Countermeasure Strategies for Pedestrian Safety
Crossing Islands and Raised Medians

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Tindale Oliver and Associates

October 1, 2015
Today’s Presentation

- Introduction and housekeeping
- Audio issues?
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Countermeasure Strategies for Pedestrian Safety Webinar Series

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**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)

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CROSSING ISLANDS/RAISED MEDIANS
LIST ALL FEATURES THAT IMPROVE PEDESTRIAN SAFETY?

- Curb extension
- High visibility crosswalks
- Lighting
- Pulled back stop bar
- On street parking
- Bike lanes
- Zone system sidewalks
- ADA
- Raised crossing island
WHY RAISED ISLAND ARE SAFER FOR PEDESTRIANS

- Breaks up complex crossing into two simpler ones
- Medians and Pedestrian Crossing Islands in Urban and Suburban Aras
  - One of FHWA’s 9 proven safety countermeasures
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


(3) Institute of Transportation Engineers. (2004). Toolbox of Countermeasures and Their Potential Effectiveness to Make Intersections Safer. Briefing Sheet 8, FHWA.
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
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

<table>
<thead>
<tr>
<th>Factors</th>
<th>OK</th>
<th>Should Consider</th>
<th>Install</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed (mph)</td>
<td>30 or less</td>
<td>35</td>
<td>40 or more</td>
</tr>
<tr>
<td>ADT</td>
<td>&lt; 9,000</td>
<td>9,000 - 15,000</td>
<td>&gt; 15,000</td>
</tr>
<tr>
<td>Number of lanes</td>
<td>3</td>
<td>4-6</td>
<td>7 or more</td>
</tr>
<tr>
<td>Pedestrian volume</td>
<td>&lt; 20/hour</td>
<td>&lt; 20/hour</td>
<td>20/hour or more</td>
</tr>
<tr>
<td>Crashes</td>
<td>0</td>
<td>1-3</td>
<td>4 or more</td>
</tr>
</tbody>
</table>

- 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
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.
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
WHERE TO PLACE

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

SINGLE UNIT (SU) TRUCK DESIGN VEHICLE
TURNING RADIUS = 42 ft [12.80 m]
SCALE = 1:20 [1:200]

- Low 2-axle vehicles and all motorcycles (including motorcycles pulling trailers)
- High 2-axle vehicles and low 3-axle vehicles
- High 3-axle vehicles and low 4-axle vehicles
- High 6-axle vehicles
- All vehicles with 7 or more axles

- 6’ - 22’
- 20’ - 34’
- 32’ - 72’
- 65’ - 71’
- 68’ - 111’
WHAT TYPE OF MEDIAN OR ISLAND

- Flush
- 6" Raised Curb
- Low Profile Barrier
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
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
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

<table>
<thead>
<tr>
<th>Median Type</th>
<th>Minimum Width</th>
<th>Recommended Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median for access control</td>
<td>4 feet</td>
<td>6 feet</td>
</tr>
<tr>
<td>Median for pedestrian refuge</td>
<td>6 feet</td>
<td>8 feet</td>
</tr>
<tr>
<td>Median for single left-turn lane and pedestrian refuge</td>
<td>16 feet [4]</td>
<td>16 feet</td>
</tr>
</tbody>
</table>

**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.
- [4] Includes a 10-foot turn lane and a 6-foot pedestrian refuge.
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

Graphic: San Francisco Better Streets Guide
OK?
OK?
OK?
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
- 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
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.
RAMP LENGTH

Sample ramp length calculation
- $6'' / (8.3\% - 2\%) = 7' 11''$

Higher curb or flatter ramp grade = longer ramp
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 PHB
- Decorative fencing
- Shade in median
- Decorative landscaping – does not block visibility
ANGLED CUT THROUGH
RIGHT OR WRONG?
Blind use curb to find direction

Finish curb to line up with crosswalk

Photo credit: Carl Sundstrom
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
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.
- 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
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
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
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**

Objectives:

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

<table>
<thead>
<tr>
<th>State</th>
<th>Corridors</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>7 corridors</td>
<td>(47.3 miles)</td>
</tr>
<tr>
<td>Georgia</td>
<td>9 corridors</td>
<td>(23.8 miles)</td>
</tr>
<tr>
<td>Illinois</td>
<td>7 corridors</td>
<td>(48.5 miles)</td>
</tr>
<tr>
<td>Oregon</td>
<td>8 corridors</td>
<td>(23.7 miles)</td>
</tr>
</tbody>
</table>
## EVALUATION OF FIXED OBJECT CRASHES
### URBAN CORRIDORS – RAISED CURB

<table>
<thead>
<tr>
<th>Lat. Dist.</th>
<th>Crashes</th>
<th>%</th>
<th>Cumul.%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1’</td>
<td>129</td>
<td>28.3%</td>
<td>28.3%</td>
</tr>
<tr>
<td>1-2’</td>
<td>157</td>
<td>34.4%</td>
<td>62.7%</td>
</tr>
<tr>
<td>2-4’</td>
<td>90</td>
<td>19.7%</td>
<td>82.5%</td>
</tr>
<tr>
<td>4-6’</td>
<td>50</td>
<td>11.0%</td>
<td>93.4%</td>
</tr>
<tr>
<td>6-8’</td>
<td>23</td>
<td>5.0%</td>
<td>98.5%</td>
</tr>
<tr>
<td>8-10’</td>
<td>6</td>
<td>1.3%</td>
<td>99.8%</td>
</tr>
<tr>
<td>10-15’</td>
<td>1</td>
<td>0.2%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>456</strong></td>
<td><strong>100%</strong></td>
<td></td>
</tr>
</tbody>
</table>

Over 80% of crashes with fixed objects 4’ or less from curb
Over 90% of crashes with fixed objects 6’ or less from curb

Source: NCHRP Report 612
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.
RAISED ISLANDS
NON-COMPLIANT DESIGNS
TL-2 WASHDOT MEDIAN\WALL
TL-2, 18 INCH MEDIAN BARRIER
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 was added when it was found that police could not force pedestrians to use overpass.
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
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
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

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Description</th>
<th>Median</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Cost Unit</th>
<th>No. of Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Island</td>
<td>Median Island</td>
<td>$10,460</td>
<td>$13,520</td>
<td>$2,140</td>
<td>$41,170</td>
<td>Each</td>
<td>17 (19)</td>
</tr>
<tr>
<td>Island</td>
<td>Median Island</td>
<td>$9.80</td>
<td>$10</td>
<td>$2.28</td>
<td>$26</td>
<td>Sq Ft</td>
<td>6 (15)</td>
</tr>
</tbody>
</table>

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

Details

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

Phase 1A: 35th to 40th
Length: 0.50 Miles
Cost: $2,215,103
Work Start: Jun 1998
Work Complete: Feb 1999

Phase 1B: 27th to 35th
Length: 0.50 Miles
Cost: $2,672,955
Work Start: Jun 1999
Work Complete: Feb 2000

Phase 2: 40th to Cirque
Length: 0.50 Miles
Cost: $3,348,458
Work Start: Sep 2001
Work Complete: Jun 2002

Phase 3A: Cirque to 54th
Length: 0.4 Miles
Cost: $2,024,214
Work Start: Aug 2009
Work Complete: Aug 2010

Phase 3B: 54th to 27th
Length: 0.50 Miles
Cost: $2,813,032
Work Start: Jun 2010
Work Complete: Jun 2011
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
Results

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

- 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
Thank You!

⇒ Archive at www.pedbikeinfo.org/webinars
  ▪ Downloadable/streaming recording and presentation slides

⇒ Questions?
  webinars@hsrc.unc.edu