CURB EXTENSIONS
BULB OUTS
NECKDOWNS
WHY

STREETFILMS
<table>
<thead>
<tr>
<th>WHEN &amp; WHERE</th>
</tr>
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<table>
<thead>
<tr>
<th>When</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited Sight Distance</td>
<td></td>
</tr>
<tr>
<td>- Pedestrians &amp; Vehicles</td>
<td></td>
</tr>
<tr>
<td>- Vehicles and Signs</td>
<td></td>
</tr>
<tr>
<td>Want to put two curb ramps in</td>
<td></td>
</tr>
<tr>
<td>Discourage High speed turning</td>
<td></td>
</tr>
<tr>
<td>High number of pedestrians waiting on corner</td>
<td>Wherever there is 24/7 on street parking</td>
</tr>
<tr>
<td></td>
<td>- Intersections</td>
</tr>
<tr>
<td></td>
<td>- Midblock</td>
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</tbody>
</table>
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
CASE STUDY: CURB EXTENSIONS
(CAMBRIDGE, MA)

Problem

- High motorist 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
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
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 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
PEDESTRIAN SAFETY IMPACTS OF CURB EXTENSIONS: A CASE STUDY Final Report SPR 304-321
- 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*:
## Table 45. Summary of issues for curb extensions.

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

- NYC street design manual
- WSDOT Design Manual Chapter 1510 Pedestrian Facilities

Chapter 2 - Geometry

Chapter 1510 - Pedestrian Facilities
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).
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
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
WASHINGTON D.C. doesn’t allow farther than 6 feet. Potential for future bike lane.
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
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

Option 1: A shorter crossing and larger overall bulb-out

Option 2: Greater directionality and sharper curb radius
BUS BULB OUT EXAMPLES

NY

Seattle

SF
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/LANDSCAPING

- **NACTO Urban Streets Design Guide**
NYC Street Design Manual 6.6.1 – Stormwater-Capturing Installations
- 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
Street furnishings & other objects may be located on curb extensions to provide more pedestrian space on sidewalk.

Should be used at designated mid-block crossings.
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?
Bollards, planters, & other fixed objects may be placed at the back of curb to protect pedestrians and prevent vehicles from driving onto the sidewalk.
- 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.
Paving on curb extension should match the surrounding sidewalks
PARKING INTEGRATED WITH SIDEWALK
PARKING INTEGRATED WITH SIDEWALK
MAINTENANCE

- Street sweepers
- Snow plows
Street sweepers – Planters and abrupt corners require hand-sweeping
PAINT & DELINEATOR POSTS
TEMPORARY TO PERMANENT
# Curb Extensions/Bulb Outs - 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>
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</thead>
<tbody>
<tr>
<td>Curb Extension</td>
<td>Curb Extension, Choker, or Bulb-Out</td>
<td>$10,150</td>
<td>$13,000</td>
<td>$1,070</td>
<td>$41,170</td>
<td>Each</td>
<td>19 (28)</td>
</tr>
</tbody>
</table>

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
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
NACTO Urban Street Design Guide
  - http://nacto.org/usdg/curb-extensions/

NYC street design manual

WSDOT Design Manual Chapter 1510 Pedestrian Facilities

SF Better Streets Design Guide

PEDESTRIAN SAFETY IMPACTS OF CURB EXTENSIONS: A CASE STUDY Final Report SPR 304-321

Signalized Intersections: Informational Guide