CURB EXTENSIONS
BULB OUTS
NECKDOWNS
WHY

STREET FILMS
<table>
<thead>
<tr>
<th>When</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited Sight Distance</td>
<td>Wherever there is 24/7 on street parking</td>
</tr>
<tr>
<td>- Pedestrians &amp; Vehicles</td>
<td>- Intersections</td>
</tr>
<tr>
<td>- Vehicles and Signs</td>
<td>- Midblock</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></td>
</tr>
</tbody>
</table>
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
- Pedestrian activity (especially children)
- Popular motorist cut-through
- High number of pedestrian collisions
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
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:

## BENEFITS & LIABILITIES

**Signalized Intersections: Informational Guide**

**Exhibit 9-4** provides a summary of the issues associated with curb extensions.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Potential Benefits</th>
<th>Potential Concerns</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 off-tracking.</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
  - [http://www.wsdot.wa.gov/publications/manuals/fulltext/m22-01/1510.pdf](http://www.wsdot.wa.gov/publications/manuals/fulltext/m22-01/1510.pdf)

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).
When Not To Use

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.
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) bicycle lane
- Minimum curb extension length typically equal to full width of the crosswalk
Typical Bulb-Out Dimensions

Curb radius: as determined by design vehicle

Length: at least 5' beyond extension of the corner property line

Width: as determined by adjacent lanes

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
RADII
SAN FRANCISCO BETTER STREETS

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

Option 2: Greater directionality and sharper curb radius
NYC Street Design Manual
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
NACTO Urban Streets Design Guide
http://nacto.org/usdg/street-design-elements/stormwater-management/bioswales/
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
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.
ADA TREATMENTS
WHAT IS GOOD & NOT COMPLIANT?

http://www.sauerburger.org/dona/crosscreditlist.html
ADA ISSUES?
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.

Warren & Smith Streets, Brooklyn DOT
- 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
Street sweepers – Planters and abrupt corners require hand-sweeping
PAINT & DELINEATOR POSTS
TEMPORARY TO PERMANENT
## CURB EXTENSIONS/BULB OUTS – COST (2013)

<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>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>

QUESTIONS? / RESOURCES

- **NACTO Urban Street Design Guide**
  - [http://nacto.org/usdg/curb-extensions/](http://nacto.org/usdg/curb-extensions/)

- **NYC street design manual**

- **WSDOT Design Manual Chapter 1510 Pedestrian Facilities**
  - [http://www.wsdot.wa.gov/publications/manuals/fulltext/m22-01/1510.pdf](http://www.wsdot.wa.gov/publications/manuals/fulltext/m22-01/1510.pdf)

- **SF Better Streets Design Guide**

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

- **Signalized Intersections: Informational Guide**
  - [https://safety.fhwa.dot.gov/intersection/conventional/signalized/fhwasa13027/](https://safety.fhwa.dot.gov/intersection/conventional/signalized/fhwasa13027/)