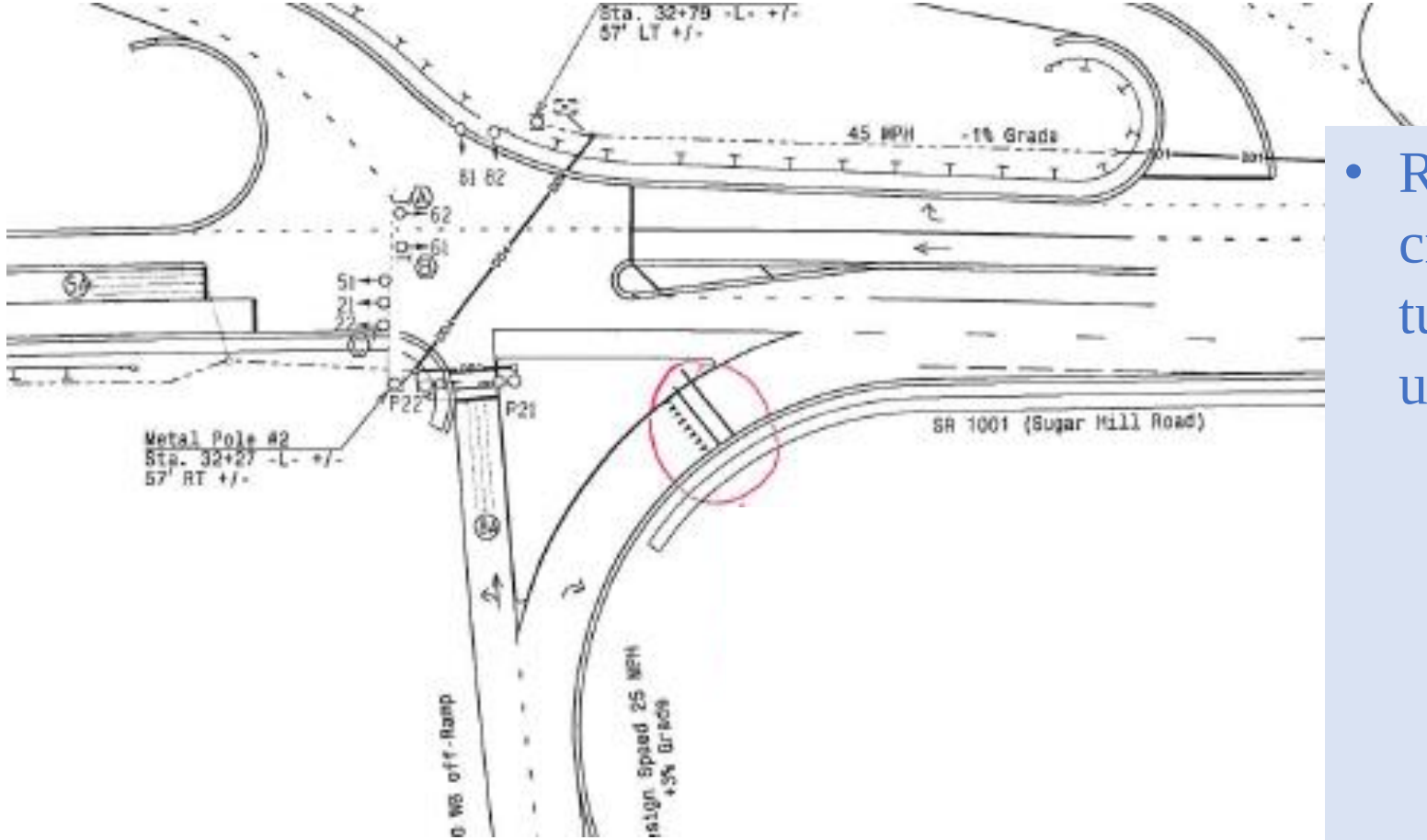
IA-21: RRFB Sign/Beacon Assembly Locations

IA-21: RRFBs at Intersections (uncontrolled approaches only)



- Treat each crosswalk separately – install RRFBs facing both directions at both crosswalks (8 RRFBs), or
- Install RRFBs on leading edge of each crosswalk facing one direction of traffic only (4 RRFBs) –
  - any pedestrian actuation must activate RRFBs at both crosswalks
- Do not install in two quadrants only

IA-21: RRFBs at Intersections (uncontrolled approaches only)



- RRFBs can be installed for crosswalks at free-flow right-turn lanes if approach is uncontrolled:
  - not under signal control
  - YIELD sign for vehicles (if used) is located after crosswalk

IA-21: RRFB Beacon Dimensions and Placement in the Sign Assembly

- Each RRFB indication must be minimum 2” x 5” and placed at least 7” apart

- Must be pedestrian actuated with push buttons or passive pedestrian detection

IA-21: RRFB Beacon Operation

- RRFBs remain dark until activated
- All RRFBs associated with a given crosswalk begin and end simultaneously
- Flash time determined as per MUTCD Section 4E.06 – pedestrian clearance time and restarts with each new pedestrian actuation
- Dimming feature should be used during nighttime operation
- New flash sequence with IA-21 – **WW+S pattern**

IA-21: RRFB Accessible Pedestrian Features

- **If** a speech pushbutton information message is used:
  - A locator tone shall be provided
  - Vibrotactile or percussive tones **shall not** be used
  - Speech message should say **"YELLOW LIGHTS ARE FLASHING"** – spoken twice

IA-21: RRFB – Current Status

- IA-11 had 188 approved agencies, many of which were local agencies.
- IA-21 currently has 96 approved agencies, including 47 State DOTs and 49 local agencies

IA-21: RRFB – Current Approval Status

- **43 State DOTs requested a "statewide-blanket" approval**
  - **Local agencies in those states do not need to request individual approval from FHWA to install RRFBs**
- **Four State DOTs requested "DOT only" approval**
  - **Arkansas, Florida, Hawaii, and Idaho**
  - **Local agencies in these states will need to request FHWA approval**
- **Three State DOTs have not requested approval**
  - **Mississippi, North Dakota, and South Carolina**
  - **Local agencies in these states will need to request FHWA approval**

Interim Approval Process

- Agencies must submit written request to FHWA Office of Operations
  (preferably by email*)
- Acknowledge commitment to:
  - Comply with the Technical Conditions detailed in IA-21
  - Maintain an inventory list of all locations at which RRFBs are installed
  - Comply with all the conditions as listed in Paragraph 18 of Section 1A.10 of the MUTCD
- Agree to the following:
  - That FHWA has the right to rescind this Interim Approval at any time; and
  - That issuance of Interim Approval does not guarantee that the provisions, either in whole or part, will be adopted into the MUTCD

* email requests to MUTCDofficialmailbox@dot.gov

Contact Information

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STEP Safe Transportation for Every Pedestrian

Rectangular Rapid Flash Beacons

Duane H. Thomas, P.E., FHWA
Megan McCarty Graham, TOOLE DESIGN

October 30, 2018

U.S. Department of Transportation
Federal Highway Administration

Operation

RRFB Video IA-21Flash Pattern

IA-21Beacon Operation

6. e. Flash period shall be **immediately initiated each and every time** a pedestrian is detected through passive detection or pushbutton activated, including when pedestrians are detected while RRFB's are already flashing and when pedestrians are detected immediately after the RRFB's have ceased flashing.

6. f. Small pilot light may be installed

Figure 2. View of pilot light to pedestrian at shared-use path crossing with median refuge. Enlargement of pilot light at right.

IA-21 Accessible Pedestrian Features

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  - A locator tone shall be provided
  - Vibrotactile or percussive tones shall not be used
  - Speech message should say "YELLOW LIGHTS ARE FLASHING" – spoken twice

Often tough crossings for bicyclists…

Education and Enforcement Considerations

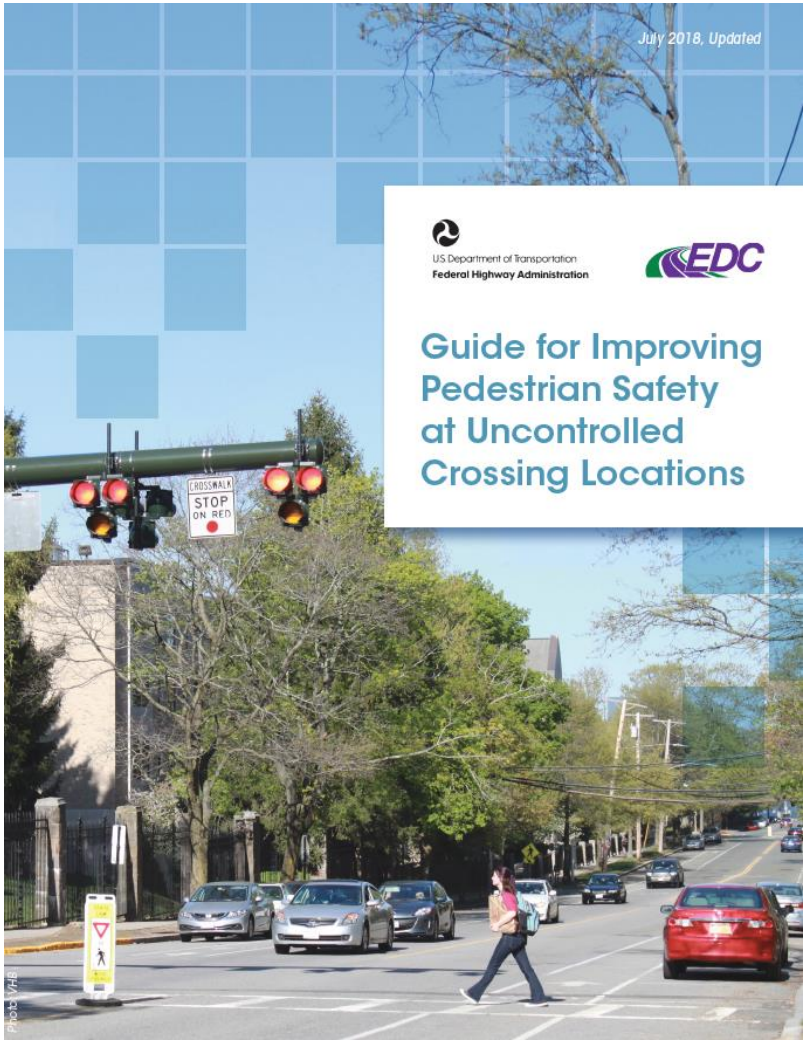
Yielding compliance may be monitored by police upon new installation

- Establish a baseline yielding rate
- Set target yield rates (70% - 80% without enforcement)
- Add enforcement if yield rates drop precipitously

Placement

Not a substitute for good design

- RRFBs are NOT a substitute for good crosswalk placement and design
- RRFBs supplement the crosswalk, the crosswalk assigns ROW to the pedestrian
- Use best practices for:
  - Crosswalk placement
  - Pavement markings
  - Lighting



https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step.cfm

Where they've been used

- Mid-blocks crossings
- Uncontrolled intersection approaches
  - Does not have similar language in the MUTCD regarding use at an intersection like the PHB
  - RRFBs may control both uncontrolled legs at an intersection
- Roundabout Crossings
- Trail Crossings
- Raised Crosswalks

RRFBs at Raised Crossings

Placement Considerations – STEP Guide

Table 1. Application of pedestrian crash countermeasures by roadway feature.

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	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
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3 lanes with raised median (1 lane in each direction)	● 1 2 3 4 5 7 9	● 1 3 5 7 9	○ 1 3 5 7 9	○ 1 3 4 5 7 9	○ 1 3 5 7 9	○ 1 3 5 7 9	○ 1 3 4 5 7 9	○ 1 3 5 7 9	○ 1 3 5 9
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	● 1 2 3 4 5 6 7 9	● 1 3 5 6 7 9	○ 1 3 5 6 9	○ 1 3 4 5 6 7 9	○ 1 3 5 6 7 9	○ 1 3 5 6 9	○ 1 3 4 5 6 7 9	○ 1 3 5 6 9	○ 1 3 5 6 9
4+ lanes with raised median (2 or more lanes in each direction)	● 1 3 5 7 8 9	● 1 3 5 7 8 9	○ 1 3 5 8 9	○ 1 3 5 7 8 9	○ 1 3 5 7 8 9	○ 1 3 5 8 9	○ 1 3 5 7 8 9	○ 1 3 5 8 9	○ 1 3 5 8 9
4+ lanes w/o raised median (2 or more lanes in each direction)	● 1 3 5 6 7 8 9	○ 1 3 5 6 7 8 9	○ 1 3 5 6 8 9	○ 1 3 5 6 7 8 9	○ 1 3 5 6 7 8 9	○ 1 3 5 6 8 9	○ 1 3 5 6 7 8 9	○ 1 3 5 6 8 9	○ 1 3 5 6 8 9

● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.

○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

7 RRFB

Placement Considerations – STEP Guide

Table 1. Application of pedestrian crash countermeasures by roadway feature.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)		● 5 6 7 9	○ 5 6 ● ●		● 5 6 7 9	○ 5 6 ● ●	● 4 5 6 7 9	○ 5 6 7 9	
3 lanes with raised median (1 lane in each direction)		● ● 5 7 9	○ ● 5 ● ●	○ ● 3 4 5 7 9	○ ● 5 ● ●	○ ● 5 ● ●	○ ● 4 5 7 9	○ ● 5 7 9	
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	● 2 3 4 5 6 7 9	● ● 5 6 7 9		○ ● 3 4 5 6 7 9	○ ● 5 6 ● 9		○ ● 4 5 6 7 9		
4+ lanes with raised median (2 or more lanes in each direction)	● ● 5 7 8 9	● ● 5 7 8 9		○ ● 5 7 8 9	○ ● 5 ● 8 9		○ ● 5 ● 8 9		
4+ lanes w/o raised median (2 or more lanes in each direction)	● ● 5 6 7 8 9	○ ● 5 6 7 8 9		○ ● 5 6 7 8 9	○ ● 5 6 ● 8 9		○ ● 5 6 ● 8 9		

● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.

○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

RRFB

Overhead placement

- Overhead placement is an option
- Intended to supplement shoulder and median mounted beacons
- No research on overhead placement yield rate or crash reduction potential

Median RRFBs

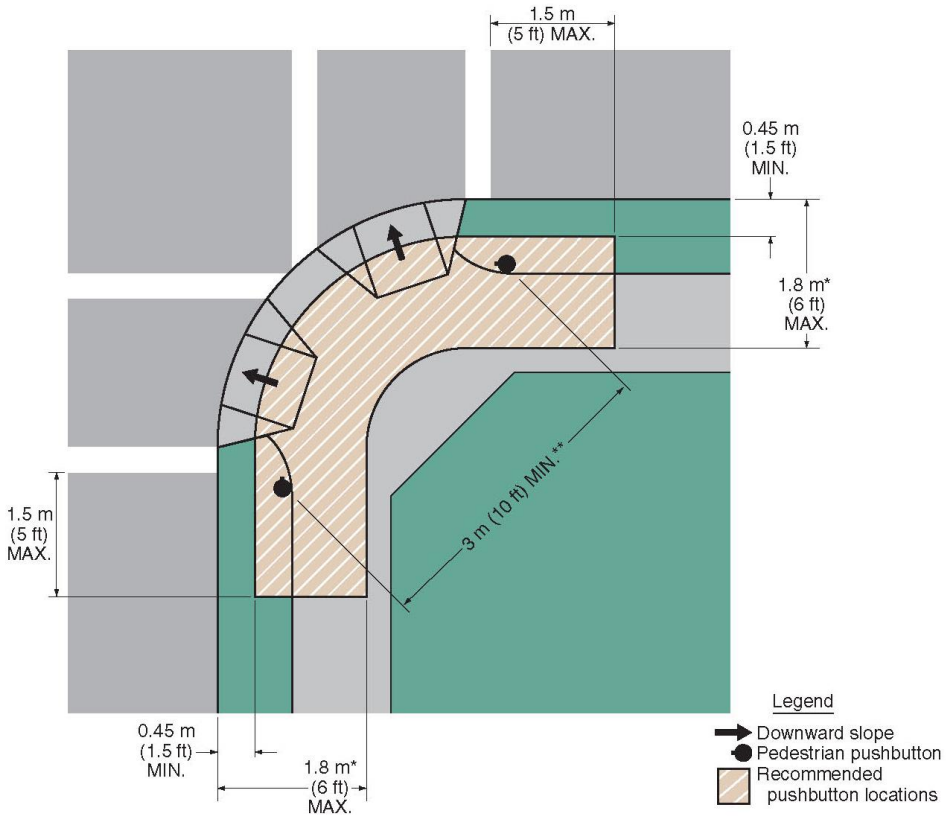
If practical, a median RRFB is desirable.

Accessible Pedestrian Push Button on Median Refuge Island


PUBLIC LIBRARY
DTOWN BOULDER STN
TheRide

Follow MUTCD Pedestrian Push Button Guidance Section 4E.08 Pedestrian Detectors

Figure 4E-2. Recommended Pushbutton Locations



* Where there are constraints that make it impractical to place the pedestrian pushbutton between 0.45 m (1.5 ft) and 1.8 m (6 ft) from the edge of the curb, shoulder, or pavement, it should not be further than 3 m (10 ft) from the edge of curb, shoulder, or pavement.

** Where there are constraints on a particular corner that make it impractical to provide the 3 m (10 ft) separation between the two pedestrian pushbuttons, the pushbuttons may be placed closer together or on the same pole.

Supplemental RRFBs

- Insufficient sight lines
- High motor vehicle speeds
- Multiple threat conditions

All other rules apply

All other rules for crosswalk placement and pavement marking apply (sight distance, advance stop/yield bar, lighting, clear pedestrian desire lines, etc.)

Case Studies

Case study: RRFB
(St. Petersburg, FL)

Problem/Background

Multi-lane, high-volume, high-speed roadways with 100+ uncontrolled crosswalks:

- Conflicts
- Motorist yielding rates < 2%
- Pedestrian injury rate higher than the county/state averages

Case study: RRFB
(St. Petersburg, FL)

Solution

- In 2003, city listed enhancements to uncontrolled crosswalks as top priority
- Vendor offered to install RRFB's at two locations
  - City agreed, conducted studies
- Cost was $10,000-15,000 dollars for purchase and installation, which was less expensive than other options

Case study: RRFB
(St. Petersburg, FL)

Details

- Compared RRFB's with dual overhead round yellow flashing beacons and side-mounted round flashing beacons
  - RRFBs provided higher yielding compliance
- Also compared two-beacon and four-beacon RRFB systems
- In all cases, yield markings placed 30 feet before crosswalks

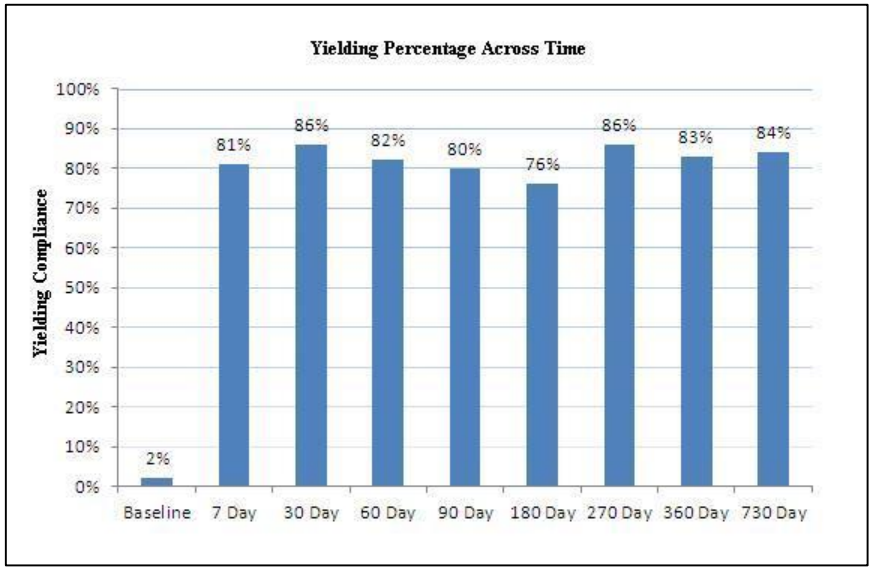
Before

After

Case study: RRFB
(St. Petersburg, FL)

Results

- Initial success led city to install 17 more RRFB's
- In May 2012, the City had 42 RRFBs and had plans for 20-30 more
- Performed equally well at night
- Four-beacon system had highest yield rates
- RRFB's also improved yield distance



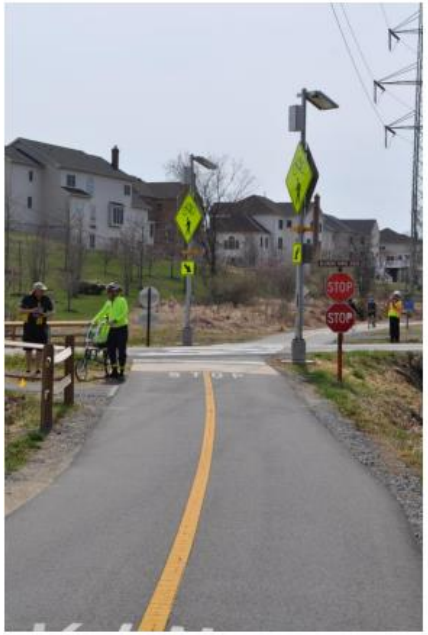
Case study: RRFB
(Belmont Ridge Rd at W&OD Trail, Virginia)

Problem/ Background

- Uncontrolled Trail Crossing
- 85th percentile roadway speed: 54mph
- 2-lane roadway
- Poor Sightlines
- Only 23% of drivers yielded when trail users were present

Case study: RRFB
(Belmont Ridge Rd at W&OD Trail, Virginia)

Case study: RRFB
(Belmont Ridge Rd at W&OD Trail, Virginia)



Virginia Center for Transportation
INNOVATION & RESEARCH

Evaluation of a Rectangular Rapid Flashing Beacon System at the Belmont Ridge Road and W&OD Trail Mid-Block Crosswalk

http://www.virginiadot.org/vtrc/main/online_reports/pdf/15-r22.pdf

LANCE E. DOUGALD
Research Scientist

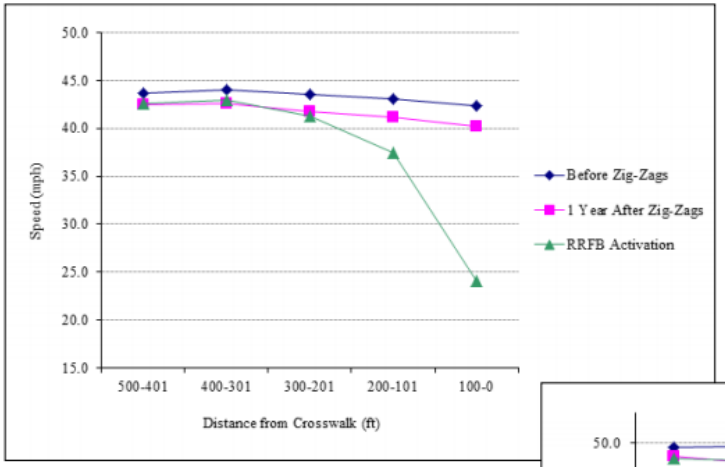
http://www.virginiadot.org/vtrc/main/online_reports/pdf/15-r22.pdf

EDC

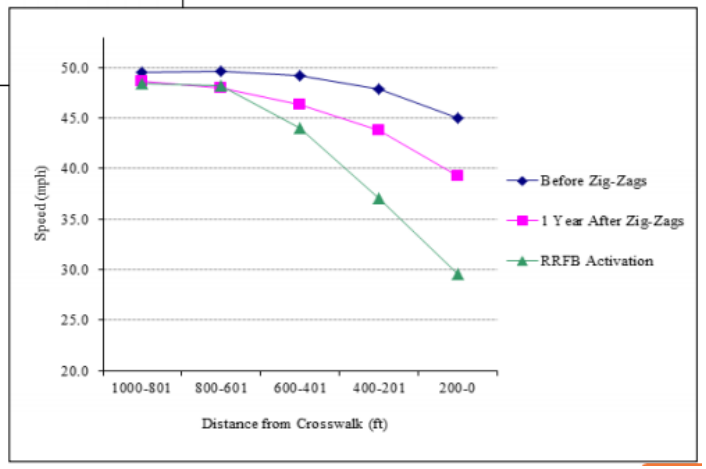
Case study: RRFB
(Belmont Ridge Rd at W&OD Trail, Virginia)

Results

- Significant improvement in yielding rate
  - Non-actuated yield rate: 42-55%
  - Actuated Yield Rate: 53-67%
- Improved overall awareness of the crossing
- Surprisingly, a large drop in speeds that was sustained



Northbound Speed on Approach



Southbound Speed on Approach

Case study: RRFB
(Belmont Ridge Rd at W&OD Trail, Virginia)

A drone view of the new Belmont Ridge Road/W&OD Trail overpass looking south. [Photo by Vantage Point Drone]

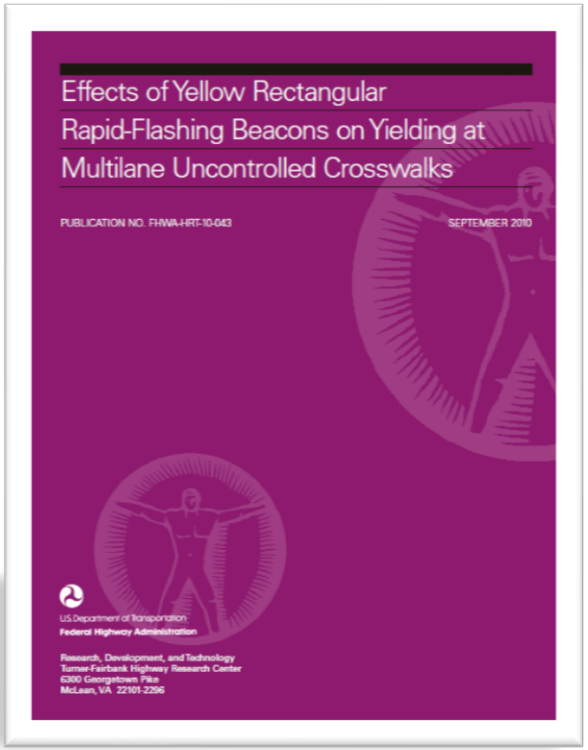
Belmont Road Bridge Opens Today

2017-07-17 LoudounNow 1 Comment

Cyclists on the W&OD Trail will enjoy a safer crossing of Belmont Ridge Road starting today.

Safety CMF & Research

"Effects of Yellow Rectangular Rapid-Flashing Beacons on Yielding at Multilane Uncontrolled Crosswalks" (Publication No. FHWA-HRT-10-043) 2010



Resources

Effects of Yellow Rectangular Rapid-Flashing Beacons on Yielding at Multilane Uncontrolled Crosswalks" (Publication No. FHWA-HRT-10-043) 2010

- https://www.fhwa.dot.gov/publications/research/safety/pedbike/10043/10043.pdf

MUTCD Interim Approvals

- http://mutcd.fhwa.dot.gov/res-interim_approvals.htm
- RRFB Specific
- http://mutcd.fhwa.dot.gov/resources/interim_approval/ia11/fhwamemo.htm

Driver-Yielding Results for Three Rectangular Rapid-Flash Patterns

- http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/TTI-2014-5.pdf

EDC

EDC-5 STEP Contacts

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Discussion

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- ⇨ **Archive at www.pedbikeinfo.org/webinars**