

Countermeasure Strategies for Pedestrian Safety

Crossing Islands and Raised Medians



Demian Miller

Tindale Oliver and Associates

October 1, 2015



**Pedestrian and Bicycle
Information Center**



Today's Presentation

- ⇒ **Introduction and housekeeping**
- ⇒ **Audio issues?**
Dial into the phone line instead of using “mic & speakers”
- ⇒ **PBIC Trainings and Webinars**
www.pedbikeinfo.org/training
- ⇒ **Registration and Archives at**
pedbikeinfo.org/webinars
- ⇒ **PBIC News and updates on Facebook**
www.facebook.com/pedbike
- ⇒ **Questions at the end**



Countermeasure Strategies for Pedestrian Safety Webinar Series

Upcoming Webinars

Road Diets

Tuesday, October 6 (1:00 – 2:30 PM Eastern Time)

Marked Crosswalks

Thursday, October 15 (1:00 – 2:30 PM Eastern Time)

Curb Extensions

Tuesday, October 27 (1:00 – 2:30 PM Eastern Time)

To view the full series and register for the webinars, visit

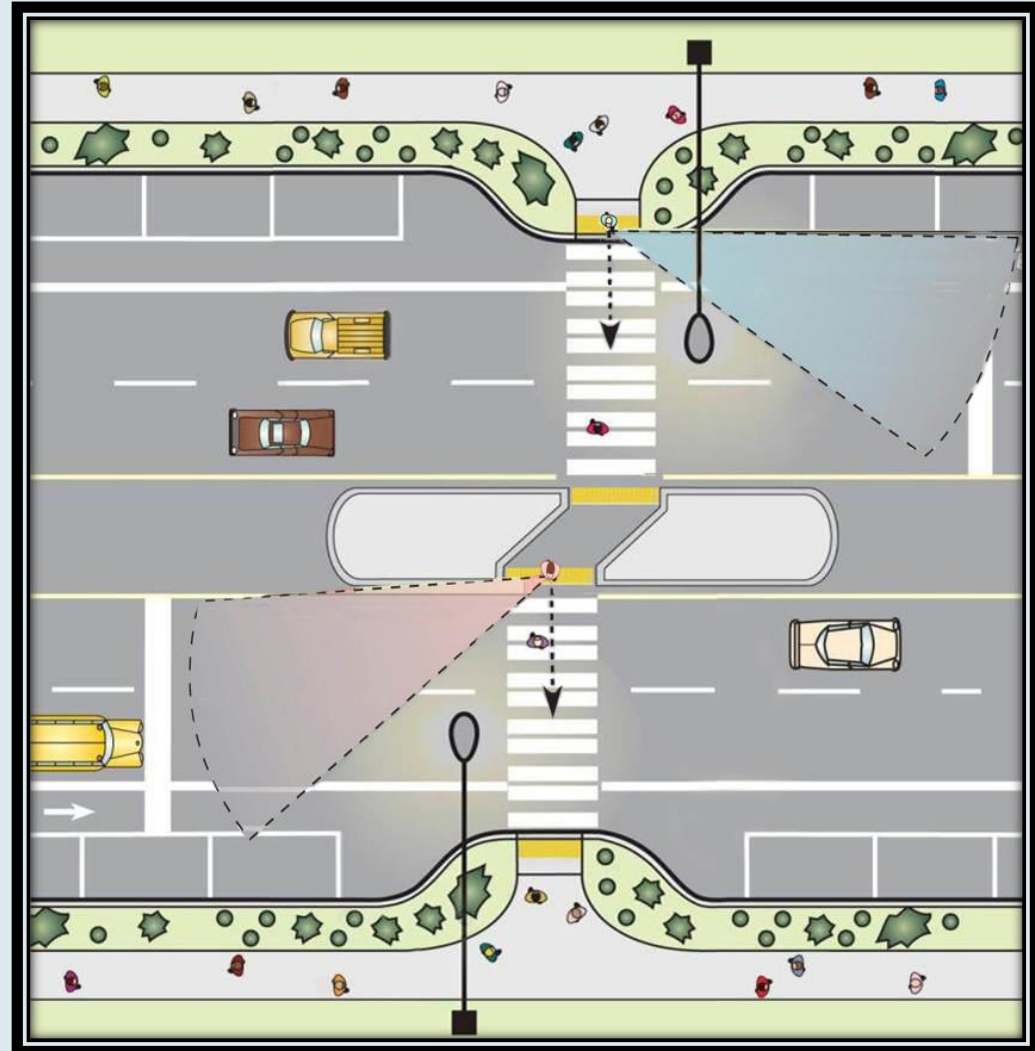
www.pedbikeinfo.org/training/webinars_PSAP_countermeasurestrategies.cfm

CROSSING ISLANDS/RAISED MEDIANS

Designing for
Pedestrian
Safety
201

WHY RAISED ISLAND ARE SAFER FOR PEDESTRIANS

- Breaks up complex crossing into two simpler ones
- Medians and Pedestrian Crossing Islands in Urban and Suburban Areas
 - One of FHWA's 9 proven safety countermeasures
 - <http://safety.fhwa.dot.gov/provencountermeasures/>



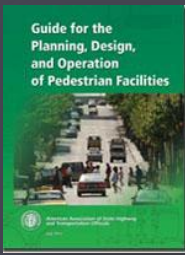
CROSSING ISLANDS/RAISED MEDIANS SAFETY



- Installing raised medians associated with a 25% reduction in pedestrian crashes in Florida ⁽¹⁾
- Installing raised medians associated with a 46% reduction in pedestrian crashes at sites with marked crosswalks, and a 39% reduction at sites with unmarked crosswalks in a sample from 30 U.S. cities ⁽²⁾
- Installing refuge islands associated with a 56% reduction in pedestrian crashes ⁽³⁾

RESEARCH

- (1) Gan, A., Shen, J., and Rodriguez, A. (2005). Update of Florida Crash Reduction Factors and Countermeasures to improve the Development of District Safety Improvement Projects. Florida Department of Transportation.
- (2) Zegeer, C., Stewart, R., Huang, H., and Lagerwey, P. (2002). Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines, FHWA-RD-01-075.
- (3) Institute of Transportation Engineers. (2004). Toolbox of Countermeasures and Their Potential Effectiveness to Make Intersections Safer. Briefing Sheet 8, FHWA.



WHEN TO INSTALL

Recommended:

- **Midblock locations**
 - Crossing exceeds 60 feet
 - Limited number of gaps in traffic
- **Local roads with low speeds & volume**
 - Aesthetic reasons
 - Special pedestrian circumstances
- **Collector with moderate-to-high speeds & volume**
 - Strongly recommended
- **Midblock multilane arterials**
 - Desirable and consideration for supplementary traffic control devices

Source: AASHTO Guide for the Planning Design, and Operation of Pedestrian Facilities, July 2004

WHEN TO INSTALL

Guidance

- Curbed sections of multi-lane roadways in urban and suburban areas, particularly in areas where there are mixtures of significant pedestrian and vehicle traffic (more than 12,000 ADT) and intermediate or high travel speeds. ¹



1. [FHWA-SA-12-011](#)

Proven Safety Countermeasures Medians and Pedestrian Crossing Islands in Urban and Suburban Areas

SUGGESTED PEDESTRIAN CROSSING ISLAND INSTALLATION CRITERIA

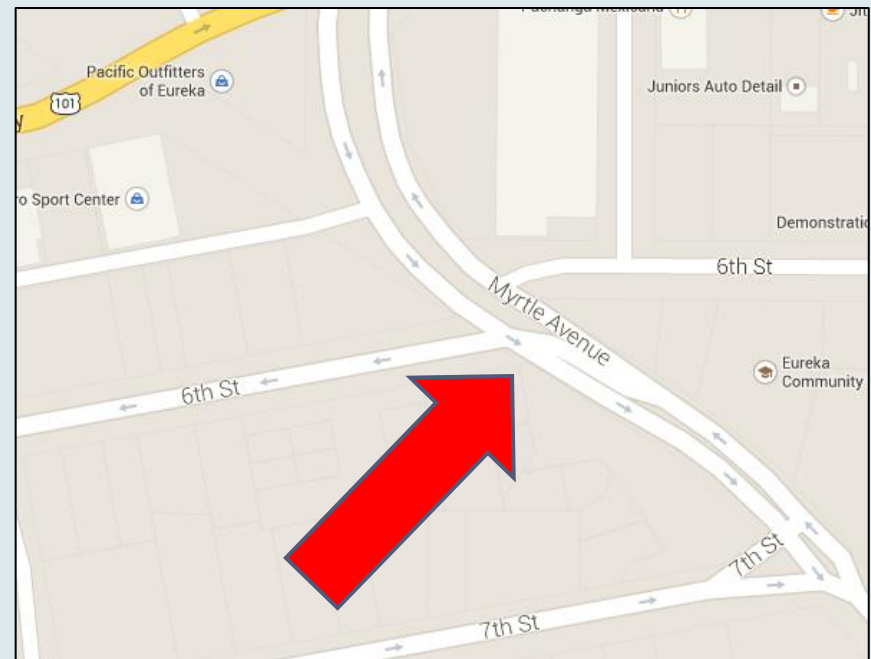
Factors	OK	Should Consider	Install
Speed (mph)	30 or less	35	40 or more
ADT	< 9,000	9,000 - 15,000	> 15,000
Number of lanes	3	4-6	7 or more
Pedestrian volume	< 20/hour	< 20/hour	20/hour or more
Crashes	0	1-3	4 or more

- Table developed based on Marked vs. Unmarked Crosswalks at Uncontrolled locations Research (Speed, ADT, Number of Lanes.
- Warrant criteria for the PHB (Pedestrian volume)
- Number of crashes selected subjectively

CASE STUDY: ISLANDS/RAISED MEDIANS (EUREKA, CA)

Problem/Background

- Wide 3 lane road
 - No marked crosswalks
- Intersection near curve
- Avoided by pedestrians, bicyclists, & motorists
- Increased traffic led to more collisions
- Highest crash intersection in the city



CASE STUDY: ISLANDS/RAISED MEDIANS (EUREKA, CA)

Solution

- Worked with CALTRANS and community
- Temporary traffic controls used to test measures
- Median island and crosswalk installed for pedestrian & bicyclist refuge
- Other islands channel vehicles and provide more refuge
- Street lighting and LED signs offer visibility



Signs, cones, and barricades were used to test the improvements before becoming permanent

CASE STUDY: ISLANDS/RAISED MEDIANS (EUREKA, CA)

Results

- Reduced conflicts and enhanced safety
- No collisions reported since project completed in 2009
- New school, business, and housing increased foot traffic and activity



Intersection with the permanent improvements

WHERE TO PLACE ISLANDS



Turning
movements

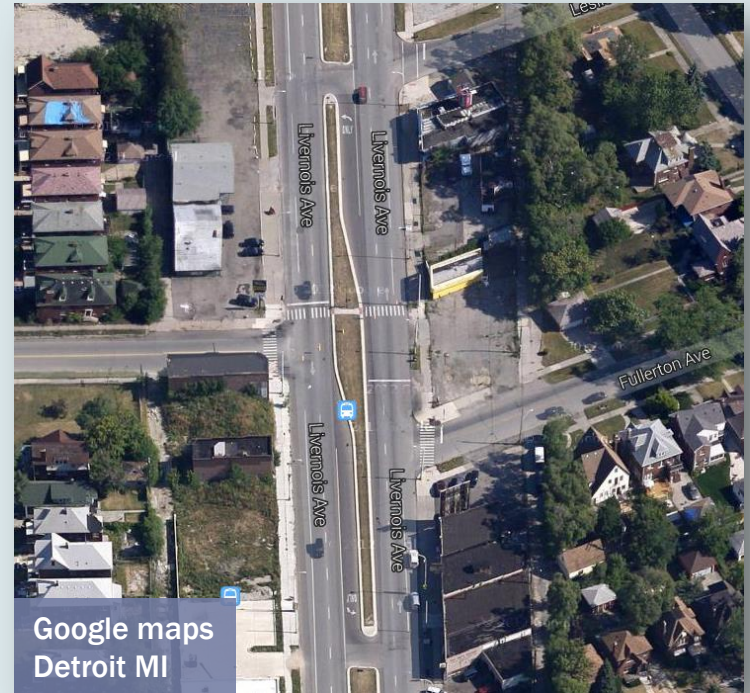
Access
management

WHERE TO PLACE

- Where there is room
- Where people are crossing
- Intersections
- Midblock



Photo Dan Burden
Bellevue WA



CAN USE FOR ACCESS MANAGEMENT



LEFT TURNS PROHIBITED AT DRIVEWAY

Left turn restricted



Left turns not restricted

POTENTIAL DRIVEWAY/ISLAND CONFLICT



DRIVER PREPARES TO MAKE LEFT TURN



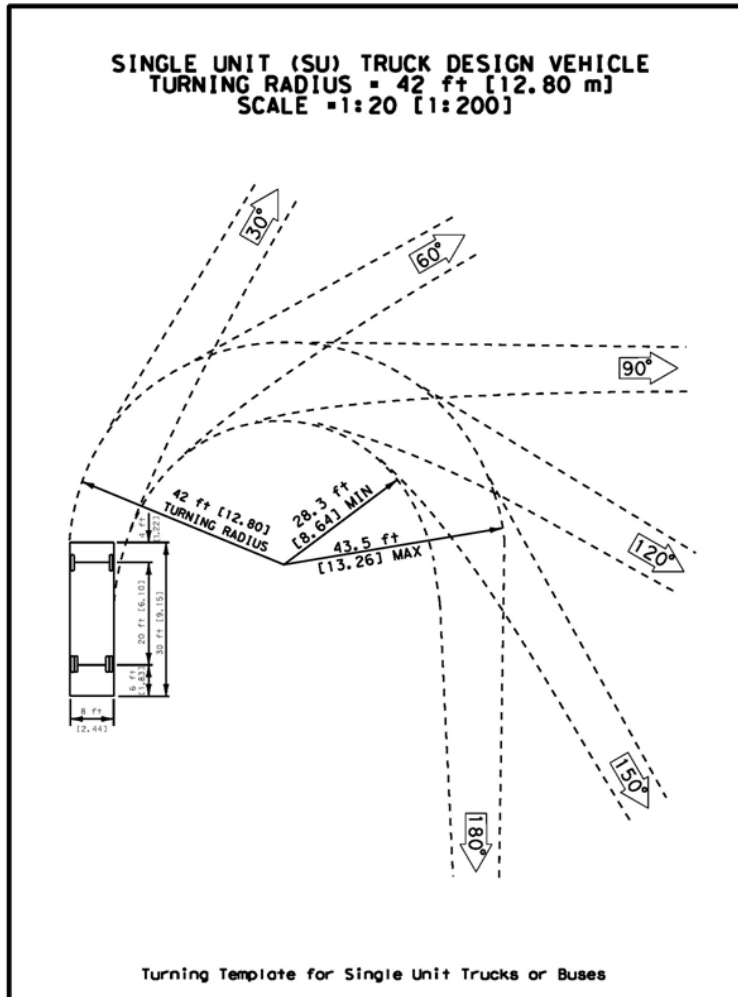
DRIVER CLEARS ISLAND



DRIVER PULLS INTO MEDIAN



LENGTH OF OPENING NEXT TO MEDIAN



Low 2-axle vehicles and all motorcycles
 (including motorcycles pulling trailers)

6'-22'



High 2-axle vehicles and low 3-axle vehicles

20'-34'



High 3-axle vehicles and low 4-axle vehicles

32'-72'



High 6-axle vehicles

65'-71'



All vehicles with 7 or more axles

68'-111'



Flush



6" Raised Curb

WHAT TYPE OF MEDIAN OR ISLAND



Low Profile Barrier

FLUSH (TWO WAY CENTER TURN LANE)

- A TWLTL is not a crossing island
- It's an opportunity for pedestrians to use what's already out there
- TWLTL provides space for island
- But better than yellow centerline



6-INCH RAISED

- Minimum 6 feet wide
- 8 feet to accommodate bicycles, wheelchairs, scooters, and groups of pedestrians
- Length parallel to street 20 feet minimum



WSDOT LOW PROFILE BARRIER



WSDOT LOW PROFILE BARRIER



WSDOT STANDARD DRAWINGS

Low Profile Traffic Curb (GD-3 - GD-11)

These drawings provide the necessary details to construct a Low Profile Barrier Curb. This curb shape has been successfully crash-tested and may be used for raised medians where the posted speed is 45 mph or less. The barrier shape redirects impacting vehicles and reduces the possibility of crossover accidents.



This system may be a more effective option than conventional traffic curb medians when access across the median is undesirable. The raised area can be either paved or used as a planting area. On state highways, even within the corporate limits of a city, the Department of Transportation has jurisdiction over medians, so some restrictions on foliage type and size may be expected.

At present, no manufacturers are listed who have produced the precast units in these drawings. This will change as usage increases.

View [Plan Sheet](#) (pdf 2.00 mb)

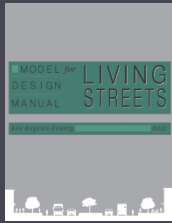
View [Contract Special Provisions](#) (pdf 14 kb)

Download [WinZip file](#) (zip 1.6 mb)
(WinZip file contains the following file formats: .dgn, .dwg, and .doc files)

Download free [Adobe Acrobat Reader](#)
Download free evaluation version of [WinZip](#)



TABLE 4.4 MEDIAN TYPES AND WIDTHS



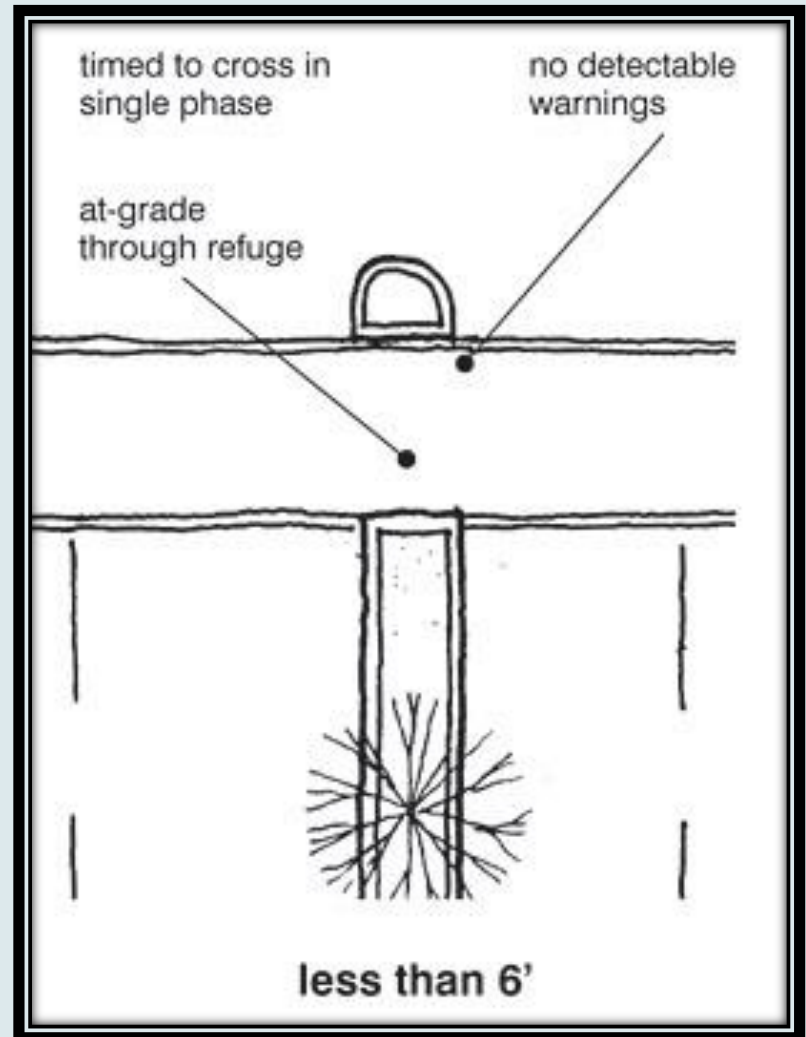
Median Type	Minimum Width	Recommended Width
Median for access control	4 feet	6 feet
Median for pedestrian refuge	6 feet	8 feet
Median for trees and lighting	6 feet [1]	10 feet [2]
Median for single left-turn lane	10 feet [3]	10 feet [2]
Median for single left-turn lane and pedestrian refuge	16 feet [4]	16 feet

Table Notes

- [1] Six feet measured curb face to curb face is generally considered the minimum width for proper growth of small caliper trees (less than 4 inches).
- [2] Wider medians provide room for larger caliper trees and more extensive landscaping.
- [3] A 10-foot lane provides for a turn lane without a concrete traffic separator.
- [4] Includes a 10-foot turn lane and a 6-foot pedestrian refuge.

MEDIANS LESS THAN 6 FEET WIDE

- Signals should be timed so that pedestrians can cross entire street in one phase
- No detectable warning strips in median

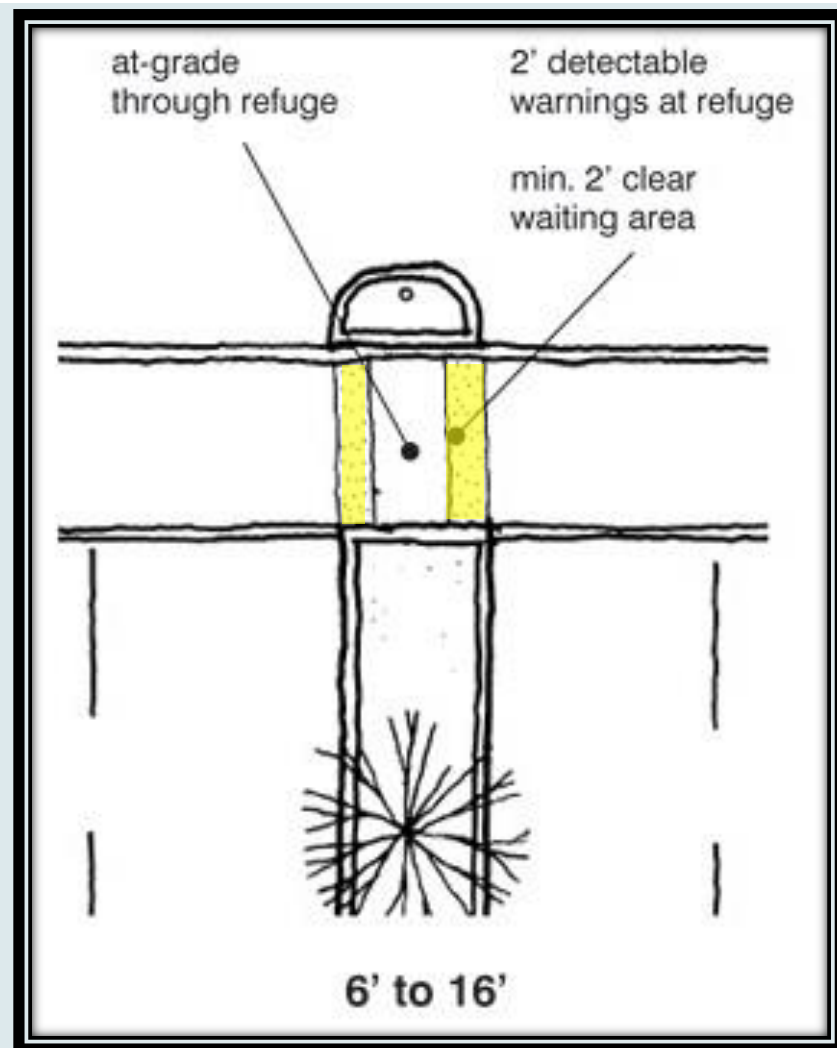


LESS THAN 6 FEET MEDIAN NO TRUNCATED DOMES



MEDIANS BETWEEN 6 AND 16 FEET WIDE

- Pathway & waiting area should be at street grade
- 2 foot wide detectable warning strips on each end
- 2 foot wide clear zone (min.) in the center



OK?



OK?

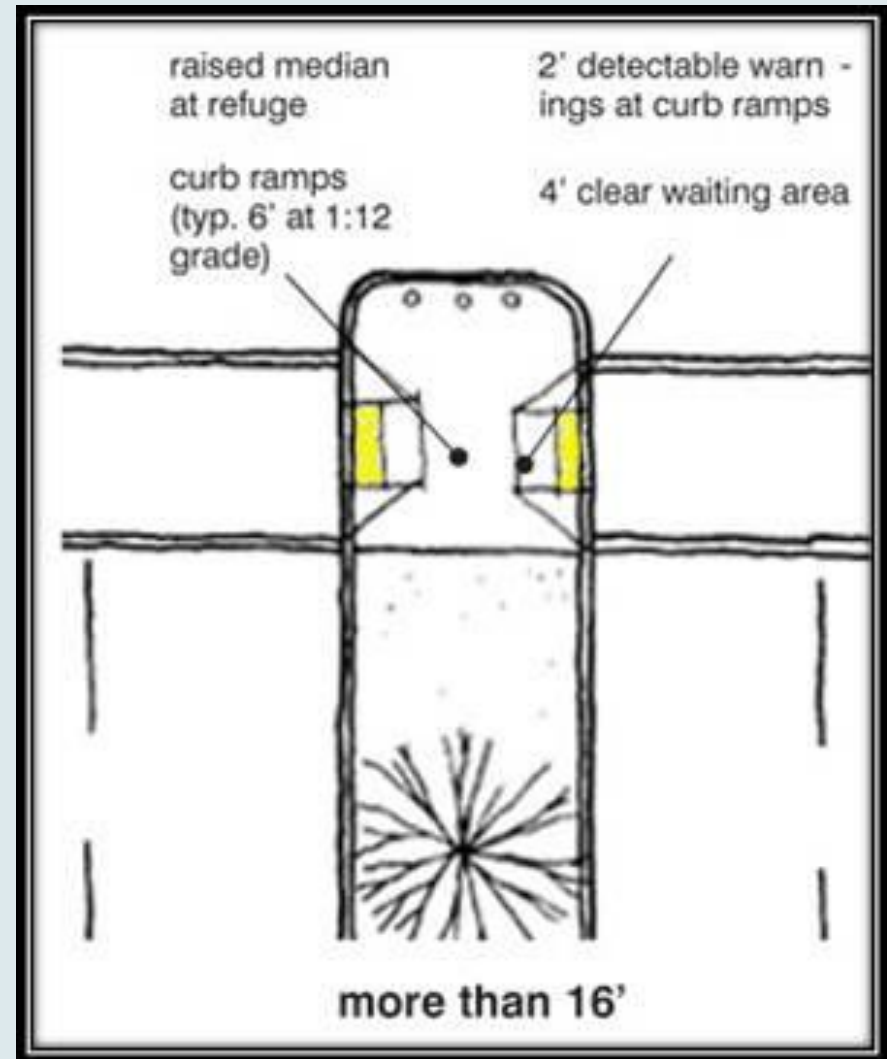


OK?



MEDIANS 16 FEET WIDE OR GREATER

- Refuge islands should be raised
 - more visibility for waiting pedestrians.
- Raised islands should include two ramps
 - 8.3% (1 inch per foot)
- Ramp ~6 feet long for 4 & 5 inch height curb
 - 2 foot wide detectable warning strips on each end & minimum 4 foot wide waiting area

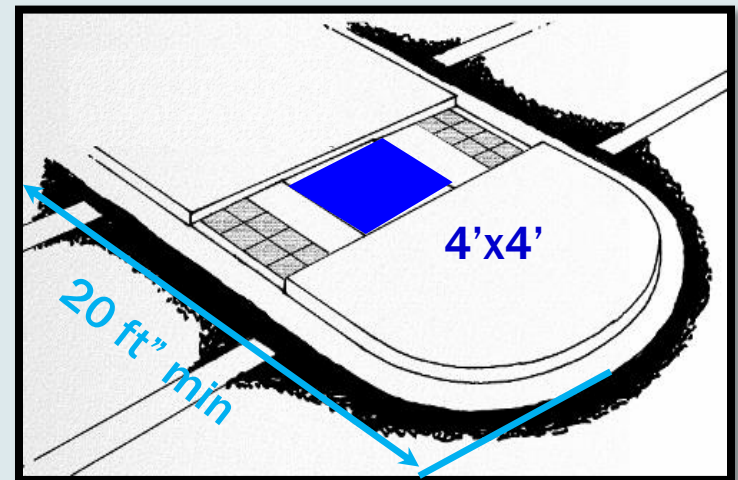
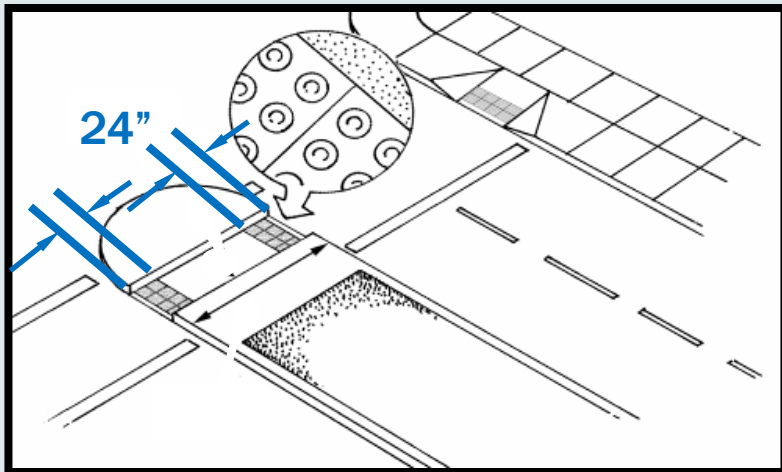


MEDIANS 16 FEET WIDE OR GREATER



ADA – AASHTO PED GREEN BOOK 2004

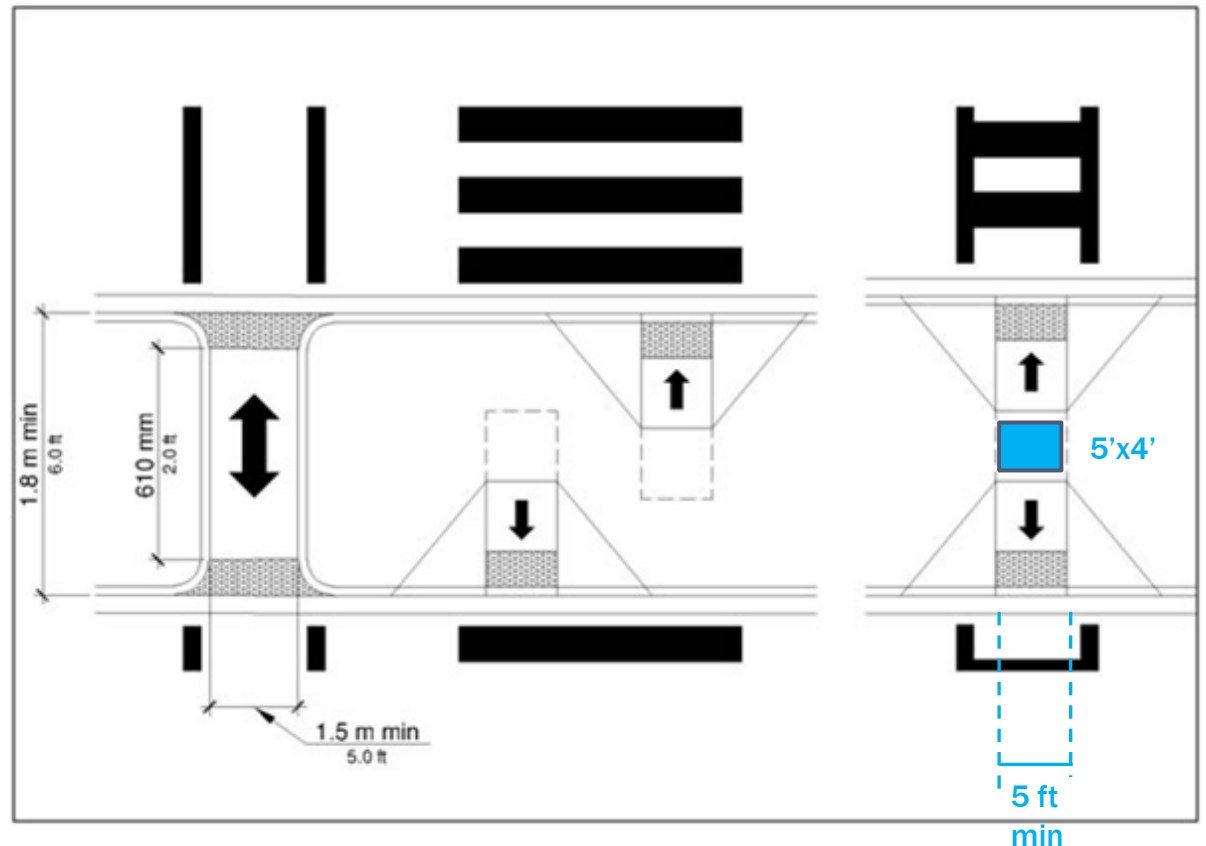
- Islands with ramps – level landing min. 4x4ft
- Ramp slope of 1V:12H (8.33%)
 - Island width ~16 feet needed if 6" curb height
- Detectable warnings bottom of all ramps
- Island length parallel to street min. 20ft



ADA PROWAG

- **R302.3.1 Medians and Pedestrian Refuge Islands.** The clear width of pedestrian access routes within medians and pedestrian refuge islands shall be 5.0 ft minimum.

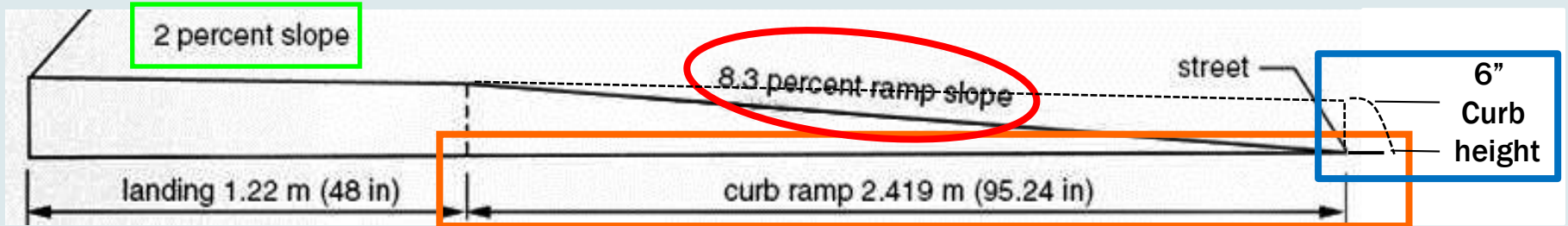
Figure R 305.2.4 Pedestrian Refuge Island



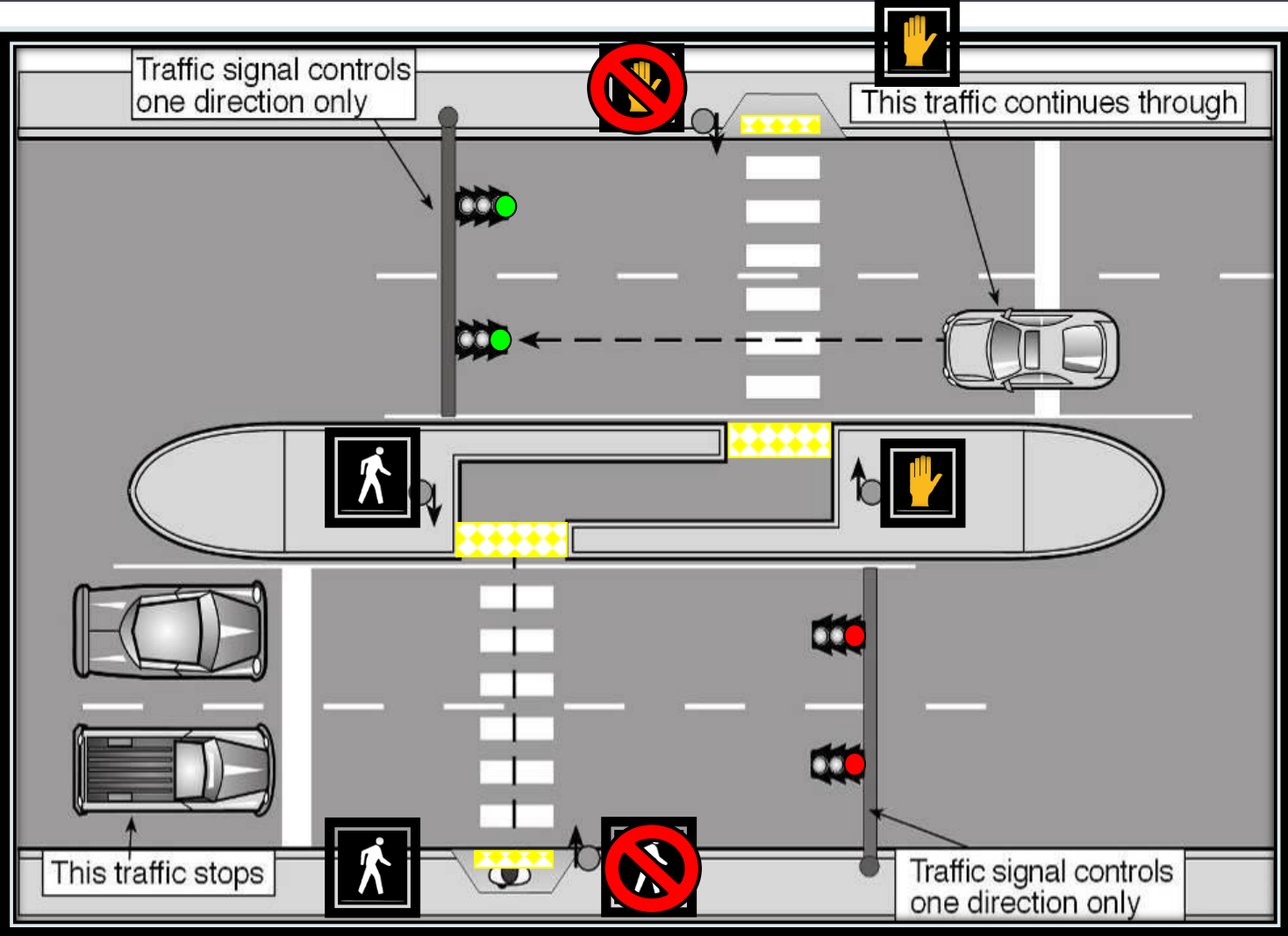
RAMP LENGTH

$$\text{Ramp Length} = \frac{\text{curb height } 6''}{(\text{ramp slope } 8.3\%) - (\text{sidewalk cross slope } 2\%)}$$

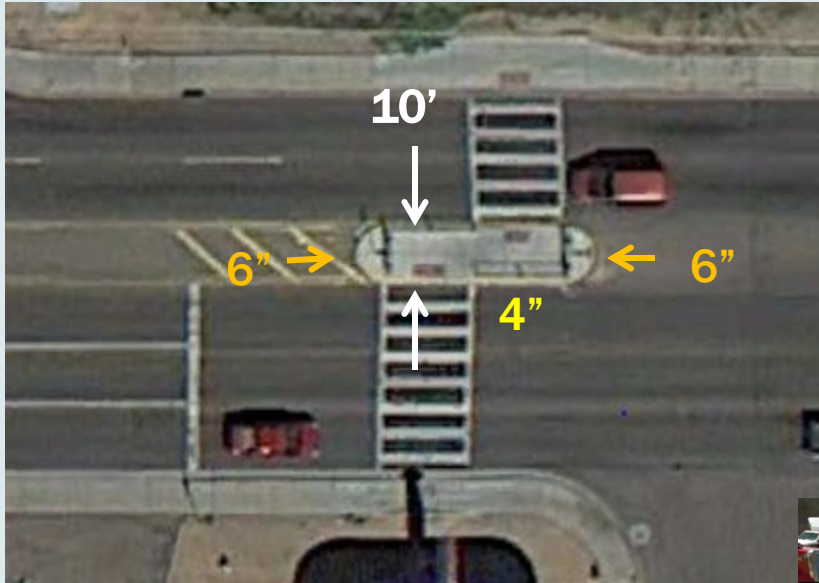
- Sample ramp length calculation
 - $6'' / (8.3\% - 2\%) = 7' 11''$
- Higher curb or flatter ramp grade = longer ramp



TWO-STAGE CROSSING



TWO-STAGE CROSSING AT 10 FT WIDE ISLAND



Compromise:

- Reduce island height in pedestrian area (4")
- Keep 6" height at each end of island

Railing in island must be crash worthy



TWO-STAGE ISLAND

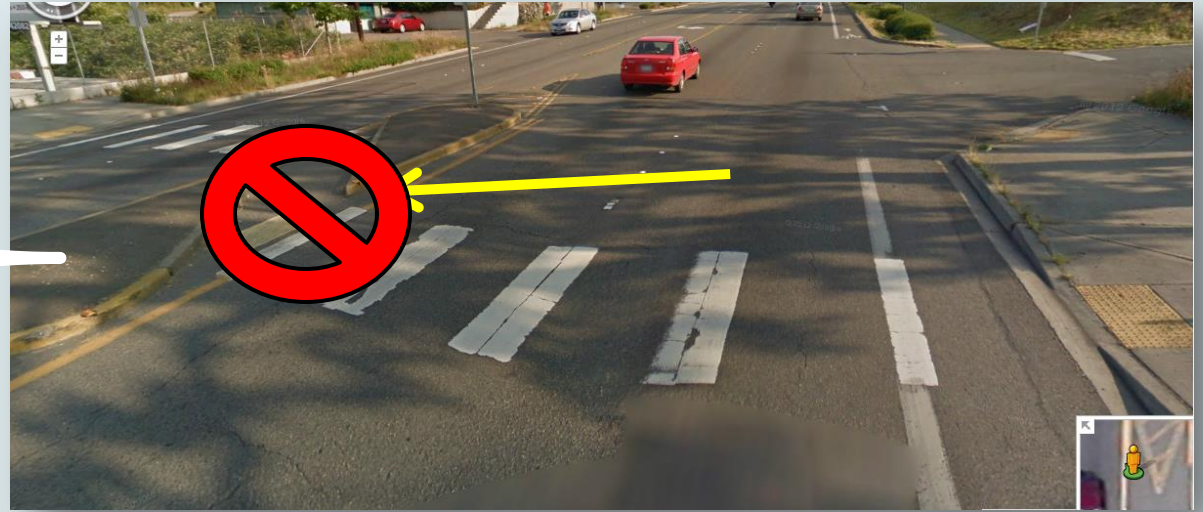


Two-Stage PHB

- Decorative fencing
- Shade in median
- Decorative landscaping – does not block visibility



ANGLED CUT THROUGH RIGHT OR WRONG?



ANGLED CUT THROUGH

- Blind use curb to find direction
- Finish curb to line up with crosswalk



Photo credit: Carl Sundstrom

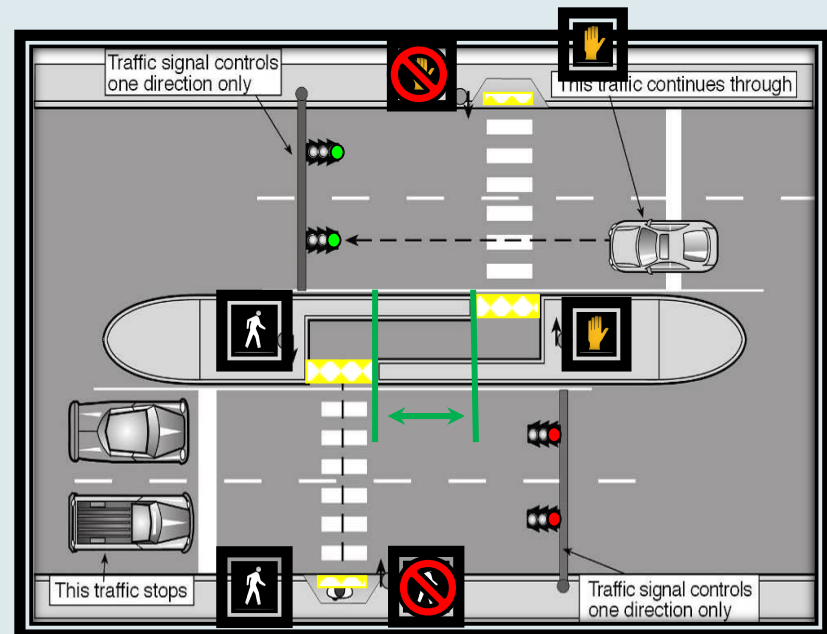
INFORMAL RESEARCH ON OFFSET CROSSWALKS

- Most UNSIGNALIZED 2-stage crossings are only staggered the width of the crosswalk.
 - Some are staggered the width of the crosswalk plus about 10 feet
- Amount of stagger need not be great
 - Especially with wider medians (16 feet or wider)
 - With medians of 20 feet or more the staggering may not be as important, even with signal or PHB-controlled
 - Every site is unique.
- The greater the stagger, the less likely someone will use it



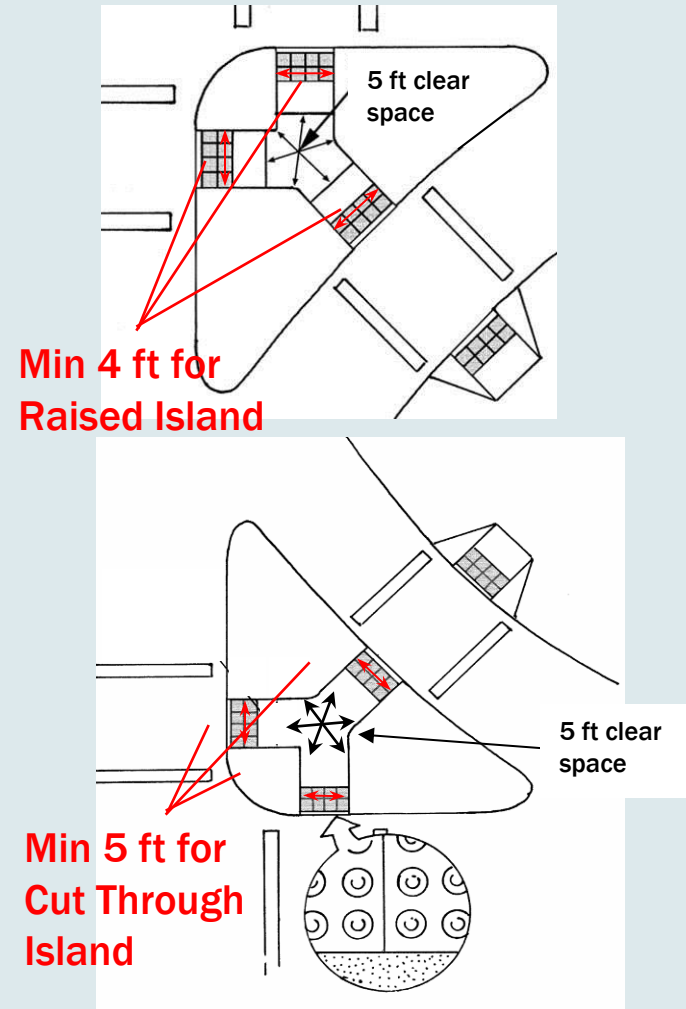
INFORMAL RESEARCH ON OFFSET CROSSWALKS

- For signal controlled crossings the width of the crosswalk plus 10 to 20 feet would typically be fine for narrower medians (in some cases to hold the pedestrians and to prevent pedestrians from viewing the wrong pedestrians signal head)
- Wider medians, greater than 16 feet, the width of the crosswalk should be sufficient
- Most of the pedestrian signals should be equipped with “egg crate” visors so that they are seen by pedestrians in the crosswalk area and not outside the crosswalk.
- This will also encourage more pedestrians to use the crosswalk.

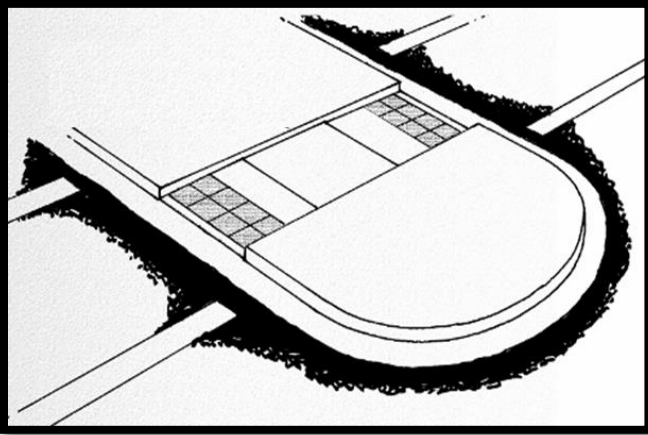


CUT-THROUGH OR RAISED CORNER ISLANDS

- With slip lanes, always use raised islands (not painted)
- Ramps must be at least 4 ft. wide
- For cut-through: must be 5 ft. wide
- Provide at least 5 feet of clear (turning) space or level landing
- Provide a 2-foot strip of detectable warnings at end of cut-through or at bottom of ramp
- Align cut-through or ramps with crosswalks



DRAINAGE



- Cut-through needs some slope
- Remember drainage at bottom of ramp





LANDSCAPING





LANDSCAPING

- Trees in median & sides of streets can help narrow long range field of vision for drivers, encouraging slower speeds
- Trees placed in median should comply with AASHTO Roadside Design Guide
- Trees should not block visibility of pedestrians crossing the street
 - Small caliper trees
 - Trim up branches
 - Bushes in median should be trimmed low

PLACEMENT OF TREES WITH RESPECT TO MEDIAN OPENINGS

- Careful consideration should be given to the location & type of landscaping
- Plantings in narrow medians may create problems for maintenance activities
- Plantings may cause visual obstructions for turning motorists
- Plantings and objects in medians may constitute roadside obstacles

Source: AASHTO Green Book

PLACEMENT OF TREES & SHRUBS WITH RESPECT TO MEDIAN OPENINGS

Guidance to consider when planting trees/bushes in medians:

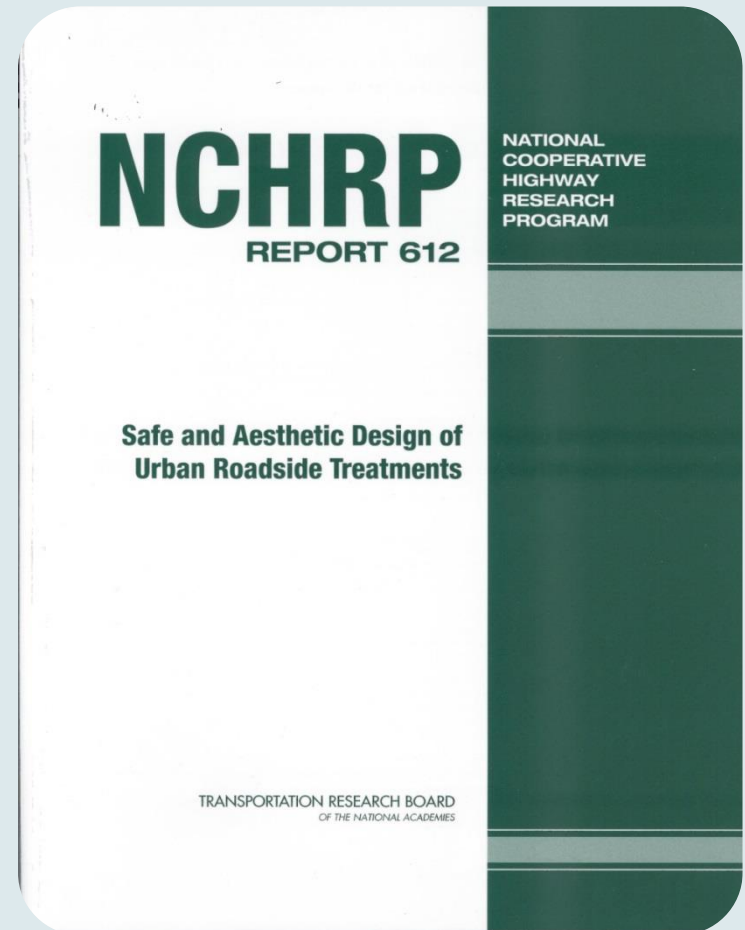
- **Non-signal median openings**
 - No shrubs with ultimate height over 30” within 50-ft of opening
 - No trees within 50 ft of opening
 - Second tree should be no closer than 100 ft from the first tree
 - No foliage between 2 ft and 6 ft above median
- **Median opening at traffic signals**
 - No shrubs with ultimate height over 30” within 50-ft of opening
 - No trees within 100 ft of opening
 - Second tree should be no closer than 100 ft from the first tree
 - No foliage between 2 ft and 6 ft above median
- **Same dimensions apply to median pedestrian crossings**

Source: Phoenix Traffic Operations Handbook, 2010

NCHRP REPORT 612

Objectives:

- Develop design guidelines for safe & aesthetic roadside treatments in urban areas
- Revised Chapter 10 of the Roadside Design Guide



CORRIDOR STUDY ANALYSIS OVERVIEW

- Identify 140+ miles of urban arterial roads
- Analyzed approximately 5 years of crash data
- Video tape corridor in both directions of travel and identify characteristics where crashes occurred (also compare to locations where the crashes did not occur)

California	7 corridors (47.3 miles)
Georgia	9 corridors (23.8 miles)
Illinois	7 corridors (48.5 miles)
Oregon	8 corridors (23.7 miles)

EVALUATION OF FIXED OBJECT CRASHES URBAN CORRIDORS – RAISED CURB

Lat. Dist.	Crashes	%	Cumul.%	
0-1'	129	28.3%	28.3%	Over 80% of crashes with fixed objects 4' or less from curb
1-2'	157	34.4%	62.7%	
2-4'	90	19.7%	82.5%	
4-6'	50	11.0%	93.4%	Over 90% of crashes with fixed objects 6' or less from curb
6-8'	23	5.0%	98.5%	
8-10'	6	1.3%	99.8%	
10-15'	1	0.2%	100%	
Total:	456	100%		Source: NCHRP Report 612

LANDSCAPE BUFFER (PLANTING STRIP) CONFIGURATION RECOMMENDATION

- Avoid putting rigid objects in “landscape buffers” 3’ wide or less.
- Place poles, light standards, or other large objects immediately adjacent to sidewalks or on opposite side of sidewalk -- not in center of planting strip.

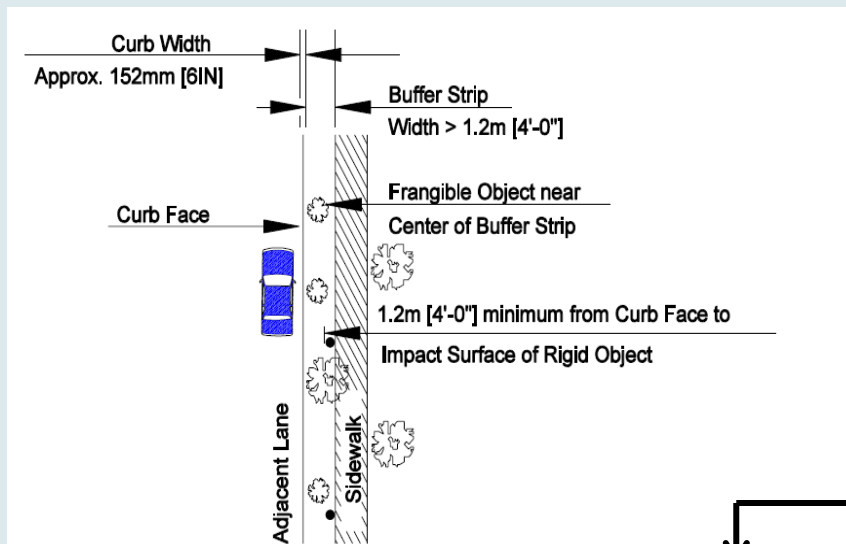


Figure 10-4. Landscape and Rigid Object Placement for Buffer Strip Widths ≤ 1.2 m [4 ft]

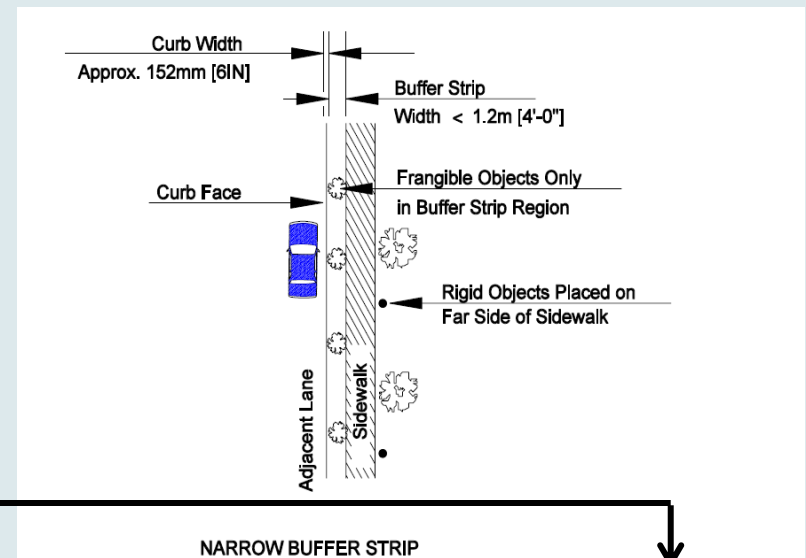
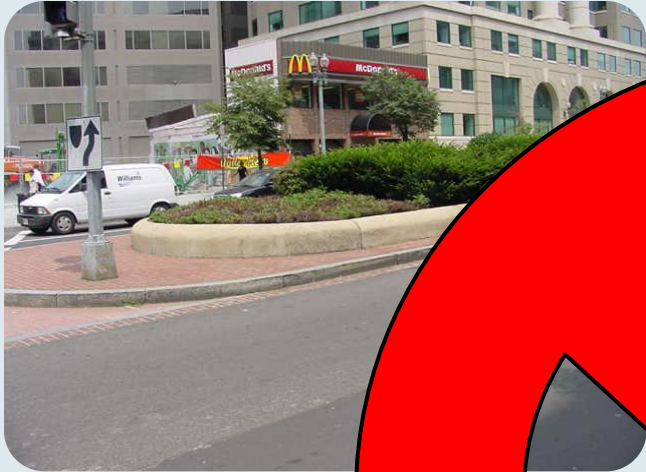


Figure 10-5. Landscape and Rigid Object Placement for Buffer Strip Widths > 1.2 m [4 ft]

RAISED ISLANDS NON-COMPLIANT DESIGNS



TL-2 WASHDOT MEDIAN\WALL



TL-2, 18 INCH MEDIAN BARRIER



LANDSCAPING

Landscaping can be a positive feature

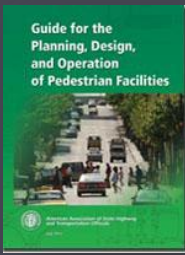
- Must not block sight lines of pedestrians and motorists at the crossing area
- Use of small trees, low shrubs, colorful native plants



MAINTENANCE

- Most likely swept by hand
- If swept by machine
 - Know width of sweepers
 - Know turning radius of sweepers
- Landscaping maintenance is essential





LANDSCAPING AS BARRIER

- May be used to prohibit midblock crossings at times
 - Traffic volumes and or speeds make intersection crossing preferred option
- Midrise shrubs and other types of planting alternatives for fencing
 - Used to divert the adjacent intersections
- Requires a commitment to maintain/water/repair

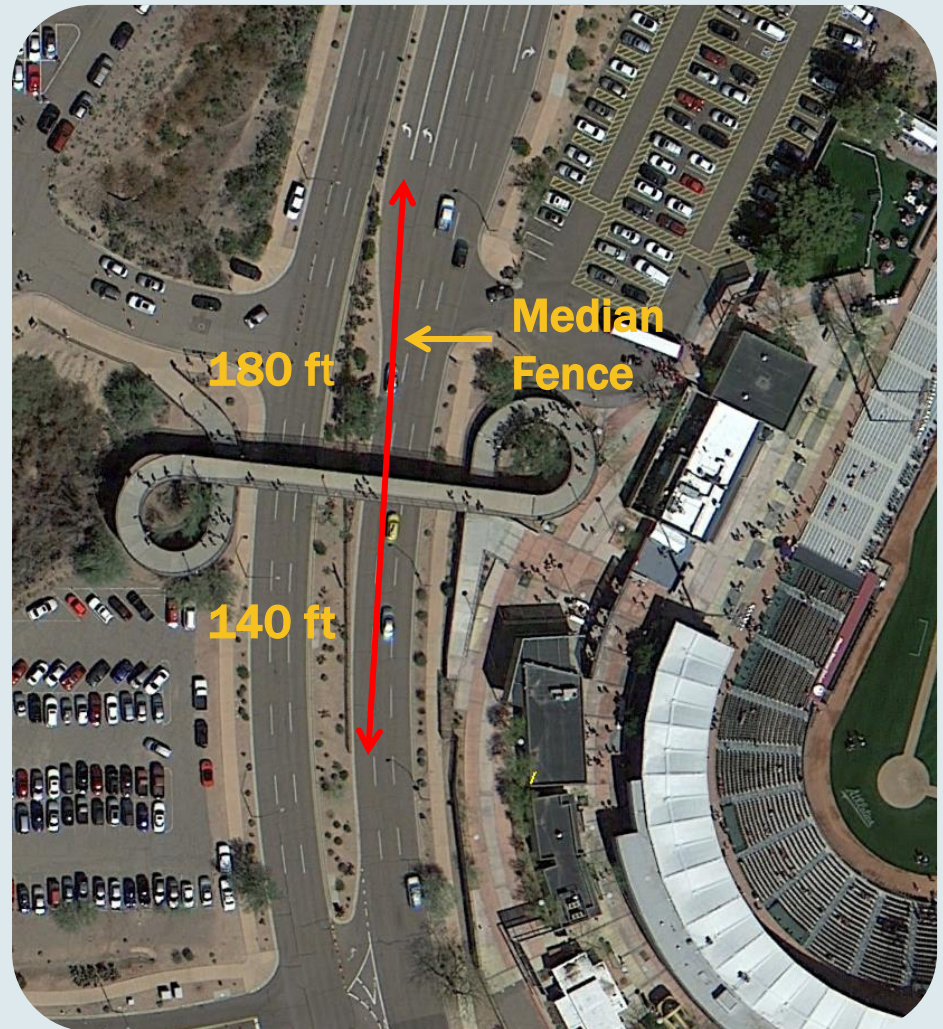
PEDESTRIAN FENCES IN MEDIANS

- Should be attractive
- Appropriate length to prevent crossings
- Treatments to prevent crossing as end points & median openings
- Visibility limitations for left turning motorists
- Must be crash worthy



MEDIAN FENCE FOR PEDESTRIAN OVERPASS

Median fence was added when it was found that police could not force pedestrians to use overpass





SIGNALIZED MIDBLOCK CROSSINGS

- Signals should be timed so that pedestrians can cross the entire street
- If the street is “too wide”, and there is a sufficient median width, a 2-stage crossing may be considered
 - Median width min 6 feet – preferably 8 to 10 feet wide
 - What crossing distance is “too long” to warrant median installation?
 - Crossing distance may be based on cycle length & distance to nearest signal
- For 2-stage crossings, a pedestrian pushbutton must be installed in median
 - Consider APS pushbuttons

MEDIAN WITH PARKING SIDEWALK

NYC Street Design Manual



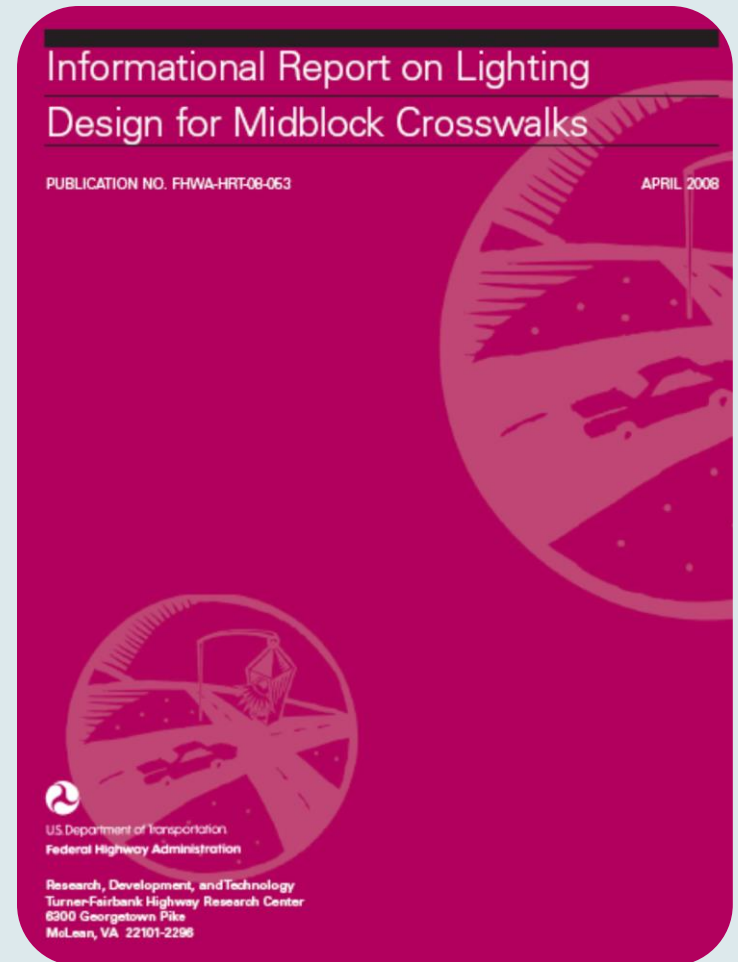
LIGHTING

- Lighting is encouraged to illuminate medians/crossing islands and crosswalk
- Continuous, double-sided lighting is preferred



INFORMATIONAL REPORT ON LIGHTING DESIGN FOR MIDBLOCK CROSSWALKS

- FHWA-HRT-08-053
 - April 2008
 - Available at <http://www.tfhrc.gov/safety/pubs/08053/08053.pdf>



SAMPLE ILLUSTRATIONS FROM FHWA REPORT

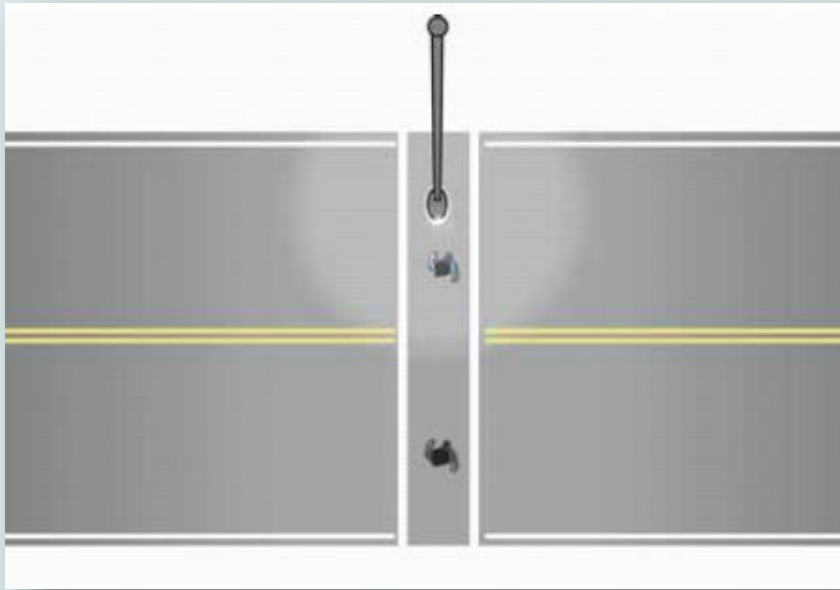


Fig 11. Traditional midblock crosswalk lighting layout

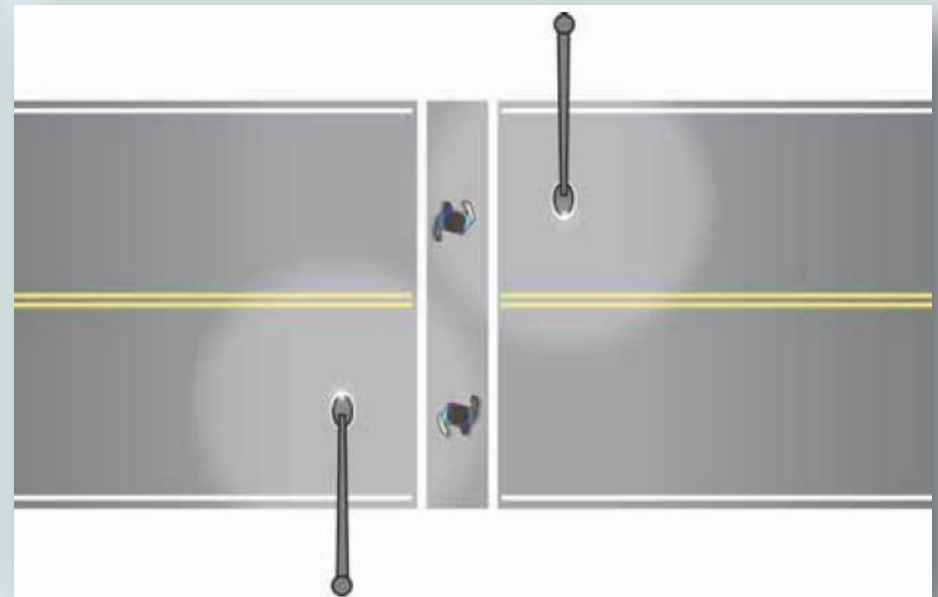


Fig 12. New design for midblock crosswalk lighting layout

Recommended lighting level: 20 lux at 5' above pavement

COST

Infrastructure	Description	Median	Average	Minimum	Maximum	Cost Unit	No. of Observations
Island	Median Island	\$10,460	\$13,520	\$2,140	\$41,170	Each	17 (19)
Island	Median Island	\$9.80	\$10	\$2.28	\$26	Sq Ft	6 (15)

Infrastructure	Description	Median	Average	Minimum	Maximum	Cost Unit	Number of Sources (Observations)
Median	Median	\$6.00	\$7.26	\$1.86	\$44	Square Foot	9 (30)

Source: “Costs for Pedestrian and Bicyclist Infrastructure Improvements: A Resource for Researchers, Engineers, Planners, and the General Public”, October 2013

POSSIBLE ISSUES WITH RAISED MEDIANS

- Construction detours when half street is closed
- *Installing medians on existing streets with lots of driveways*
- Need room to make U-turns (narrow cross-sections)
 - Check turning templates
- Street width consideration (medians result in wider streets)
 - ROW cost/Maintenance/Traffic signal timing
- Prohibiting crossing may require median fencing
 - Aesthetics (wrought iron)
 - Make sure fencing does not block driver visibility
 - Fencing should be crash worthy
 - Provide about 200 feet fencing on either side of main crossing point (Rule of Thumb)
 - Issues at the end points of fencing

U-TURN POINTS FOR CONTINUOUS MEDIANS

- U-Turn points were designed into continuous median
- Delineator posts discourage U-Turns for average drivers
- Emergency Vehicles run over delineators then replace
- Crossover point when roadwork is being done on one side of the roadway



CASE STUDIES

CASE STUDY: ISLANDS/RAISED MEDIANS (UNIVERSITY PLACE, WA)

Problem/Background

- City incorporated in 1995, wanted 'Main Street'
- Current main road was busy arterial with little ped/bike infrastructure
- Not safe for all users



Bridgeport Way, prior to improvements

CASE STUDY: ISLANDS/RAISED MEDIANS (UNIVERSITY PLACE, WA)

Solution

- Held design charrette for road improvements
- Residents & city wanted road to accommodate all users:
 - Sidewalks, bicycle lanes, medians, streetlights, mid-block crossings, etc.
- Had to deal with critics and doubters

Is council moving too fast on Bridgeport?

By LINDATARR
Editor

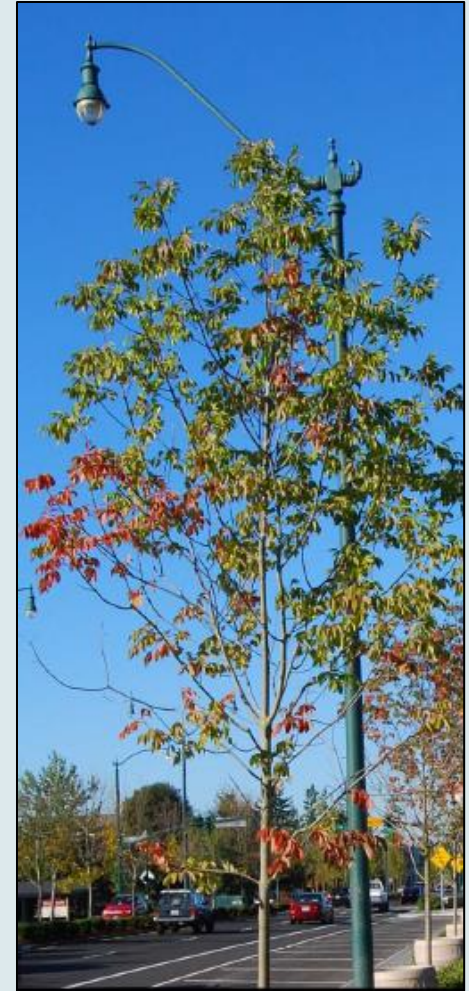
A discussion on where to

after Public Works Director Ben Yazici informed the council that it would be near impos-

should rely on research and the videos to answer questions, he said.

or a three-lane thoroughfare with roundabouts. The council is scheduled to make that deci-

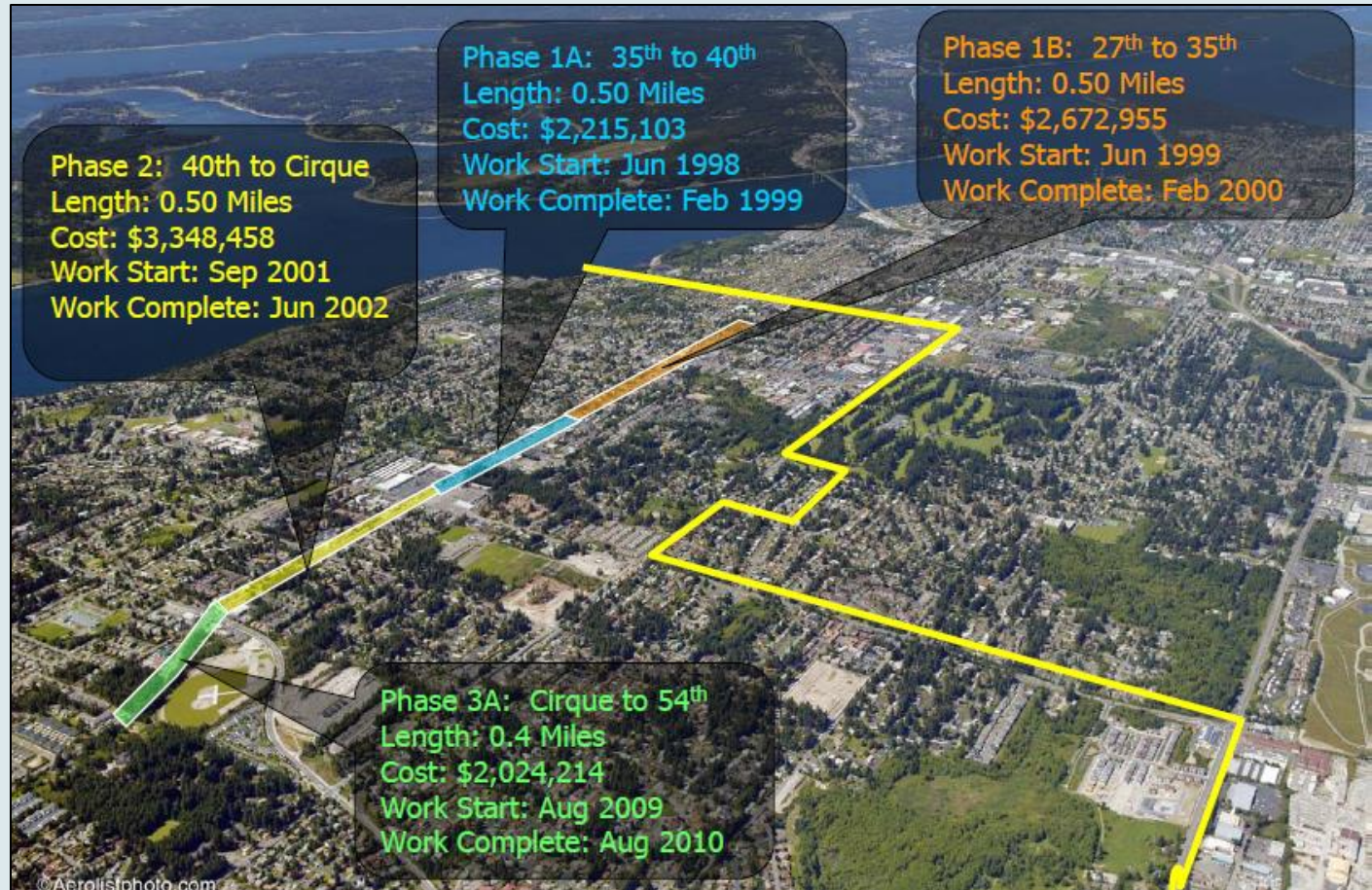
Council decides which fix for Bridgeport it wants to pursue. "It would be nice to have a



CASE STUDY: ISLANDS/RAISED MEDIANS (UNIVERSITY PLACE, WA)

Details

- Roadwork began 2 years after charrette
- 4 phases
- 1.9 miles
- ~\$10.2 million

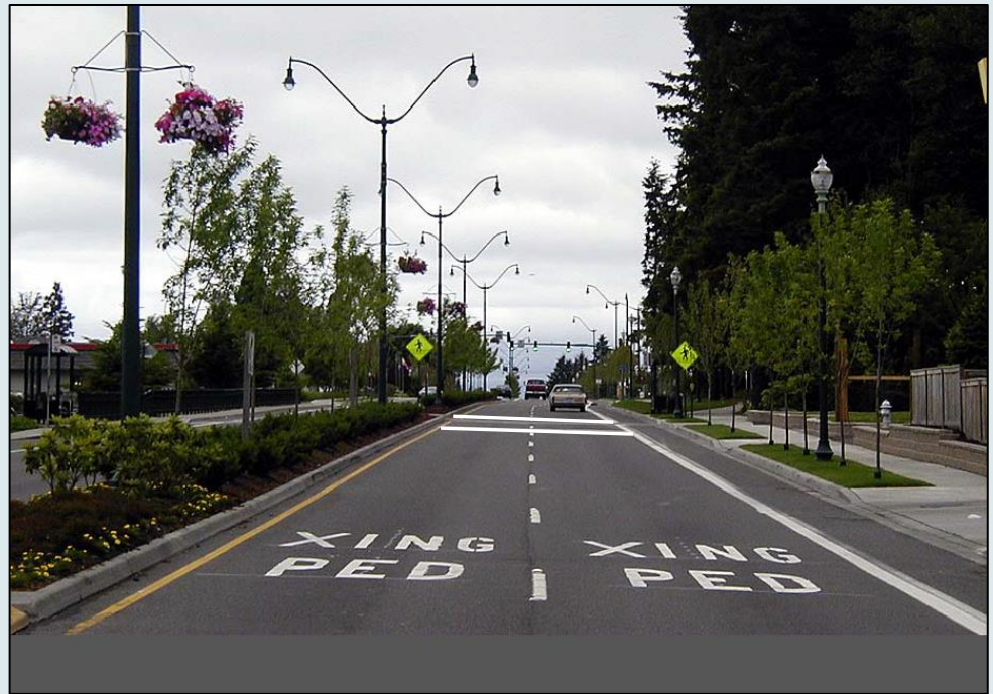


CASE STUDY: ISLANDS/RAISED MEDIANS (UNIVERSITY PLACE, WA)

Details

Roadway added elements that residents desired:

- Went from 5 lanes to 4 lanes with bicycle lanes and sidewalks
- Two-way turn lane replaced by landscaped median
- Mid-block crossings installed
- Utility lines buried
- lighting added



Mid-block pedestrian crossing

CASE STUDY: ISLANDS/RAISED MEDIANS (UNIVERSITY PLACE, WA)

Results

- 20% reduction in accidents along corridor
- 40% reduction in injuries along corridor
- Sales volume along corridor increased
- Mobility improved

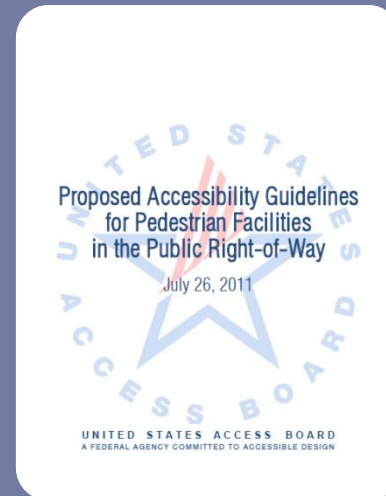
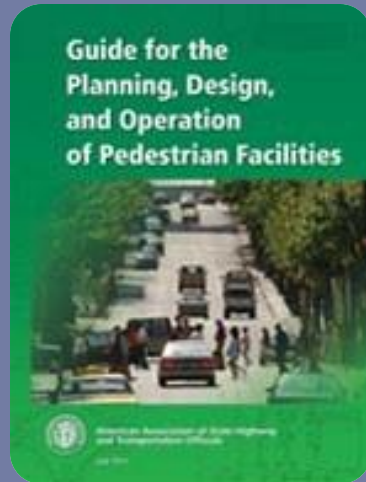
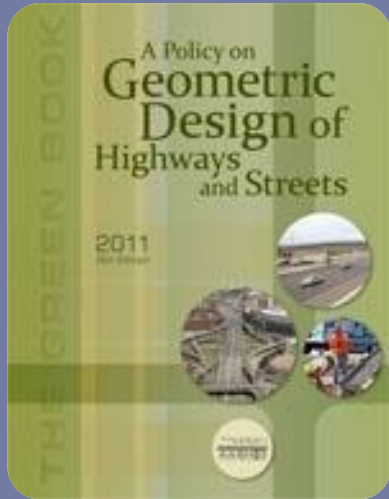


Before



After

NATIONAL GUIDANCE DOCUMENTS



AASHTO
Policy on
Geometric
Design of
Highways
and Streets

AASHTO
Guide for the
Planning,
Design, and
Operation of
Pedestrian
Facilities
July 2004

Public Right-
of-Way
Accessibility
Guidelines

QUESTIONS? RESOURCES

- AASHTO Guide for the Planning Design, and Operation of Pedestrian Facilities, July 2004
- AASHTO Policy on Geometric Design of Highways and Streets
- Public Right-of-Way Accessibility Guidelines
- Model Design Guide for Living Streets Los Angeles County 2011
- Update of Florida Crash Reduction Factors and Countermeasures to improve the Development of District Safety Improvement Projects
- Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations FHWA-RD-01-075.
- Toolbox of Countermeasures and Their Potential Effectiveness to Make Intersections Safer
- Informational Report on Lighting Design for Midblock Crosswalks FHWA-HRT-08-053
- NCHRP Report 612
- Washington State DOT Low Profile Barrier
 - <http://www.wsdot.wa.gov/Design/Standards/PlanSheet/GD-3.htm>

Thank You!

⇒ **Archive at www.pedbikeinfo.org/webinars**

- Downloadable/streaming recording and presentation slides

⇒ **Questions?**

webinars@hsrc.unc.edu