Countermeasure Strategies for Pedestrian Safety

Curb Extensions, Bulb Outs and Neckdowns

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October 27, 2015

Today's Presentation

- **Introduction and housekeeping**
- **Audio issues?**
  Dial into the phone line instead of using "mic & speakers"
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- **Questions at the end**

Countermeasure Strategies for Pedestrian Safety Webinar Series

Upcoming Webinars

Rectangular Rapid Flashing Beacons

Thursday, November 5 (1:00 – 2:30 PM Eastern Time)

Pedestrian Hybrid Beacons

Thursday, November 12 (2:00 – 3:30 PM Eastern Time)

Leading Pedestrian Interval

Wednesday, December 2 (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

CURB EXTENSIONS
BULB OUTS
NECKDOWNS

DPS 201

WHEN & WHERE

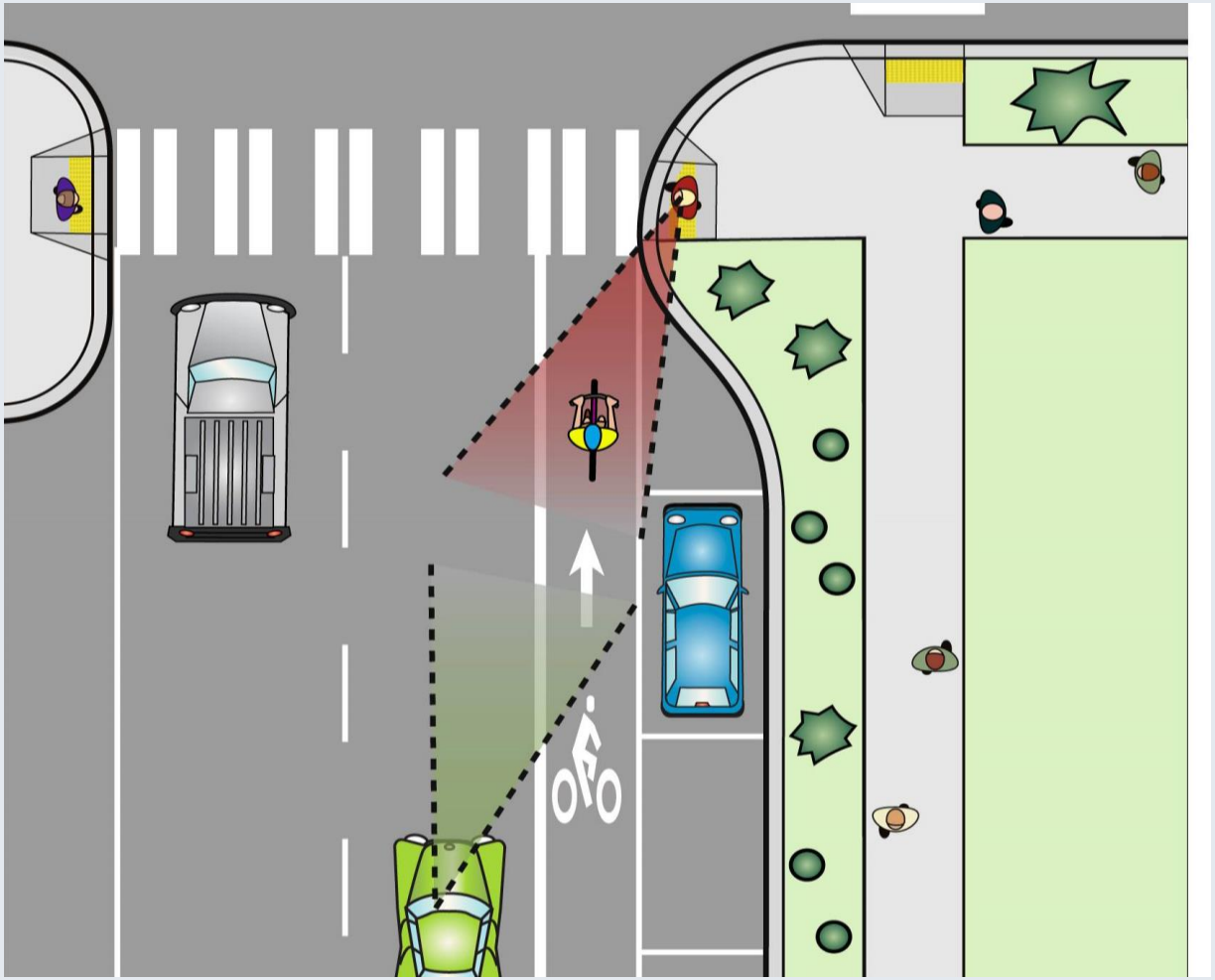
When

- Limited Sight Distance
  - Pedestrians & Vehicles
  - Vehicles and Signs
- Want to put two curb ramps in
- Discourage High speed turning
- High number of pedestrians waiting on corner

Where

- Wherever there is 24/7 on street parking
  - Intersections
  - Midblock

BETTER VISIBILITY



BETTER TO SEE YOU WITH

Pedestrians wait where they can see - in front of parked cars

Curb extension places pedestrian where they can see and be seen

WIN - WIN

CASE STUDY: CURB EXTENSIONS (CAMBRIDGE, MA)

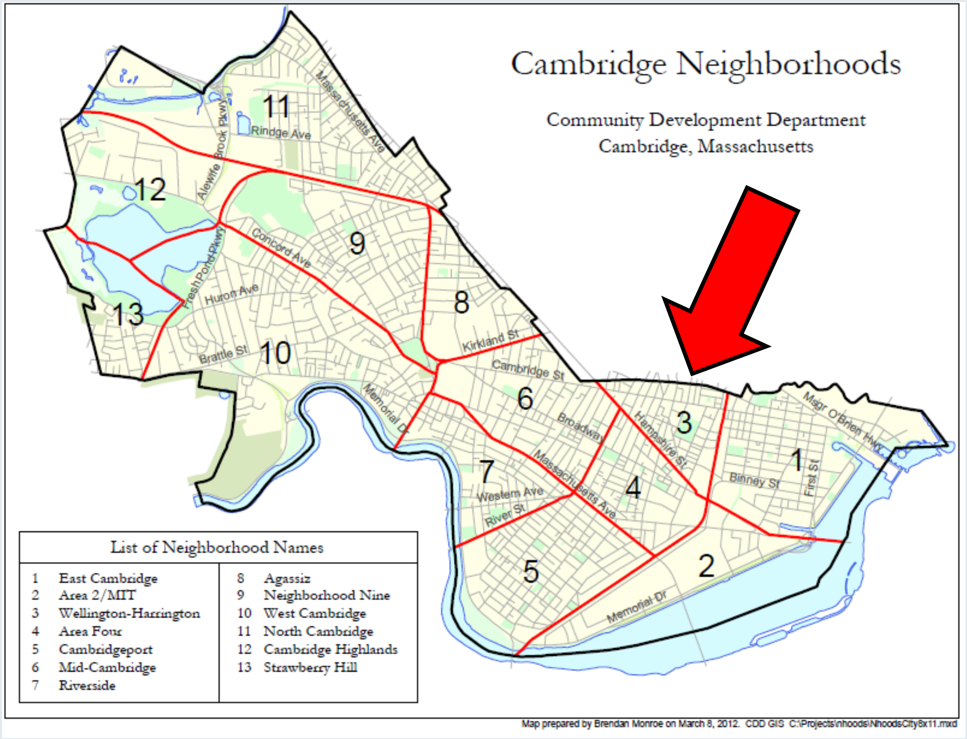
Problem

- High motorist high speeds on Berkshire Street
- Failure to obey STOP signs
- High pedestrian activity (especially children)
- Popular motorist cut-through
- High number of pedestrian collisions

CASE STUDY: CURB EXTENSIONS (CAMBRIDGE, MA)

Background

- Residential area with mix of businesses and retail shops
- Residents had long-complained about speeding and disregarding STOP signs
- Police data confirm the problem



CASE STUDY: CURB EXTENSIONS (CAMBRIDGE, MA)

Solution

- Curb extensions installed as part of a traffic calming effort
  - 3 intersections
- Other improvements included:
  - Raised crosswalks/intersections
  - Chicanes
  - Restriping crosswalks
  - Altering pedestrian park access points
- Done in three phases - total cost $8,236,516
  - 20% local, 80% state/federal

Curb extension at Berkshire and Plymouth Streets

Motorist view of the curb extension at Berkshire and Plymouth Streets

CASE STUDY: CURB EXTENSIONS (CAMBRIDGE, MA)

Results

- Curb extensions reduced the crossing distance, limited exposure time, improved visibility, & slowed turning vehicles
- Survey found 44% liked the changes, 28% did not
- 47% felt pedestrian safety improved
- 61% said it was more difficult to find parking (despite net loss of 1 on-street space)

Curb Extension at Berkshire St & York St

CURB EXTENSIONS/BULB OUTS - SAFETY

- NO CMF's/CRF's
- Curb extensions contribute to increased pedestrian safety by:
  - Increasing pedestrian visibility
  - Allows pedestrians to better observe approaching motorists
  - Decreasing crossing distance
  - Reducing pedestrian exposure to traffic
  - Can reduce speeds by visually narrowing the street
  - Slows turning vehicles
  - Can improve signal timing / may reduce cycle length

SAFETY RESEARCH

- PEDESTRIAN SAFETY IMPACTS OF CURB EXTENSIONS: A CASE STUDY Final Report SPR 304- 321
  - http://www.oregon.gov/ODOT/td/tp_res/docs/reports/pedestrainsafetycurbext.pdf
- Doesn't include CRF but covers yielding rates
- **Safety Performance**
  - By reducing the pedestrian crossing distance and exposure of pedestrians to traffic, this treatment should reduce the frequency of pedestrian collisions. A New York City study suggested that curb extensions appear to be associated with lower frequencies and severities of pedestrian collisions.(102) Curb extensions should also reduce speeds on approaches where they are applied.
- King, M. "Calming New York City Intersections" *Transportation Research Circular EC019:*
  - *Urban Street Symposium Conference Proceedings*, Dallas, TX, June 28-30, 1999.
  - Washington, DC: TRB, NRC, December 2000.

BENEFITS & LIABILITIES

Signalized Intersections: Informational Guide

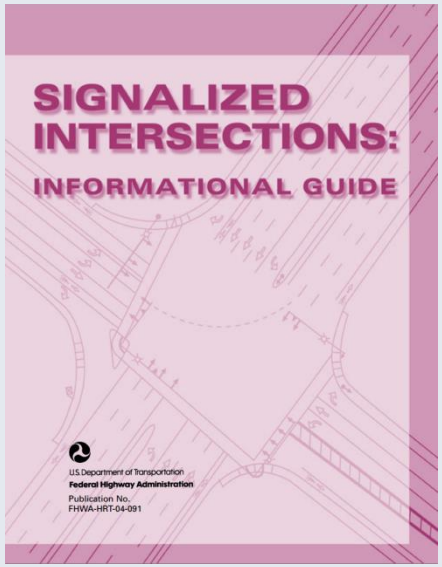
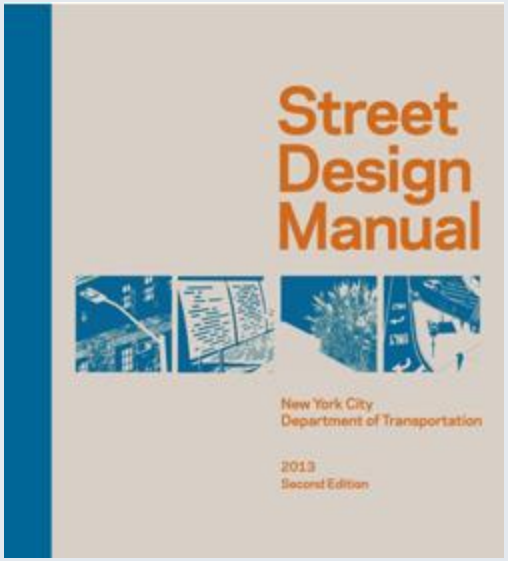


Table 45. Summary of issues for curb extensions.

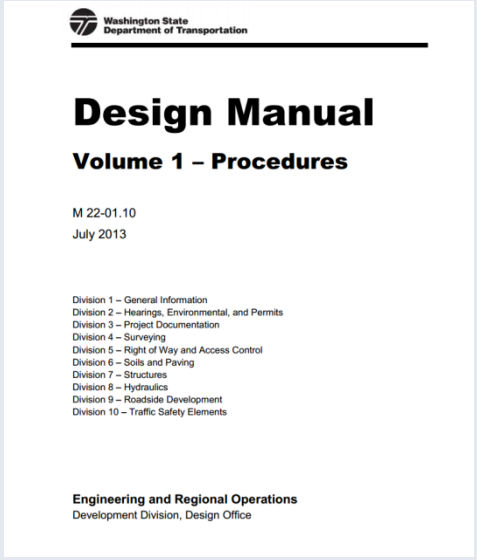
Characteristic	Potential benefits	Potential Liabilities
Safety	Reduction in right-turning vehicle/pedestrian collisions. Fewer right-turn-on-red violations.	May increase right-turning/through vehicle rear- end collisions due to increased speed differential. Large vehicle offtracking.
Operations	Less overall delay due to reduction in time needed to serve pedestrian movement.	May adversely affect operation if curb extension replaces a travel lane. Right-turn movements delayed. Emergency vehicles may be significantly delayed.
Multimodal	Shorter crossing distance. Facilitates the use of two perpendicular ramps rather than a single diagonal ramp. Better visibility between pedestrians and drivers.	May be more difficult for large trucks and buses to turn right.
Physical	None identified.	Drainage may be adversely affected.
Socioeconomic	Low to moderate costs.	None identified.
Enforcement, Education, and maintenance	None identified.	None identified.

DESIGN GUIDANCE

- NYC street design manual
  - Http://www.nyc.gov/html/dot/downloads/pdf/nycdot_streetdesignmanual_ch2.pdf
- WSDOT Design Manual Chapter 1510 Pedestrian Facilities
  - *http://www.wsdot.wa.gov/publications/manuals/fulltext/m22-01/1510.pdf*



Chapter 2 - Geometry



Chapter 1510 – Pedestrian Facilities

DESIGN GUIDANCE

Washington State DOT Design Manual

- Extend the curb no farther than the width of the parking lane.
- Design the approach nose to ensure adequate setback of vehicles to provide visibility of pedestrians.
- At traffic signals - curb extensions can be used to reduce pedestrian signal timing (less crossing distance).

WHEN NOT TO USE

Washington State Department of Transportation

Washington State DOT Design Manual

- Do not use curb extensions on State highways when:
  - The design vehicle encroaches on curbs or opposing lanes
  - On-street parking is not provided/allowed.
  - The posted speed is above 35 mph.

CURB EXTENSIONS ON ONE SIDE OF INTERSECTION

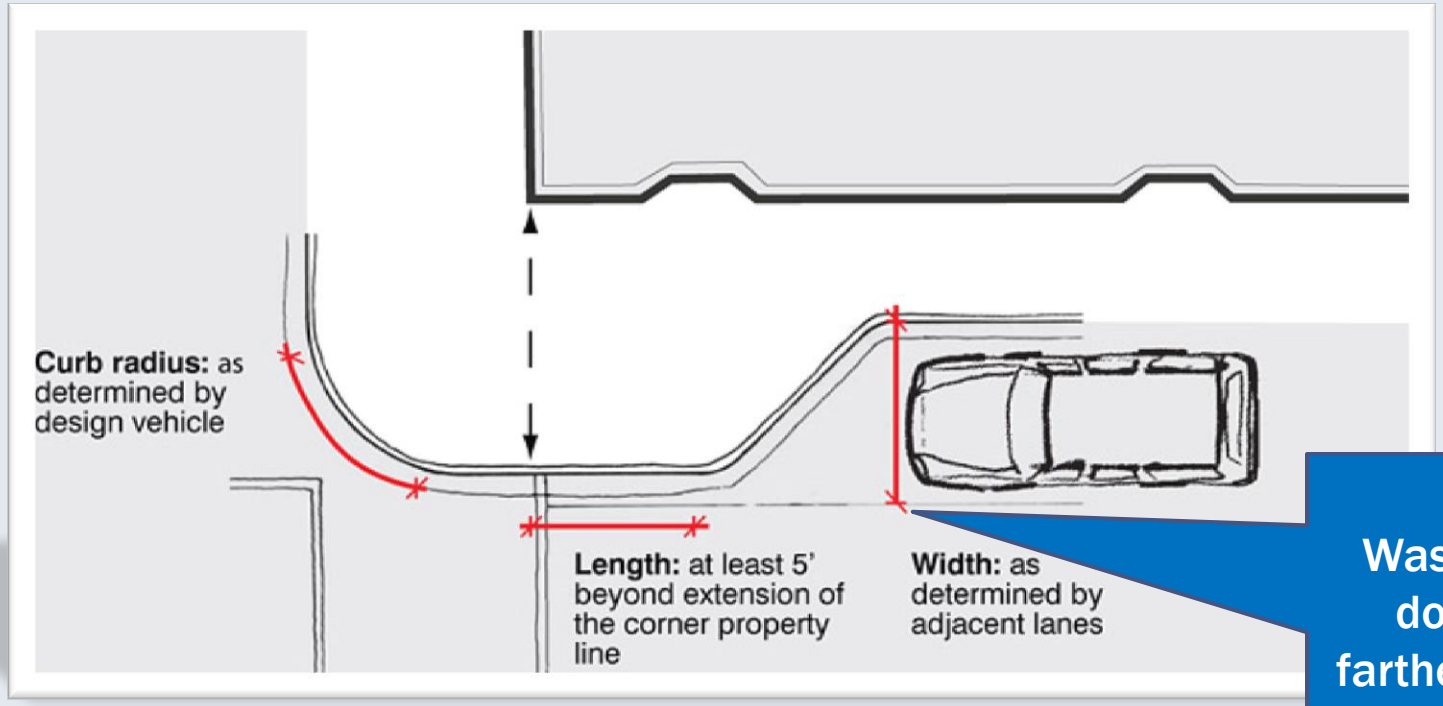
- Use Caution: Drivers that may run through the right turn lane on one side will hit the curb extension
- Bollards installed to help alleviate the situation

DIMENSIONS
NYC STREET DESIGN MANUAL

- Width is typically 2 feet less than width of parking lane
  - Curb extension can extend to (not into) the bicycle lane
- Minimum curb extension length typically equal to full width of the crosswalk

DIMENSIONS
SAN FRANCISCO BETTER STREETS

Typical Bulb-Out Dimensions

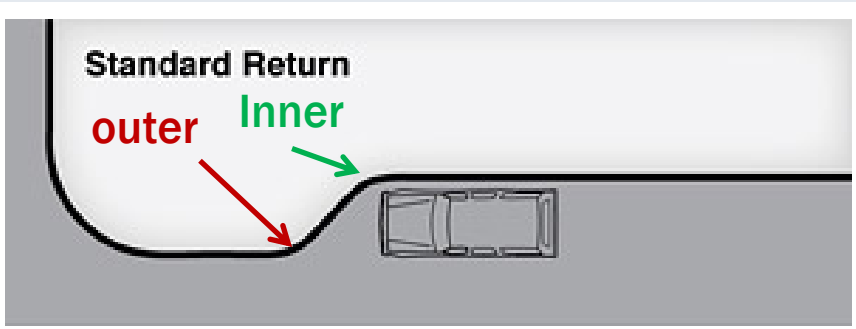


Washington D.C. doesn't allow farther than 6 feet. Potential for future bike lane

RADII
SAN FRANCISCO BETTER STREETS

Standard return: inner/outer curb radius of 20ft & 10ft

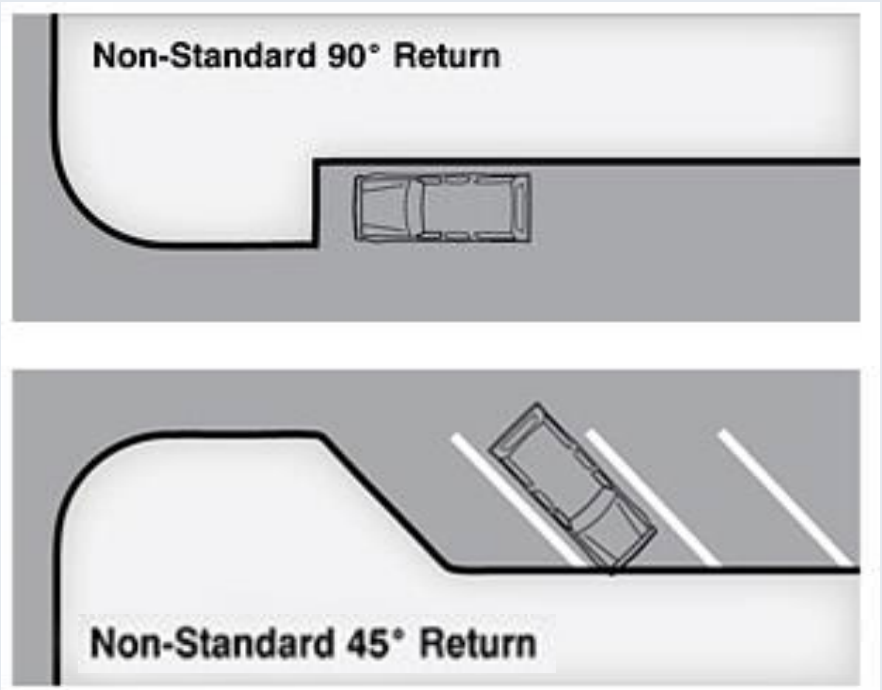
- Enable street sweeping machines to sweep the entire curb line
- May be reduced to 15ft and 10ft to



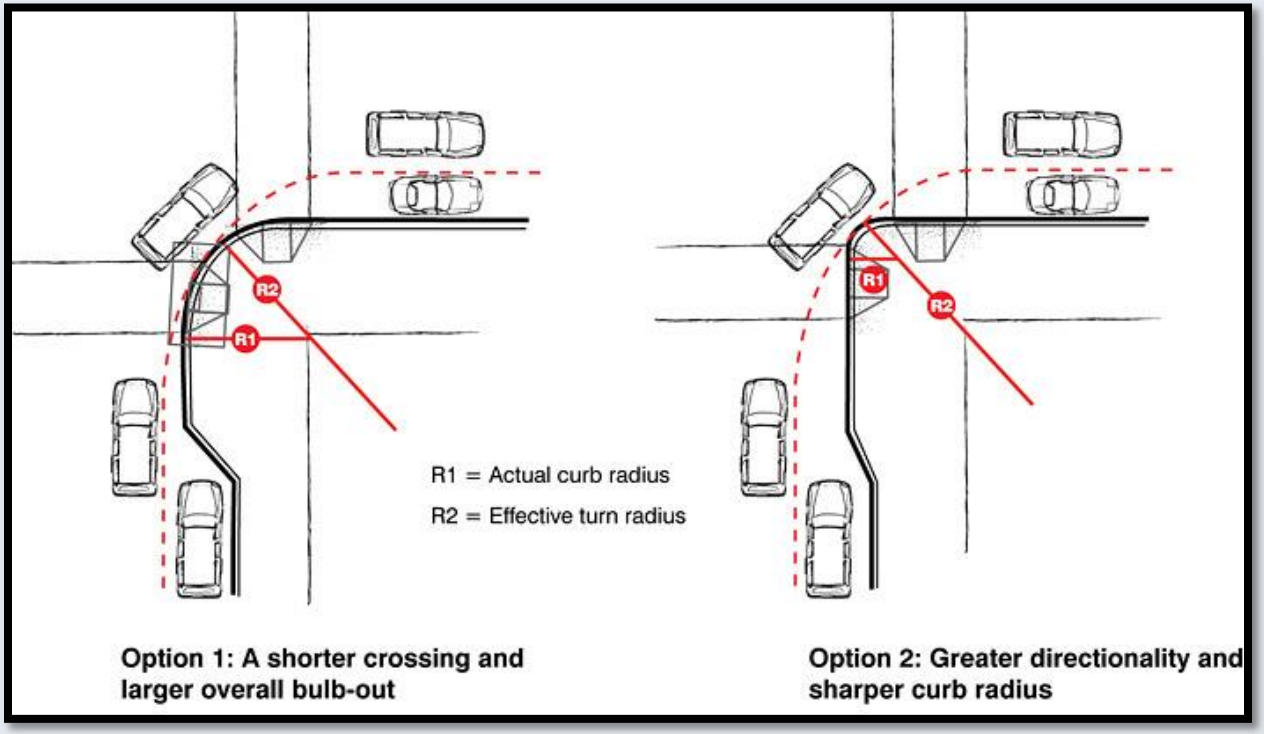
RADII
SAN FRANCISCO BETTER STREETS

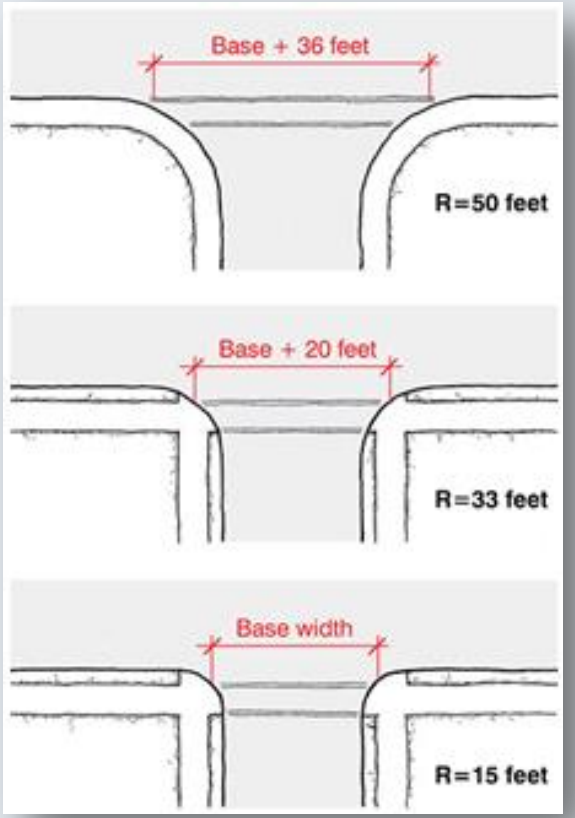
Non-standard return:

- 90 degree return:
  - Used with parallel or perpendicular parking.
- 45 degree return:
  - used with either parallel parking (45 degree return) or angled parking.
- Increases pedestrian space & minimize parking loss
- More difficult & costly to maintain
- 90 degree - more difficult for vehicles to enter/leave the space



RADII
SAN FRANCISCO BETTER STREETS



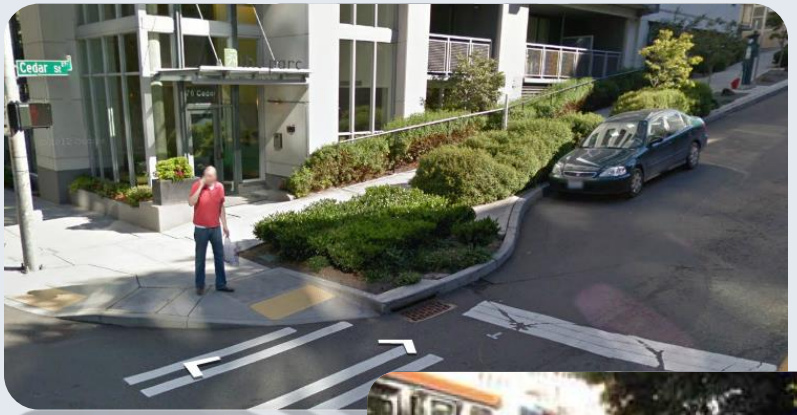


BUS BULB OUT

BUS BULB OUT EXAMPLES

DRAINAGE

- Must design to maintain storm water drainage & prevent ponding
- Options:
  - Relocate catch basins
  - Channel water through, around, or in-between
    - Bioswales



DRAINAGE/TRENCH DRAINS

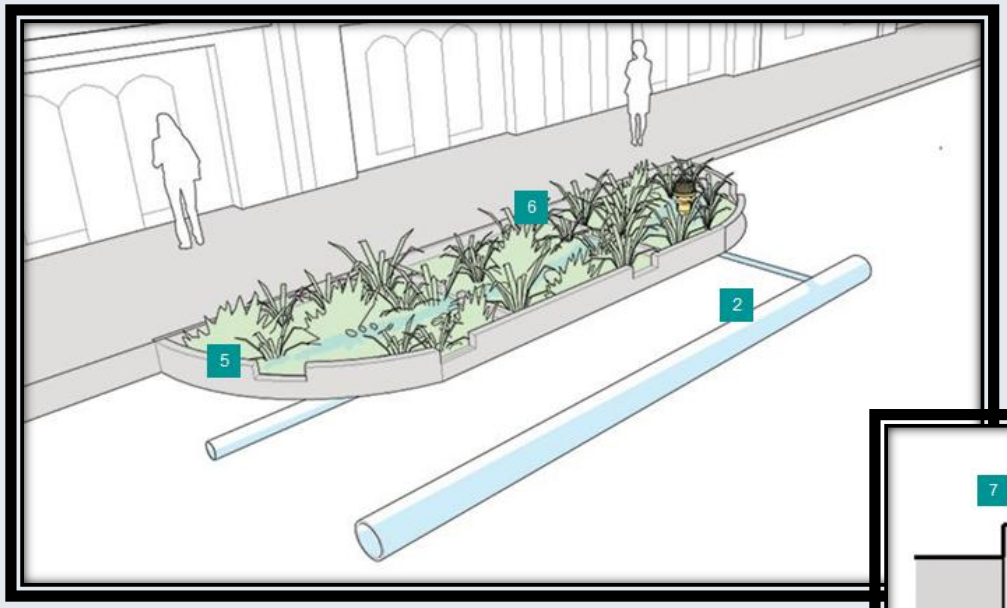
- Trench Drain considered to reduce cost & implementation
- Proper proportion trench drain to sidewalk
  - Left picture, smaller drain, attractive and proportioned
  - Right picture, wide drain, visually too dominant

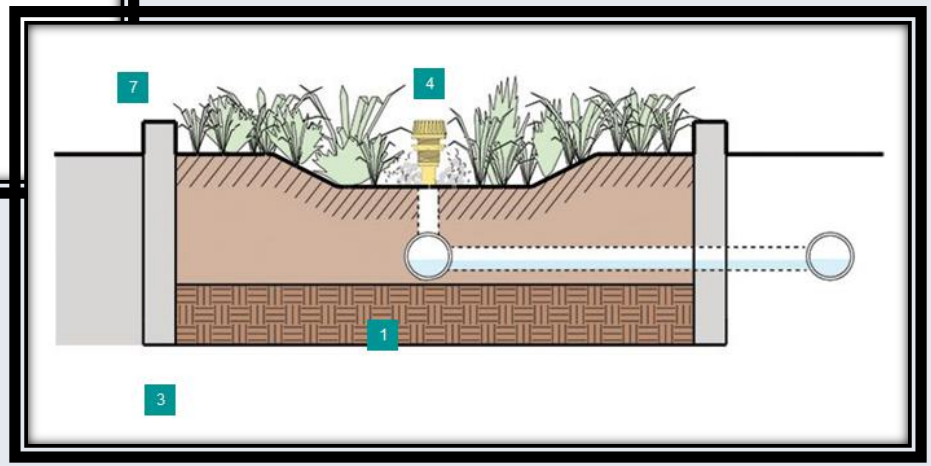
SFbetterstreets guide

DRAINAGE

DRAINAGE/LANDSCAPING

- NACTO Urban Streets Design Guide
- http://nacto.org/usdg/street-design-elements/stormwater-management/bioswales/





BIOSWALE DESIGN RESOURCES

- NYC Street Design Manual 6.6.1 – Stormwater-Capturing Installations

BIOSWALE DESIGN RESOURCES

- Portland Oregon- Appendix G of the 2008 Stormwater Management Manual

- http://www.portlandoregon.gov/bes/47963

MID-BLOCK CONSIDERATIONS

- Include bollards, landscaping, or other buffers between pedestrians & vehicles
- Buffer treatment height, width, & design **must not** impede a driver's view of pedestrians
- Use special paving or edging treatment to distinguish the ped plaza from the travel lane
- Street lighting at choker

MID-BLOCK CONSIDERATIONS

- Street furnishings & other objects may be located on curb extensions to provide more ped space on sidewalk
- Should be used at designated mid-block crossings

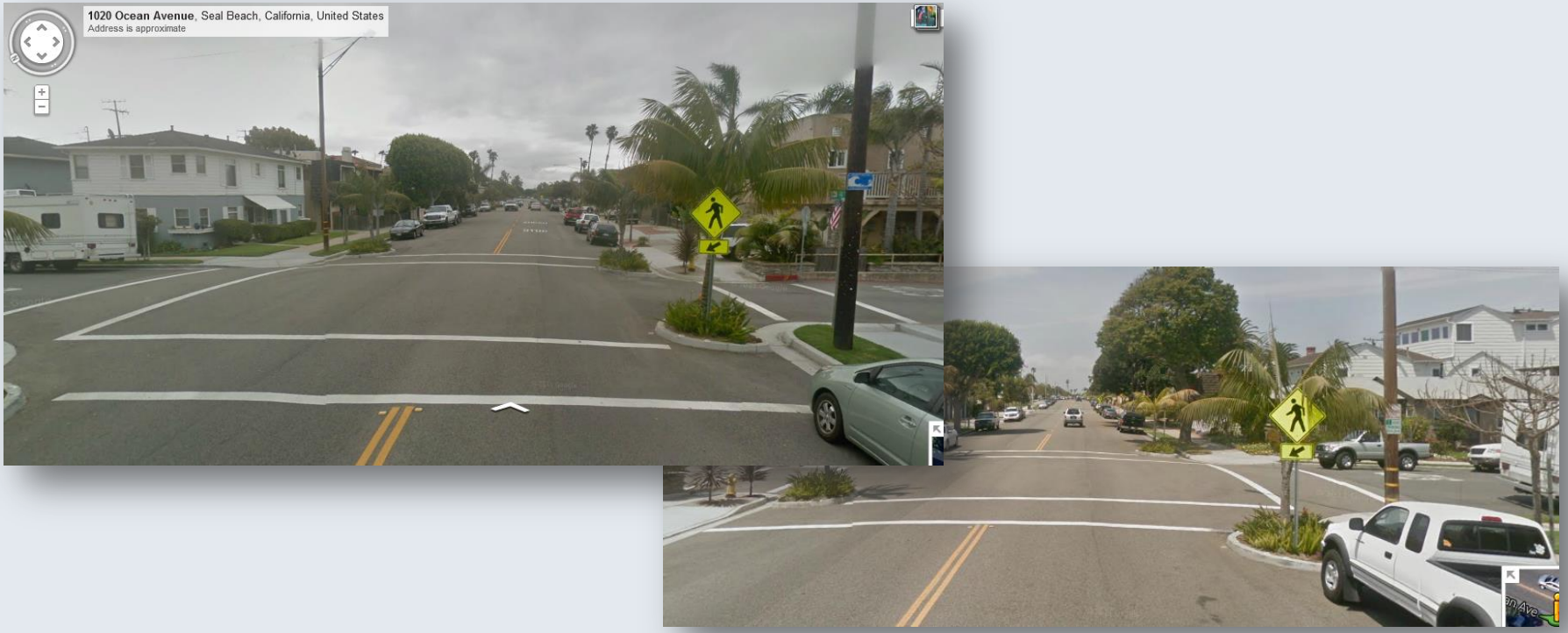
ADA TREATMENTS
WHAT IS GOOD & NOT COMPLIANT?

http://www.sauerburger.org/dona/crosscreditlist.html

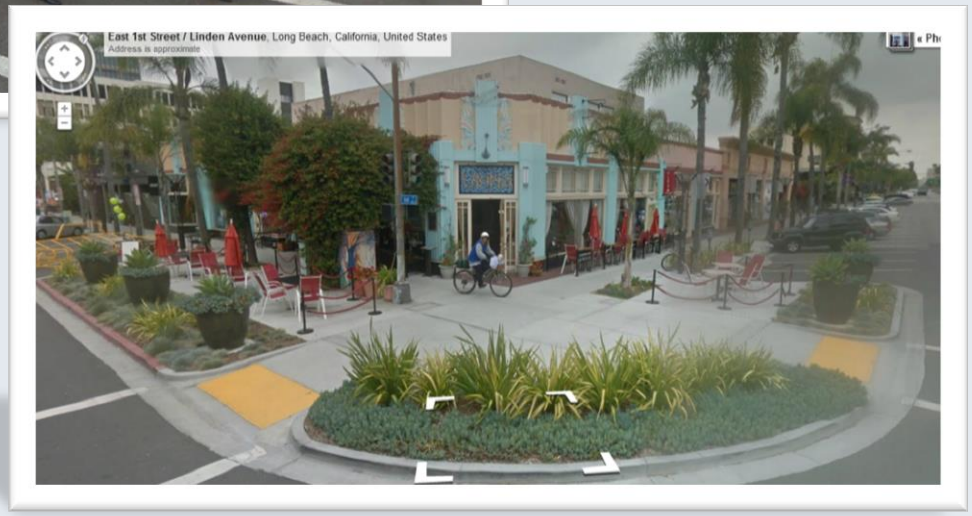
ADA ISSUES?

SITE FEATURES

Site features such as landscaping, controller cabinets, poles, benches, planters, bollards, and newspaper stands should not obstruct the view of pedestrians or drivers.



SITE FEATURES
GOOD OR BAD DESIGN?



FIXED OBJECTS

Warren & Smith Streets, Brooklyn DOT

Bollards, planters, & other fixed objects may be placed at the back of curb to protect pedestrians and prevent vehicles from driving onto the sidewalk.

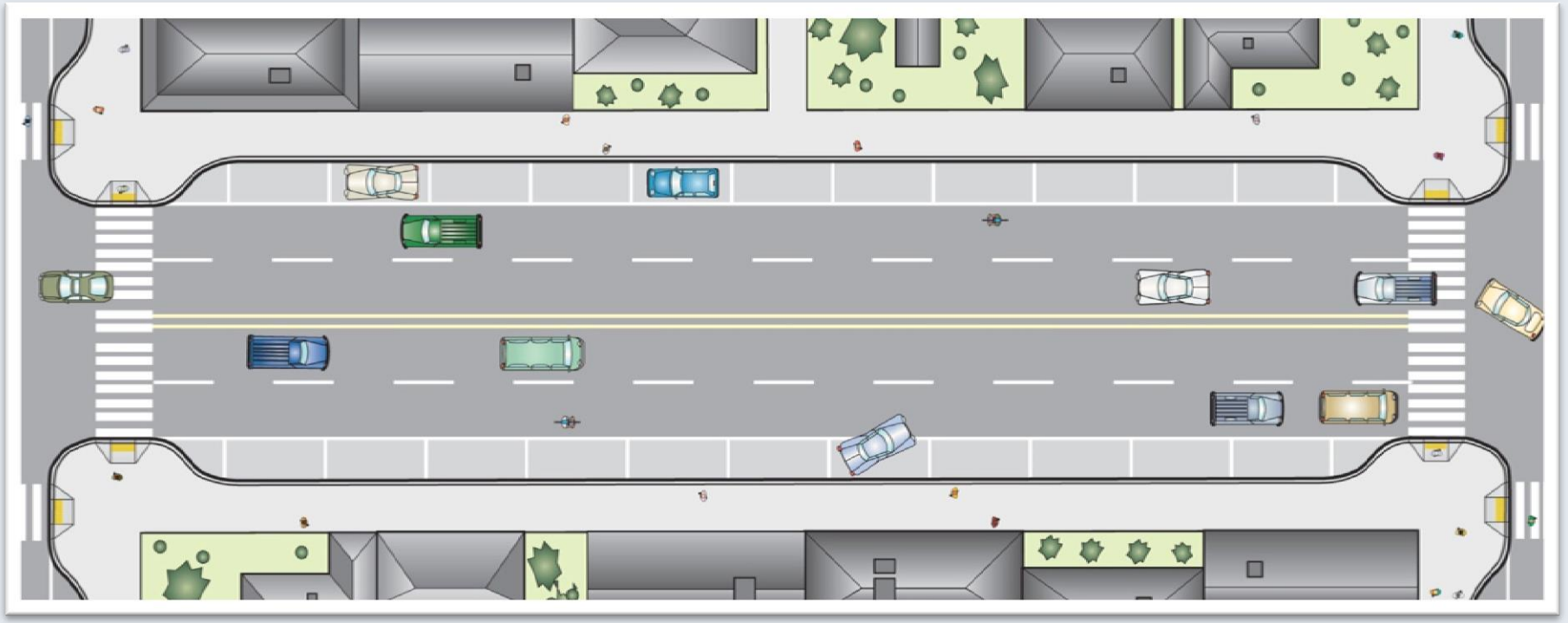
SIGHTLINES
NYC STREET DESIGN MANUAL

- Provide open sight–lines to the crossing for approaching motorists
- The design and placement of street furniture, trees, and plantings on a curb extension must not impede pedestrian flow, obstruct a clear path, interfere with “daylighting” the crossing, or emergency operations.

Curb extensions
(Credit: Michele Weisbart)

PARKING INTEGRATED WITH SIDEWALK

- Paving on curb extension should match the surrounding sidewalks

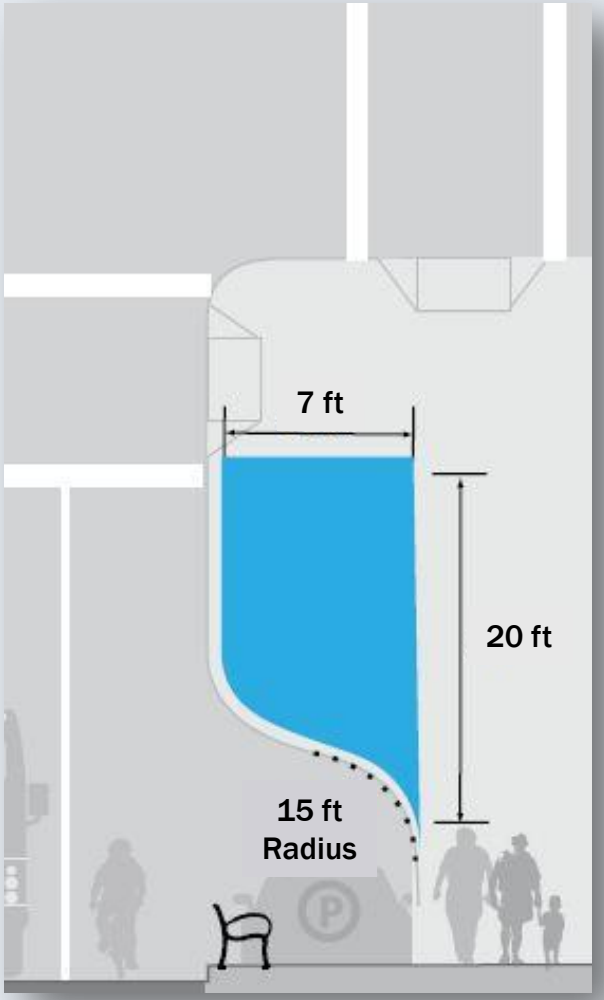


PARKING INTEGRATED WITH SIDEWALK

PARKING INTEGRATED WITH SIDEWALK

MAINTENANCE

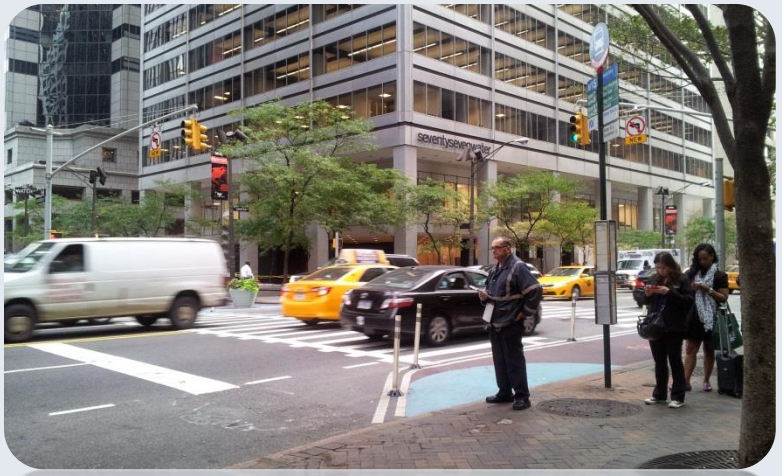
- Street sweepers
- Snow plows



MAINTENANCE

- Street sweepers – Planters and abrupt corners require hand-sweeping

PAINT & DELINEATOR POSTS



TEMPORARY TO PERMANENT

CURB EXTENSIONS/BULB OUTS - COST

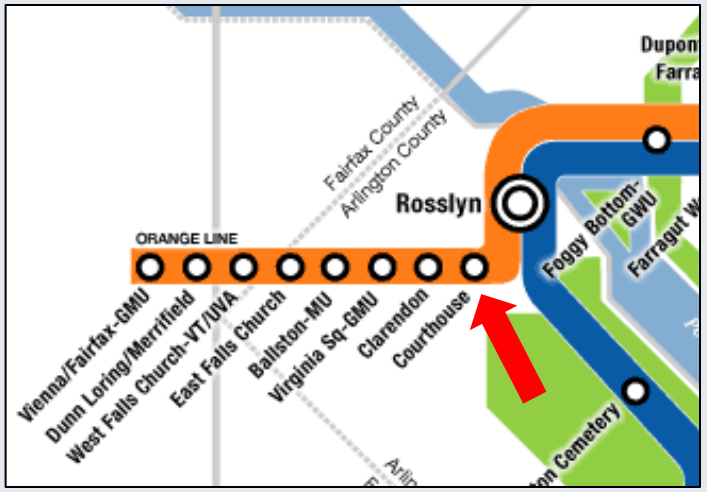
Infrastructure	Description	Median	Average	Minimum	Maximum	Cost Unit	No. of Observations
Curb Extension	Curb Extension, Choker, or Bulb-Out	$10,150	$13,000	$1,070	$41,170	Each	19 (28)

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

CASE STUDY: CURB EXTENSIONS (ARLINGTON COUNTY, VA)

Problem/Background

- Wilson and Clarendon Boulevards near Court House Station on the Metrorail Orange line
- Heavy traffic/high vehicle speeds near a metro station
- Rosslyn-Ballston Corridor served by 5 underground metro stations and two main arterials
  - Difficult for pedestrians to cross roadways to stations
- 1999 'Pedestrian Initiative' launched to improve safety



CASE STUDY: CURB EXTENSIONS (ARLINGTON COUNTY, VA)

Solution

- Reduced lanes from 3 to 2
- Seven curb extensions built to shorten crossing distances, calm traffic, & provide more visible crossing points
  - left space for busses to load and unload passengers
- Higher-visibility ladder crosswalks and signs installed
- Dangerous driveway removed

CASE STUDY: CURB EXTENSIONS (ARLINGTON COUNTY, VA)

Details/Results

- Total project cost $50,000
- No before/after data gathered
- Staff & others report higher instances of drivers yielding to pedestrians
- Positive community reaction

QUESTIONS? / RESOURCES

- NACTO Urban Street Design Guide
  - http://nacto.org/usdg/curb-extensions/
- NYC street design manual
  - Http://www.nyc.gov/html/dot/downloads/pdf/nycdot_streetdesignmanual_ch2.pdf
- WSDOT Design Manual Chapter 1510 Pedestrian Facilities
  - http://www.wsdot.wa.gov/publications/manuals/fulltext/m22-01/1510.pdf
- SF Better Streets Design Guide
- http://www.sfbetterstreets.org/find-project-types/pedestrian-safety-and-traffic-calming/traffic-calming-overview/curb-extensions/
- PEDESTRIAN SAFETY IMPACTS OF CURB EXTENSIONS: A CASE STUDY Final Report SPR 304- 321
  - http://www.oregon.gov/ODOT/td/tp_res/docs/reports/pedestrainsafetycurbext.pdf
- Signalized Intersections: Informational Guide
  - http://safety.fhwa.dot.gov/intersection/signalized/13027/

Thank You!

- **Archive at www.pedbikeinfo.org/webinars**
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- **Questions?**
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