AGENDA
BLOOMINGTON TRANSPORTATION COMMISSION
REGULAR MEETING
TUESDAY, JUNE 19, 2018 4:00 P.M.
COUNCIL CHAMBERS, CITY HALL
109 EAST OLIVE STREET
BLOOMINGTON, ILLINOIS

1. CALL TO ORDER

2. ROLL CALL

3. PUBLIC COMMENT
A public comment period not to exceed thirty (30) minutes will be held during each Board and Commission meeting, as well as all regularly scheduled City Council meetings, Committee of the Whole meetings, meetings of committees and/or task forces (hereinafter "committees") created by the City Council, work sessions, and special meetings of the City Council. Nothing herein shall prohibit the combination of meetings, at which only one public comment period will be allowed.

Anyone desiring to address the Board, Commission, Committee or City Council, as applicable, must complete a public comment card at least five (5) minutes before the start time of the meeting. Public comment cards shall be made available at the location of the meeting by City staff at least 15 minutes prior to the start time of the meeting. The person must include their name, and any other desired contact information, although said person shall not be required to publicly state their address information. If more than five individuals desire to make a public comment, the order of speakers shall be by random draw. If an individual is not able to speak due to the time limitation and said individual still desires to address the individuals at a future meeting of the same type, said individual shall be entitled to speak first at the next meeting of the same type. (Ordinance No. 2015-46))

4. MINUTES: Review and approve the minutes of the May 15, 2018 regular meeting of the Bloomington Transportation Commission.

5. REGULAR AGENDA
A. **Information:** Proposed Improvements: Front Street between East and Madison
B. **Information:** May Citizen Comments/Complaints Summary
C. **Information:** Miscellaneous Updates and Information: I-AA Drive Resurfacing, City Transportation Project Funding Overview Discussion

6. OLD BUSINESS
A. Any old items brought back by the Commission

7. NEW BUSINESS
A. Any new items brought up by the Commission

8. COMMISSIONER COMMENTS

9. ADJOURNMENT

For further information contact:
Philip Allyn, City Traffic Engineer
Department of Public Works
Government Center
115 E. Washington Street, Bloomington, IL 61701
Phone: (309) 434-2225 ; Fax: (309) 434-2201; E-mail: traffic@cityblm.org

MINUTES
BLOOMINGTON TRANSPORTATION COMMISSION
REGULAR MEETING
TUESDAY, MAY 15, 2018 4:00 P.M.
COUNCIL CHAMBERS, CITY HALL
109 EAST OLIVE STREET
BLOOMINGTON, ILLINOIS

MEMBERS PRESENT: Ms. Jill Blair, Ms. Maureen (Reenie) Bradley, Ms. Katherine Browne, Mr. Michael Gorman, Ms. Elizabeth Kooba

MEMBERS ABSENT: Ms. Angela Ballantini, Ms. Kelly Rumley

OTHERS PRESENT: Mr. Steve Rasmussen, Interim City Manager; Mr. George Boyle, City Attorney; Mr. Jim Karch, Director of Public Works; Mr. Kevin Kothe, City Engineer; Mr. Philip Allyn, City Traffic Engineer.

1. CALL TO ORDER: Mr. Gorman called the meeting to order at 4:01 pm.

2. ROLL CALL: Mr. Allyn called the roll. With five members in attendance, a quorum was established.

3. PUBLIC COMMENT:
No Public Comments were heard.

4. MINUTES: Reviewed and approved the minutes of the April 17, 2018 regular meeting of the Bloomington Transportation Commission. Ms. Bradley motioned to approve the minutes. Ms. Blair seconded the motion. The motion was approved by the Transportation Commission unanimously via voice vote.

5. REGULAR AGENDA: No Items

A. TC2018-03: City Pavement Marking and Crosswalk Policy Review

Mr. Allyn informed the Commission that Staff is starting the process of reviewing and updating various policies. The first policy to be reviewed is the Pavement Marking Policy, which includes a section on crosswalks. The intent of the discussion today is to gain initial comments and feedback on the current policy, including items or details on which additional information is requested. We are going through at a Staff level as well making various tweaks and revisions due to changes in practice or updating references to outdated publications such as the Manual on Uniform Traffic Control Devices (MUTCD). In the packet is a list of items that we are currently planning on revising. A revised policy will be brought back in June or July with the Commission and Staff changes for approval or additional comment.

Ms. Bradley mentioned that there did not appear to be a reference to pavement markings on speed bumps. Mr. Allyn agreed this would be a good section to add. Ms. Bradley indicated that the bumps on both Northpoint and on Colton by the high school need to be repainted.

Mr. Gorman inquired about the City's ability to stay on top of maintaining the pavement markings. Mr. Allyn indicated that it is difficult to keep up with the amount of staff and markings that we have. Mr. Gorman mentioned that he had been talking with the Town of Normal Engineering Department and they are also struggling, but are not at the point where it would be beneficial to purchase additional equipment. Would this be a good opportunity for cooperation with the Town in potentially sharing equipment? Mr. Karch indicated that it's not an equipment issue, it's a personnel issue; we don't have the people we need to do more. We have both a long-line machine and a walk-behind machine. The work is generally done at night. We do struggle as most communities do. Mr. Gorman asked if there was an opportunity to share

staff with one municipality hiring additional people and then contracting them out to the other municipality part of the time. Mr. Karch indicated that we do partner with the Town and with McLean County whenever possible. However, with the current political climate there is not the ability to be adding additional staff at this time. In addition, if adding staff becomes a possibility, there are other areas with a greater need for additional staff such as maintenance of our sewers. From a safety perspective, feces in a basement is not a positive thing and minimizing backups into residents' basements as a matter of public health is likely a higher need.

Mr. Gorman mentioned that in conversations with Alderman Buragas, one of the reasons she asked for the Commission to be created is because she has had several instances of her constituents saying they have requested crosswalks and been denied because our policy is too restrictive. Mr. Gorman would like to see the policy be loosened as part of this update. He didn't have any specific requests, but thought that a number of the guides mentioned in the packet such as the NACTO Urban Streets Design Guide and AASHTO have more progressive ideas and he would suggest moving more in that direction. Mr. Allyn reminded that obviously the more markings that are added, the more there is to maintain, which we just discussed was already difficult. There is certainly a balancing act between what is needed and what is maybe perceived to be needed. There is also the issue where if people see the same thing repeatedly, it starts to get ignored. For example, if there is a marked crosswalk on both sides of every intersection, but there are no pedestrians using the crosswalk, then the lines begin to blend into the background and drivers no longer see them. For this reason, we do try to be a little selective on where we use the two lines versus the high-visibility crosswalks. We need to keep them from become overused and ignored so that in places where they are needed, they are still effective. Obviously, there is a fine line here and we will see what we can do to loosen the policy a bit. Mr. Gorman mentioned that Alderman Buragas had done some independent research and had found studies where the overuse effect is not as much of an issue as it is made out to be. Mr. Allyn indicated he would be happy to review whatever information she has on the subject. We also welcome new studies and additional information to help make the best decisions that we can.

Ms. Blair indicated that one thing in the crosswalk section that jumped out to her was that mid-block crosswalks should not be allowed. She cannot think of a particular place where one would be needed, but it seemed odd to say they should not be allowed. Mr. Allyn mentioned this was an example of some of the odd wordings that are intended to be cleaned up a bit as part of this process. In engineering terminology, that particular language of "should" and "shall" have very exact definitions, which is why they are used. Generally speaking, mid-block crosswalks are not the safest crosswalk locations. It is safer to have them at intersections where they are expected by drivers rather than in the middle of a block, which is why the policy says they should not be allowed. There are places however, such as on Olive outside City Hall, where a major pedestrian route crosses a street in which they are advantageous and needed. The following section expands that if mid-block crosswalks are used, they shall be high-visibility. Mr. Gorman also mentioned that they are also used in locations such as where Constitution Trail crosses streets. The Town of Normal has recently started installing mid-street signs at these locations reminding drivers to stop for pedestrians in the crosswalk.

Ms. Bradley asked about citizen volunteers helping paint faded lines on speed bumps. Mr. Allyn responded that there were a number of reasons why the City would prefer this work to be done by City employees rather than volunteers, not the least of which is the safety of people working in the roadway. In addition, there are union considerations and significant liability concerns if this work is not done correctly.

Ms. Blair asked about the statement at the beginning regarding requests for changes to the pavement markings must be made in writing. What is the reason for this and what is considered "in writing"? Mr. Allyn indicated this is mostly an administrative item. It is often difficult to receive a comment verbally with no way to record it and then remember the details when back in the office several hours later. The

Non-emergency Complaint/Request Form, which can be found on the website and obtained in person at the Public Works office, is the preferred method since it helps track and document requests internally. Emails also work. The website has a good comment/request submittal form that is also available. In addition, the My Bloomington app has a comment submittal form where you can also upload photos. Comments submitted through the website and the app get emailed to the responsible party for response, so these work fine. Comments on Facebook pages are usually not constantly monitored, and phone calls or face-to-face conversations are difficult to record, so these are not suggested methods of submitting a request.

B. Information: April Citizen Comments/Complaints Summary

Mr. Allyn indicated a summary of the complaints/comments received since April 1 was provided in the agenda packet and requested any comments or questions. There were no comments.

Ms. Bradley asked if the parking restriction on Oak Street was north or south Oak Street and what was the reason for the request. Mr. Allyn indicated that it is part of a neighborhood dispute regarding parking of potential commercial vehicles on the street.

C. Information: IDOT Route 9 Phase I Study Update

Mr. Allyn indicated that Engineering Staff recently met with IDOT who informed us that they are in the early stages of a Phase I study for the entire Route 9 corridor through the City. They do not yet know the details of the work, but the basic scope of the project is a mill and overlay with some curb and gutter removal and replacement and some areas of pavement cross slope correction. The curb lines will generally stay the same (streets will not be widened or narrowed). Curb ramps will be updated to meet current ADA requirements. It does not sound like there will be significant changes to traffic signal equipment other than minor ADA improvements. There was some discussion of adding bike lanes through a portion or the City. It is still very early in the process and there is not yet an estimated construction date. There will be a public open house at some point, likely this late summer or fall. The bike lane additions are primarily focused on the section that is one-way and may involve some loss of on-street parking. Staff will be providing input where possible, but this is a project that IDOT will be driving.

Mr. Gorman asked about potential changes in the alignment of Route 9 around Bent Elementary School. Mr. Karch indicated that we are still working on this with IDOT and some elected officials. We still see it as a critical need to get Route 9 off of Lee and relocated onto Center and hopefully there will be more updates in the future.

6. OLD BUSINESS:

A. Legal Department Brief Presentation on Role and Duties of the Commission

Mr. Boyle gave a presentation on the role and duties of the Commission. A copy of the City Code relating to the Commission was distributed. Mr. Boyle stated the ordinance establishing the Commission is brief does have some good information. Now that we are about eight months in, the Commission seems to be doing a good job fulfilling the major functions outlined in the ordinance. The purpose of the Commission is to assist, advise, and inform administrative and elected officials of the City on matters pertaining to the transportation of people and materials it the City. Highlights of the last eight months have been when the Commission was able to weigh in on proposed ordinances such as the one that affected downtown traffic flow and specific projects to give Staff input that we would not normally receive. The areas of focus consist of advising on policy matters involving streets and highways, pedestrian ways, bikeways, multi-purpose trails and truck routes. With respect to how items get put on the agenda, they can come from the City Traffic Engineer, the Director of Public Works or Director of Community Development, the City Manager, or the Mayor or City Council. In addition, if a citizen requests in writing for an item to be heard by the Commission, the Traffic Engineer can place it on the agenda or the Transportation Commission can place an item on the agenda by majority vote.

With respect to powers and duties, the Commission reviews various proposals outlined in Section 302. There are also additional powers and duties outlined in Section 303. Mr. Allyn prepared a document (provided in the binders) titled "Area of Responsibilities" that summarizes the powers and duties in Section 303 with illustrative examples. The Commission has the ability to provide recommendations to improve transportation conditions on policy-level matters such as complete streets, parking management, traffic circulation, and the like. It has the ability to review and make recommendation on matters of transportation in the various plans the City has such as the Bicycle Master Plan or the Street Improvement Master Plan. Thirdly, there is the ability to receive concerns from the City Traffic Engineer. This could be the Citizen Complaints/Concerns referred to previously or it could be something coming from Staff. Fourth, the Commission can conduct public hearings on matters that Council or Staff feels are pertinent. Finally is the ability to make suggestions on programs and outreach as they relate to bicycle facilities.

In summary, it feels like the Commission has thus far been functioning well. The hope in reviewing this information, even though it is a fairly simple and straightforward ordinance, is to be a springboard for questions or dialogue on what the role of the Commission is moving forward.

7. NEW BUSINESS: None

8. COMMISSIONER COMMENTS:
Mr. Gorman mentioned that this week is the Good To Go Commuter Challenge put on by the McLean County Planning Commission. This is an opportunity to try to become a more sustainable commuter for the week. There is a website, goodtogomclean.org where people can log their commutes (anything that does not include driving alone) and become eligible for prizes from the Regional Planning Commission.

8. ADJOURNMENT: The meeting adjourned at 4:31 pm unanimously by voice vote; motioned by Ms. Blair and seconded by Ms. Bradley.

Respectfully,

Philip Allyn
City Traffic Engineer

CITY OF BLOOMINGTON
REPORT FOR THE TRANSPORTATION COMMISSION
June 19, 2018

CASE NUMBER:	SUBJECT:	ORIGINATING FROM:
Information	**Proposed Improvements: Front Street between East and Madison**	**Philip Allyn, PE, PTOE City Traffic Engineer**
REQUEST:	**Item submitted for review by the Transportation Commission. Any feedback or comments are welcome and will be used to develop an updated policy (if required) to be brought back at a later meeting.**	

STAFF RECOMMENDATION: Approval

Staff submits the following information to the Commission. Any comments or feedback is appreciated.

1. ATTACHMENTS:

- **a. Location Map**
- **b. Proposed Modifications Exhibit**
- **c. Curb Bump-out information:**
  - **i. NACTO Urban Street Design Guide: Curb Extensions**
  - **ii. NACTO Urban Street Design Guide: Pedestrian Safety Island**
  - **iii. FHWA Traffic Calming Document – Curb Extensions Excerpt**
  - **iv. Powerpoint Presentation of an Overview of Curb Extensions, Bulb Outs, and Neckdowns**
  - **v. Oregon Case Study on Pedestrian Safety Impact of Curb Extensions**
- **d. Rectangular Rapid Flashing Beacons (RRFB) information**
- **e. Potential Decorative Crosswalk Information: DuraTherm & DecoMark (or similar)**

2. BACKGROUND AND SUPPLEMENTAL INFORMATION:

The intersections of Front Street with Center Street and with Main Street have been signalized since at least the 1940's or 50's when Center and Main were both major north-south streets in Downtown Bloomington. With the creation of the system of one-way streets in the 1970's, the majority of vehicular traffic was diverted to Madison Street (southbound) and East Street (northbound) within this area. The traffic signal infrastructure was modernized in the early 1980's and again in the late 1990's. While the above ground equipment has been easily maintained (poles painted, bulbs replaced and ultimately replaced with LED's), the underground conduits and wires have been largely untouched since they were installed as part of the 1980's work.

Vehicle volumes at these intersections noticeably decreased in the 1970's and with pedestrian volumes increasing, the purpose of the signals shifted from solely vehicular to increased emphasis on pedestrian accommodation. With the creation of the Connect Transit transfer area on Front Street, the number of pedestrian crossings has increased. In addition, Main Street is one-way to the north, all but eliminating a vehicular need at this intersection. The main purpose today of the signals at each of these intersections is to help facilitate pedestrians crossing Front Street. They are no longer warranted based on vehicular volume.

During sewer repair work in advance of the resurfacing of Front Street from Madison Street to East Street planned for later this summer, City Staff discovered severely deteriorated underground traffic signal infrastructure at the intersection of Center Street and Front Street. The cost to replace this underground infrastructure was estimated to be $15,000 to $20,000. Given the upcoming resurfacing work – which also includes a significant amount of sidewalk and curb ramp removal and replacement – it was determined that if the signals were to be removed, now is the time to do so.

Feedback solicited from area stakeholders in late May was significantly in favor of removing the traffic signals (~70% in favor). Specific coordination meetings were had with McLean County (who has four major facilities along Front Street) and Connect Transit.

In consideration of removing the signals, Public Works is proposing a new configuration that will make it easier for pedestrians to cross. An exhibit showing the new curb lines is attached. The proposed changes include bumping out the curbs at the intersections at Main Street and at Center Street and installing small sections of raised medians. The proposed changes will decrease the street width and provide a more pedestrian-friendly configuration in addition to adding green space and other streetscape elements. Several documents are attached with information relating to curb bump-outs (also known as curb extensions). Raised medians are proposed to help focus pedestrian crossings to the crosswalk locations. The curb bump-outs and raised medians contribute to increased pedestrian safety by:

- Increasing pedestrian visibility
- Allowing pedestrians to better observe approaching motorists
- Decreasing crossing distance
- Reducing pedestrian exposure to traffic
- Can reduce vehicle speeds by visually narrowing the street
- Slowing turning vehicles

The intersection at Center Street will operate under all-way stop control. There will be no stop signs at Main Street; however, crosswalk signs will be added with pushbutton activated high-visibility flashers (Rectangular Rapid Flashing Beacons or RRFB's). Once activated, the flashers will immediately warm drivers of the presence of a pedestrian in the crosswalk. Other features being considered include the use of decorative crosswalks at locations where crossings are desired to be focused. Information on the proposed RRFB and potential decorative crosswalks is attached.

In order to evaluate the potential changes and their possible impacts to pedestrian, vehicular and bus traffic, the Department of Public Works temporarily disabled the traffic signals and installed

barricades mimicking the new curb lines along Front Street, from Madison Street to East Street June 13, 2018 through June 15, 2018. This test-run allowed Staff to monitor the proposed changes for compatibility with the transfer area buses, delivery trucks, and higher car volumes using the Lincoln parking deck. While minor adjustments are being considered, the test showed positive results. Vehicles were able to negotiate adequately, and pedestrians were still able to cross easily.

Staff will begin completing cost estimates to determine the final scope of work. Funding is anticipated to come from the Annual Resurfacing and Sidewalk Replacement programs, from which significant work on Front Street was already budgeted.

3. STAFF RECOMMENDATION:

Staff submits the above information to the Commission. Any comments or feedback is appreciated.

Respectfully submitted,

Philip Allyn, PE, PTOE
City Traffic Engineer

City of Bloomington Illinois

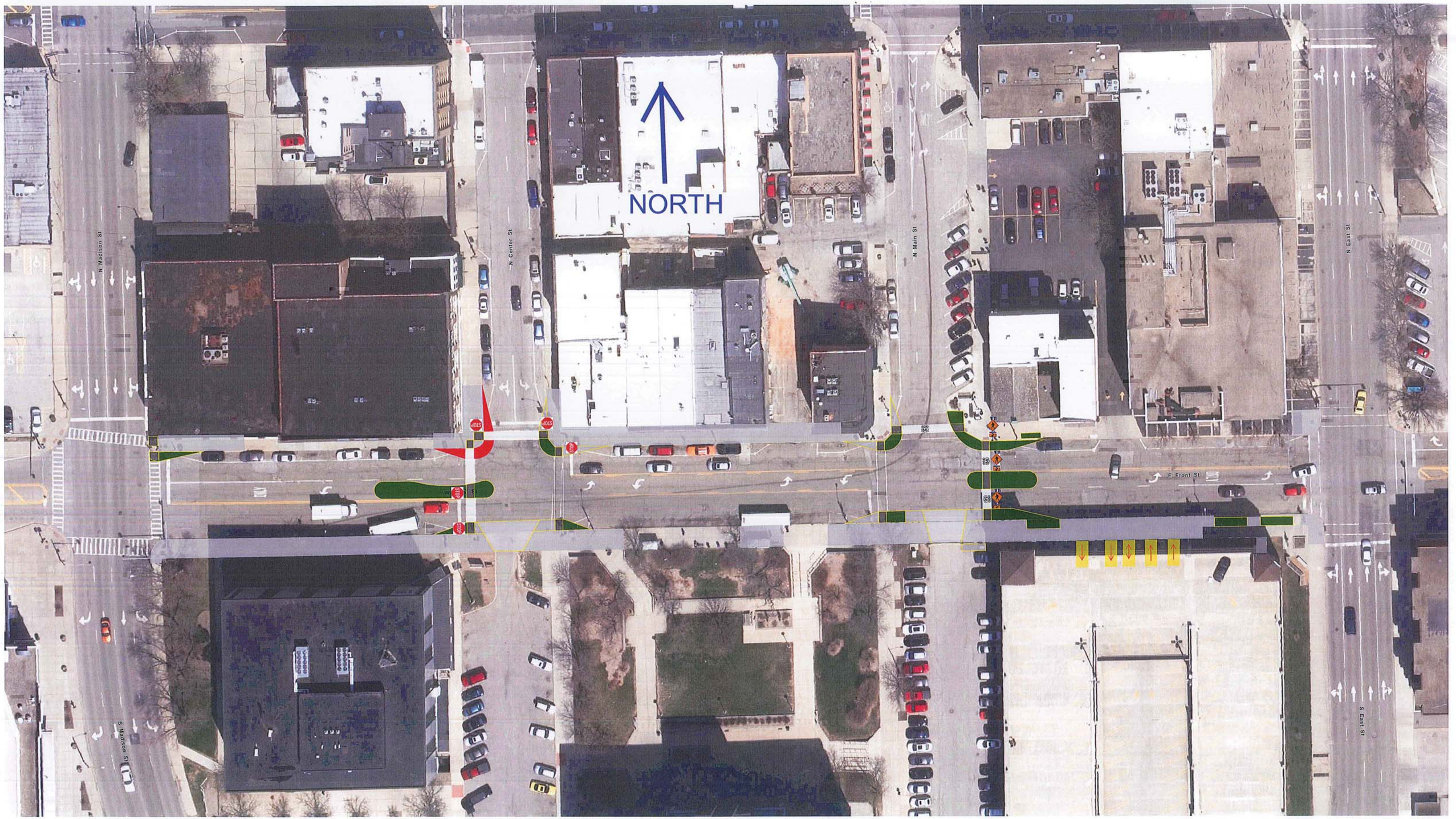
Public Works Department

Front Street Change

0 275 550

Feet

Date: 6/18/2018


NORTH
N Madison St
N Center St
N Main St
N East St
E Front St
S Madison St
S East St
STOP

Curb Extensions

Curb extensions visually and physically narrow the roadway, creating safer and shorter crossings for pedestrians while increasing the available space for street furniture, benches, plantings, and street trees. They may be implemented on downtown, neighborhood, and residential streets, large and small. Curb extensions have multiple applications and may be segmented into various sub-categories, ranging from traffic calming to bus bulbs and midblock crossings.

APPLICATION

Curb extension is an umbrella term that encompasses several different treatments and applications. These include:

- Midblock curb extensions, known as pinchpoints or chokers, which may include cut-throughs for bicyclists.
- Curb extensions used as gateways to minor streets known as neckdowns.
- Offset curb extensions that force vehicles to move laterally, known as chicanes.
- Curb extensions at bus (or transit) stops, also known as bus bulbs.
- Conventional curb extensions, which are a recommended feature where there is on-street parking.

BENEFITS & CONSIDERATIONS

Curb extensions decrease the overall width of the roadway and can serve as a visual cue to drivers that they are entering a neighborhood street or area.

Curb extensions increase the overall visibility of pedestrians by aligning them with the parking lane and reducing the crossing distance for pedestrians, creating more time for preferential treatments, such as leading pedestrian interval and transit signal priority.[1]

Curb extensions tighten intersection curb radii and encourage slower turning speeds.

Installation of curb extensions may require moving a fire hydrant to maintain adequate curbside access in case of a fire. In such cases, a curb extension may incur additional expense or be reoriented to avoid conflict with the hydrant.[2]

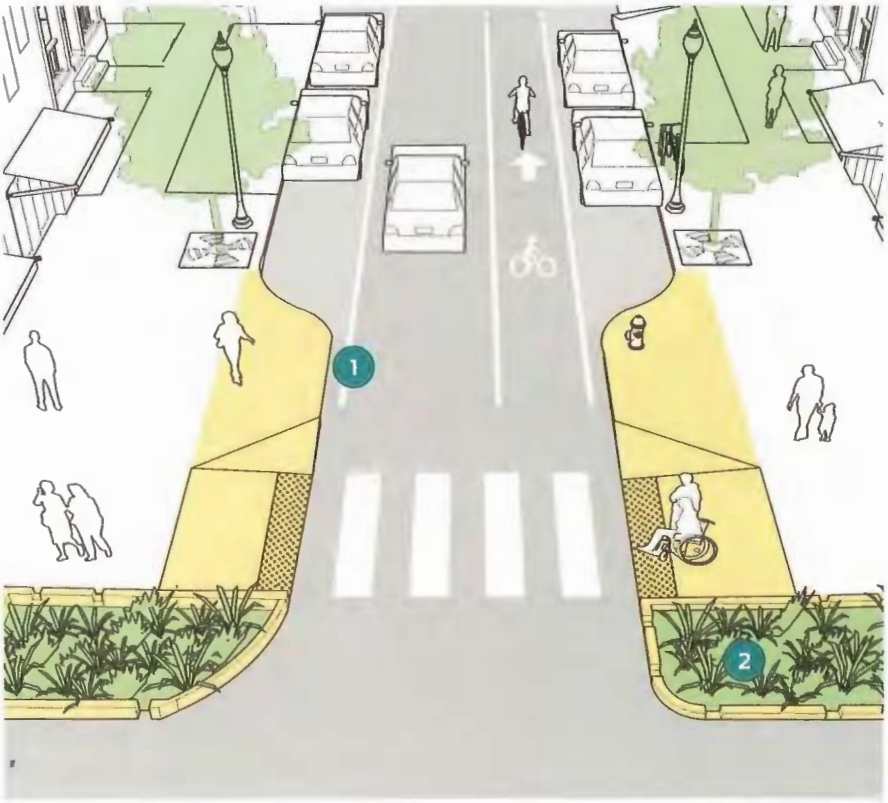
Used as a bus bulb, curb extensions may improve bus travel times by reducing the amount of time a bus takes to merge with traffic after boarding. Bus bulbs also help to prevent motorists from double parking in the bus stop.[3]

Where application of a curb extension adversely impacts drainage, curb extensions may be designed as edge islands with a 1–2-foot gap from the curb or a trench drain.

Curb extensions can be implemented using low-cost, interim materials. In such cases, curb extensions should be demarcated from the existing road-bed using temporary curbs, bollards, planters, or striping.

Gateway

Curb extensions are often applied at the mouth of an intersection. When installed at the entrance to a residential or low-speed street, a curb extension is referred to as a "gateway" treatment and is intended to mark the transition to a slower speed street.



CRITICAL

The length of a curb extension should at least be equal to the width of the crosswalk, but is recommended to extend to the advanced stop bar.

RECOMMENDED

1 A curb extension should generally be 1–2 feet narrower than the parking lane, except where the parking lane is treated with materials that integrate it into the structure of the sidewalk.

NEW YORK, NY

Curb extensions should be installed whenever on-street parking is present to increase visibility, reduce the crossing distance, provide extra queuing space, and allow for enhancements, such as seating or greenery.

2 Combine stormwater management features, such as bioswales or rain gardens, with curb extensions to absorb rainwater and reduce the impervious surface area of a street.

INDIANAPOLIS, IN

Curb extensions may be combined with bioswales in order to decrease puddling at crosswalks.

OPTIONAL

Curb extensions may be treated with corner street furniture and other amenities that enhance the public realm.

NEW YORK, NY

In advance of a full reconstruction, gateways can be designed using striping or signage that communicates the entrance into a slow zone.

Pinchpoint

Curb extensions may be applied at midblock to slow traffic speeds and add public space. When utilized as a traffic calming treatment, midblock curb extensions are referred to as "pinchpoints" or "chokers".

RECOMMENDED

1 Plant street trees on curb extensions aligned to the parking lane to narrow the overall profile of the roadway. Before installing street trees on the curb extension, assess surrounding utilities to ensure that the trees' roots will not damage underground infrastructure.

OPTIONAL

Pinchpoints can facilitate midblock pedestrian crossings of low-volume streets. These crossings do not need to be marked, unless volumes exceed 2,000–3,000 vehicles per day or midblock destinations warrant an enhanced treatment.

2 Bicycle racks can be combined with curb extensions, especially in areas where bicycle parking is insufficient or demand for long-term or short-term parking is unmet.

NEW YORK, NY

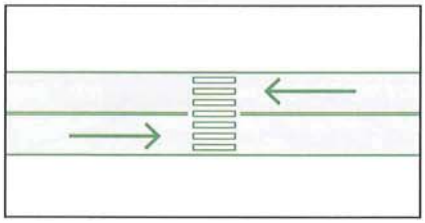
6 1/2 Avenue in New York City connects a series of privately-owned public spaces that cut midblock through Midtown. The visibility of crossing pedestrians was improved here using pinchpoints constructed with interim materials.

Pedestrian Safety Islands

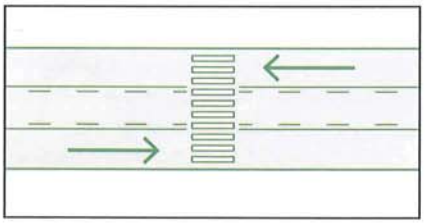
A pedestrian safety island reduces the exposure time experienced by a pedestrian in the intersection. While safety islands may be used on both wide and narrow streets, they are generally applied at locations where speeds and volumes make crossings prohibitive, or where three or more lanes of traffic make pedestrians feel exposed or unsafe in the intersection.

CHICAGO, IL

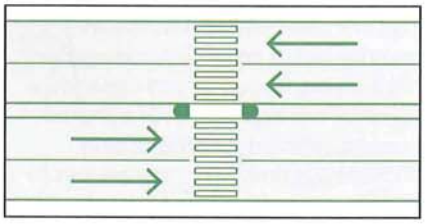
2 lanes



3 lanes



4 lanes



As the number of travel lanes increases, pedestrians feel more exposed and less safe entering the intersection. For unsignalized crossings, higher speeds and volumes may necessitate the use of a median at narrower cross sections.

DISCUSSION

Pedestrian safety islands limit pedestrian exposure in the intersection. They are recommended where a pedestrian must cross three lanes of traffic in one direction (on a 1-way or a 2-way street), but may be implemented at smaller cross-sections where space permits.

CRITICAL

Pedestrian safety islands should be at least 6 feet wide, but have a preferred width of 8–10 feet. Where a 6-foot-wide median cannot be attained, a narrower raised median is still preferable to nothing. The minimum protected width is 6 feet, based on the length of a bicycle or a person pushing a stroller. The refuge is ideally 40 feet long.

The cut-through or ramp width should equal the width of the crosswalk. Where this cannot be achieved, crosswalks should be striped wider than the cut-through area.

RECOMMENDED

All medians at intersections should have a "nose" which extends past the crosswalk. The nose protects people waiting on the median and slows turning drivers.

Safety islands should include curbs, bollards, or other features to protect people waiting.

It is preferable to have the crosswalk "cut-through" the median. Where the median is wider than 17 feet, ramps are preferred. This dimension is based on a 6-inch-high curb, two 1:12 ramps, and a 5-foot-wide level landing in the center.

OPTIONAL

Pedestrian safety islands may be enhanced using plantings or street trees. Plantings may require additional maintenance responsibilities and need to be maintained to ensure visibility.

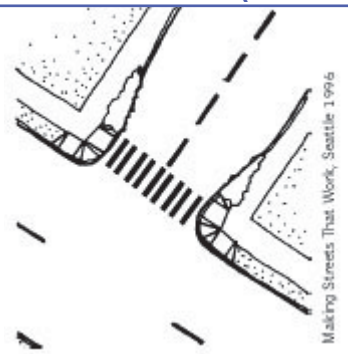
CRYSTAL CITY, VA

The "nose" in the median above protects pedestrians from turning cars.

Traffic Calming

23. Curb Extensions

Close Print



Curb extensions - also known as bulb-outs or neckdowns extend the sidewalk or curb line out into the parking lane, which reduces the effective street width. Curb extensions significantly improve pedestrian crossings by reducing the pedestrian crossing distance, improving the ability of pedestrians and motorists to see each other, and reducing the time that pedestrians are in the street.

Curb extensions placed at an intersection essentially prevent motorists from parking in or to close to a crosswalk or from blocking a curb ramp. Motor vehicles parked at corners present a threat to pedestrian safety, as they block sight lines, obscure visibility of pedestrians and other vehicles, and make turning particularly difficult for emergency vehicles and trucks. Motorists are encouraged to travel more slowly at intersections or midblock locations with curb extensions, as the restricted street width sends a visual cue to motorists. Turning speeds at intersections are reduced with curb extensions (curb radii should be as tight as is practicable).

Curb extensions are only appropriate where there is an on-street parking lane. Curb extensions must not extend into travel lanes, bicycle lanes or shoulders). The turning needs of larger vehicles such as school buses need to be considered in curb extension design.

Purpose:

- Improves safety for pedestrians and motorists at intersections; increases visibility and reduces speed of turning vehicles.
- Encourages pedestrians to cross at designated locations.
- Prevents motor vehicles from parking at corners.

Considerations:

- Curb extensions should typically be used where there is a parking lane, and where transit and cyclists would be traveling outside the curb edge for the length of the street.
- Midblock extensions provide an opportunity to enhance midblock crossings. Care should be taken to insure that street furniture and landscaping do no

Photo by Dan Burden

This curb extension in Venice, Florida reduced motorists turning speeds by 6–8 MPH. Pedestrian crossing distance and time exposed to traffic was also reduced.

Photo by Peter Lagerway

A curb extension on an arterial street in Seattle, Washington. The crossing distance for pedestrians is substantially reduced by the installation of this device.

block motorists view of pedestrians
- Where intersections are used by significant numbers of trucks or buses, the curb extensions need to be designed to accommodate them. However, it is important to take into consideration that those vehicles should not be going at high speeds, and most can make a tight turn at slow speeds. It is also not always necessary for a roadway to be designed so that a vehicle be expected to turn from right lane to right lane -i.e., the vehicles can often encroach into adjacent lanes safely where volumes and/or speeds are slow. Keep in mind that speeds should be slower in a pedestrian environment.
- Emergency access is often improved through the use of curb extensions, as intersections are kept clear of parked cars. Fire engines and other emergency vehicles can climb a curb where they

would not be able to move a parked car. In addition, at mid-block locations, curb extensions can keep fire hydrants clear of parked cars and make them more accessible.
- Curb extensions can be used to place landscaping and street furniture; this is especially beneficial where sidewalks are otherwise too narrow.

Estimated Cost

Curb extensions cost from $2,000 to $20,000 per corner, depending on design and site conditions. Drainage is usually the most significant determinant of costs. If the curb extension area is large and special pavement and street furnishings and planting are included, costs would also be higher. Costs can go up significantly if something major such as a mast arm or controller box is moved.

Close Print

CURB EXTENSIONS
BULB OUTS
NECKDOWNS

DPS 201

WHY

WHEN & WHERE

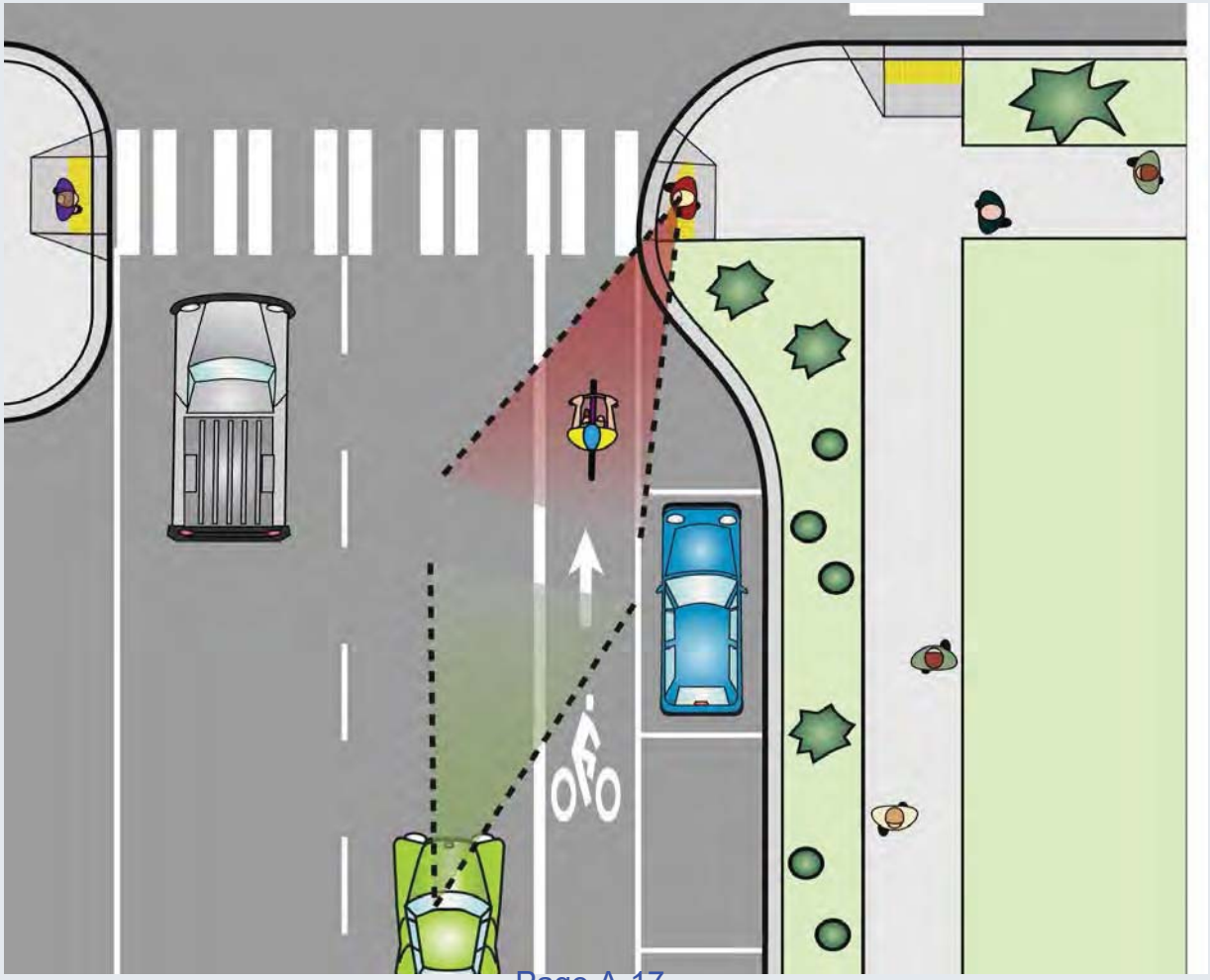
When

- 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)

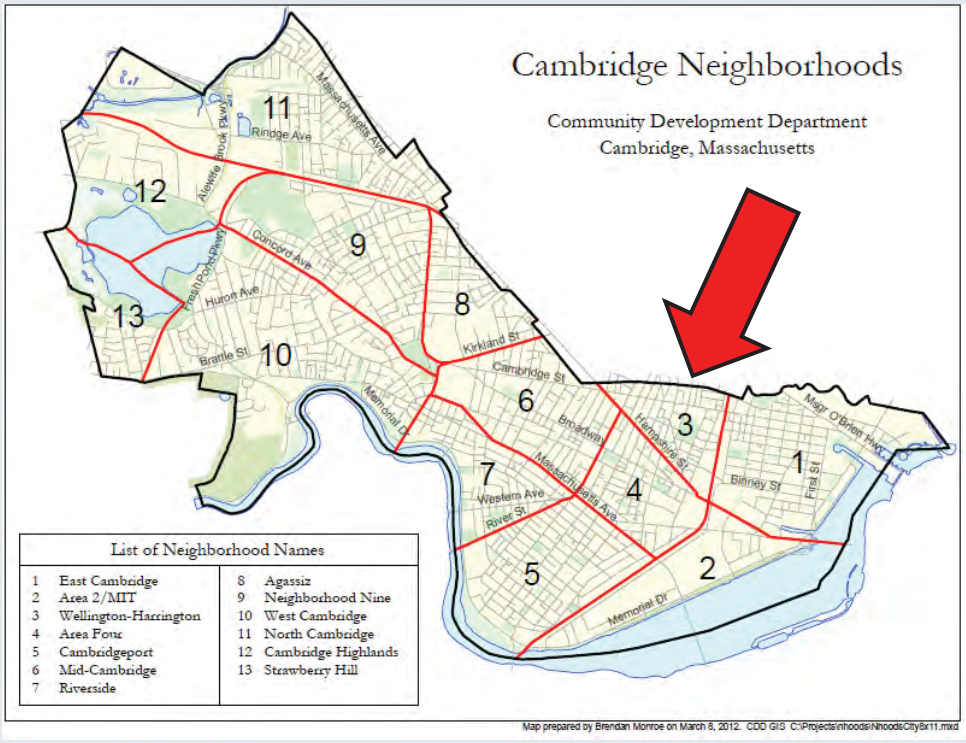
Problem

- High motorist 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

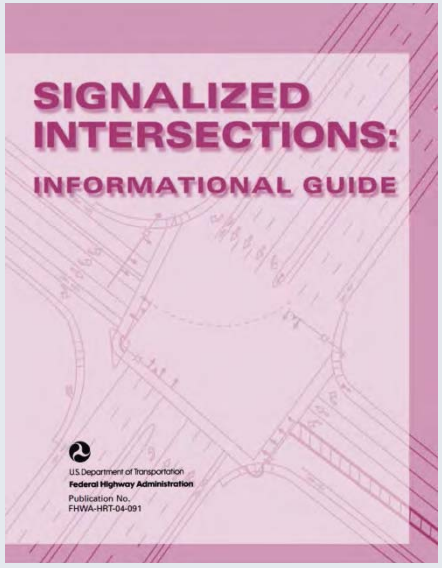


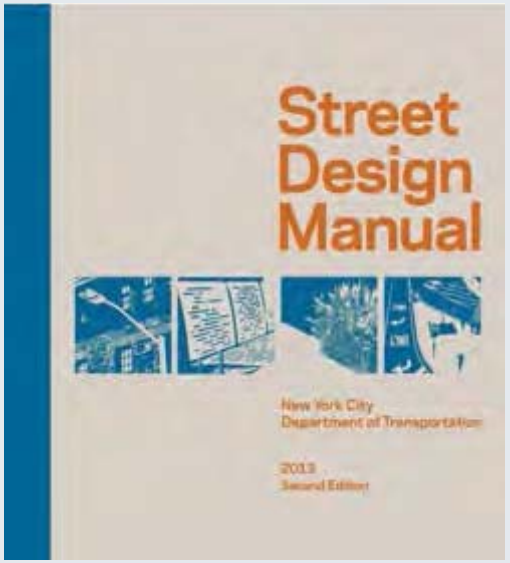
Table 45. Summary of issues for curb extensions.

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.

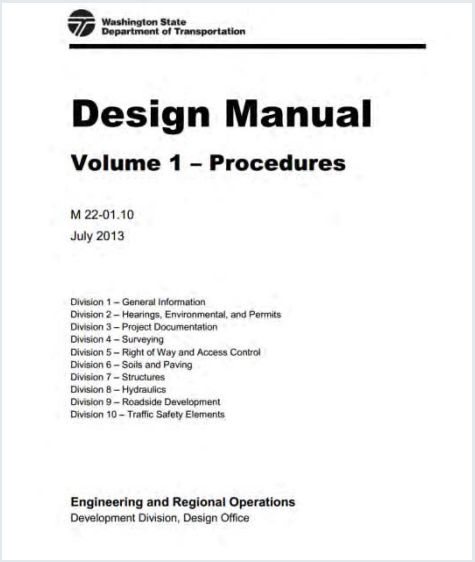
Page A-26

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

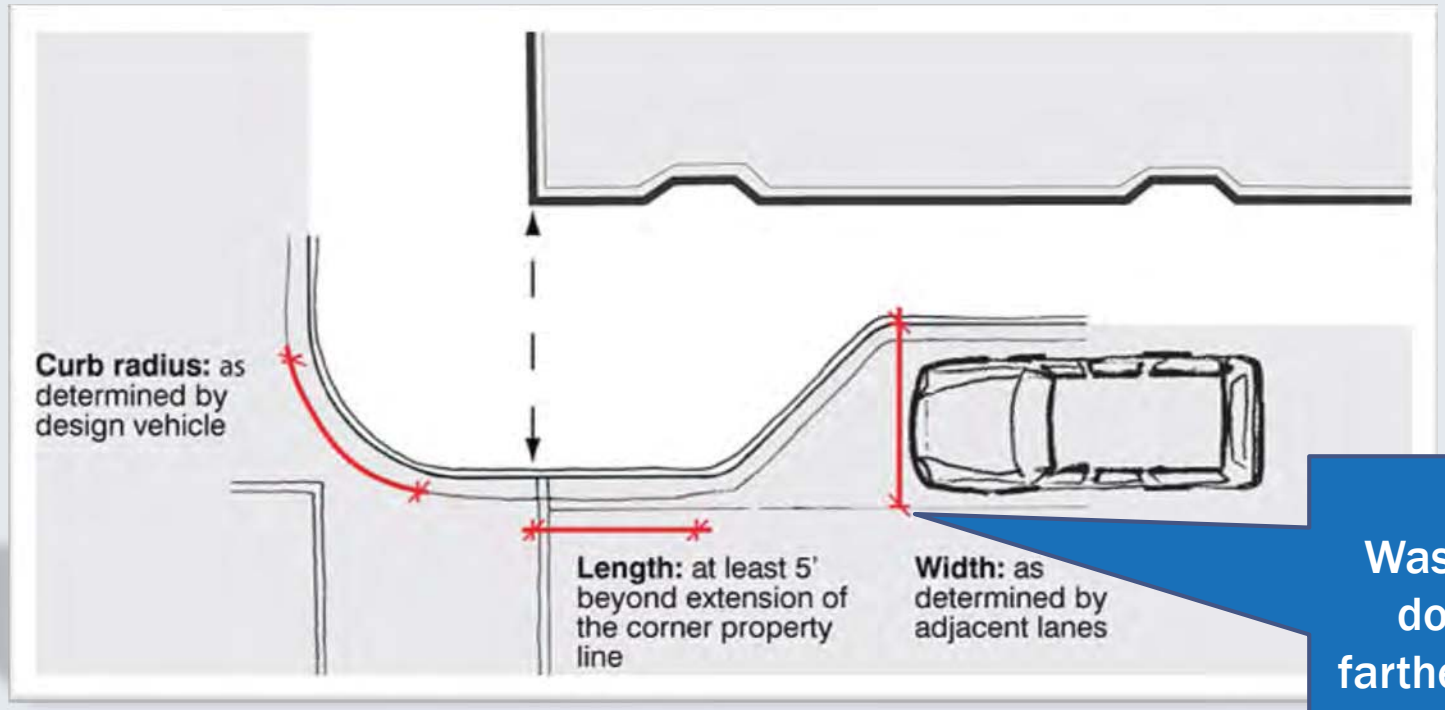
- Use Caution: Drivers that may run through the right turn lane on one side will hit the curb extension
- Bollards installed to help alleviate the situation

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

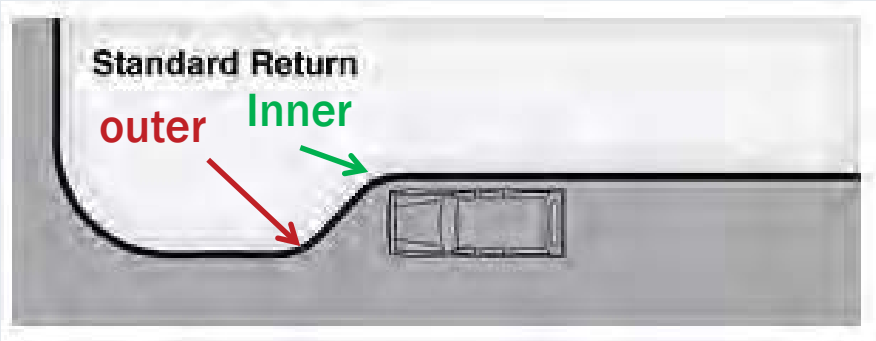


Washington D.C. doesn't allow farther than 6 feet. Potential for future bike lane

RADII
SAN FRANCISCO BETTER STREETS

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

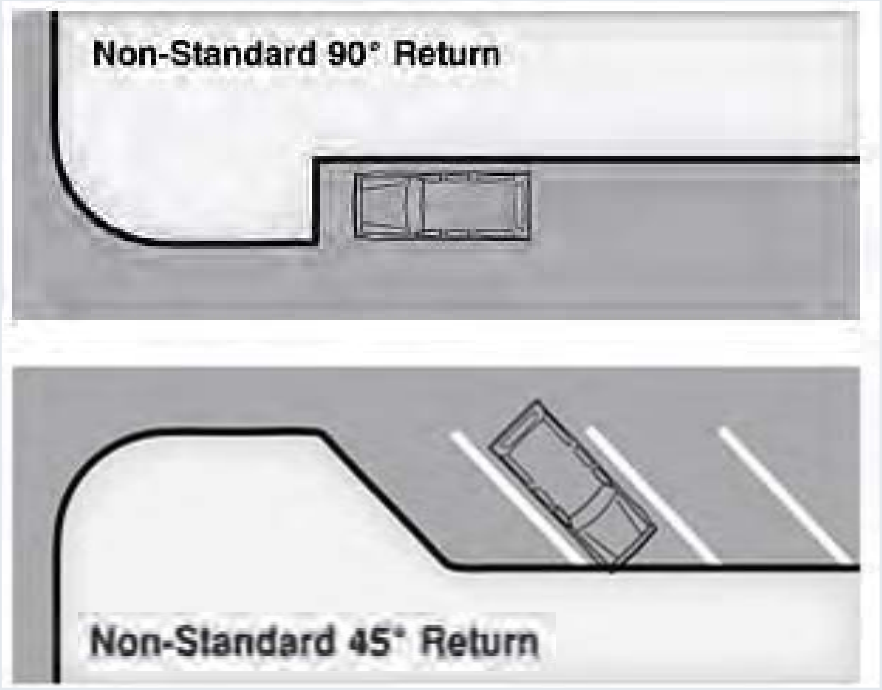
- Enable street sweeping machines to sweep the entire curb line
- May be reduced to 15ft and 10ft to



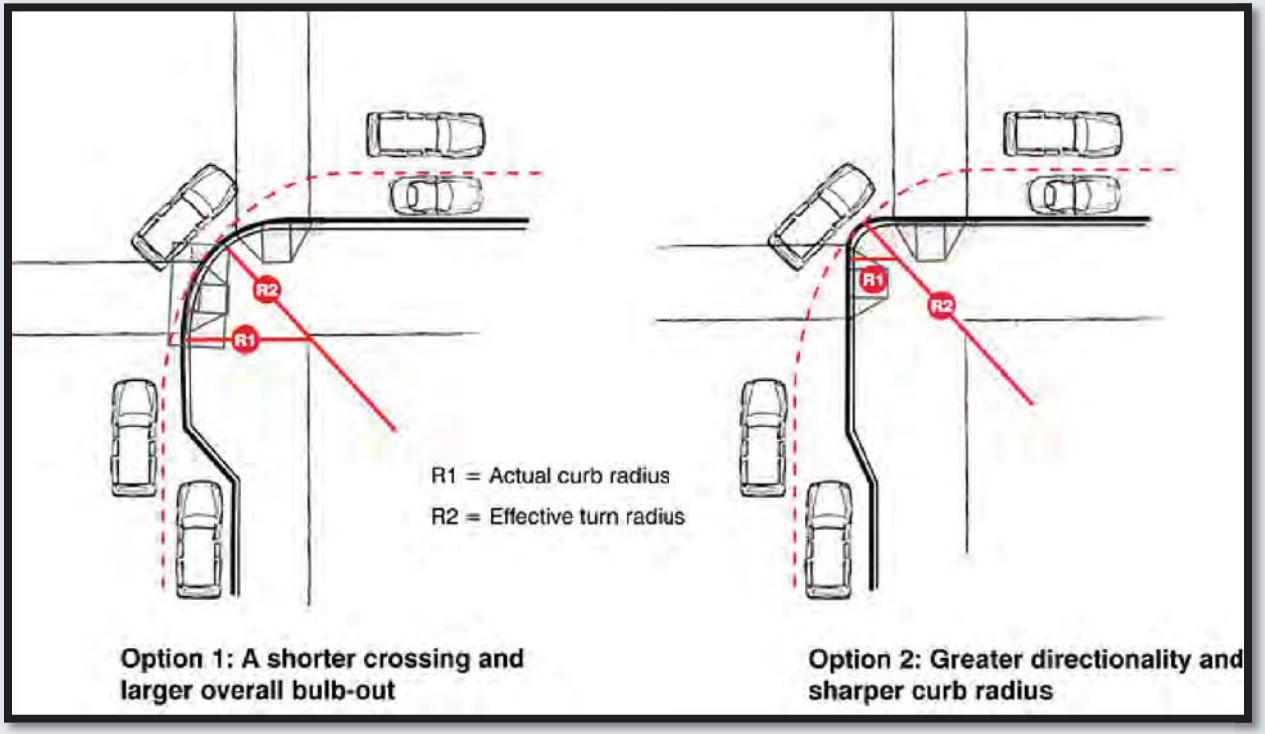
RADII
SAN FRANCISCO BETTER STREETS

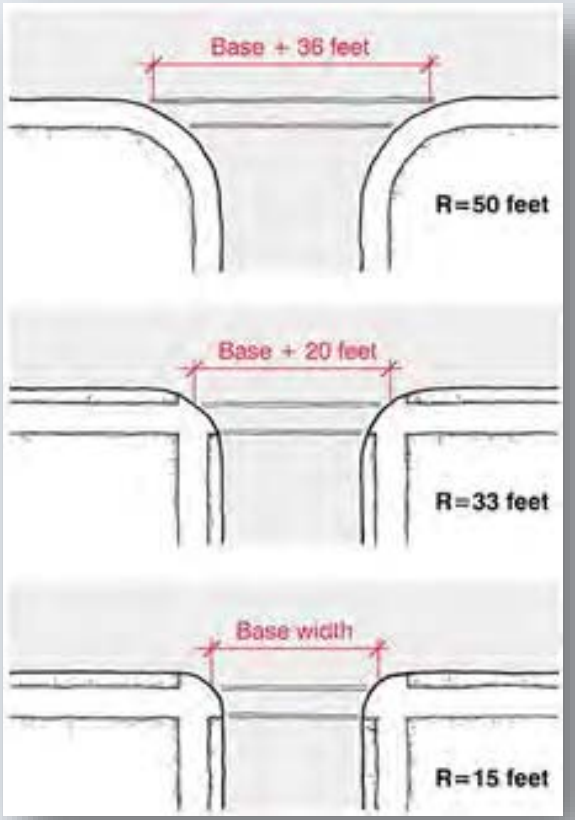
Non-standard return:

- 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



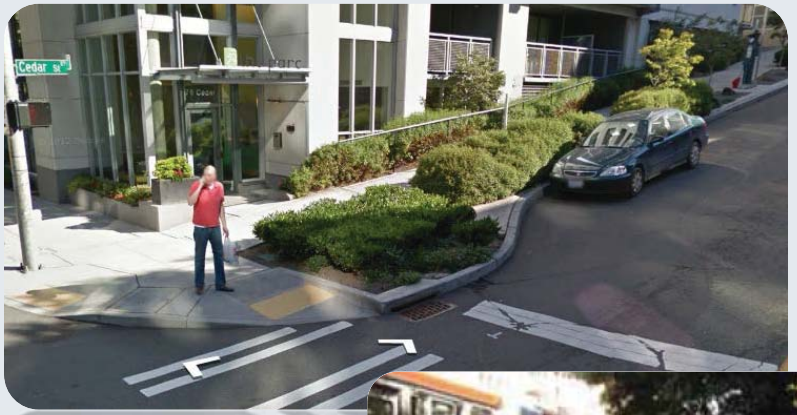


BUS BULB OUT

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



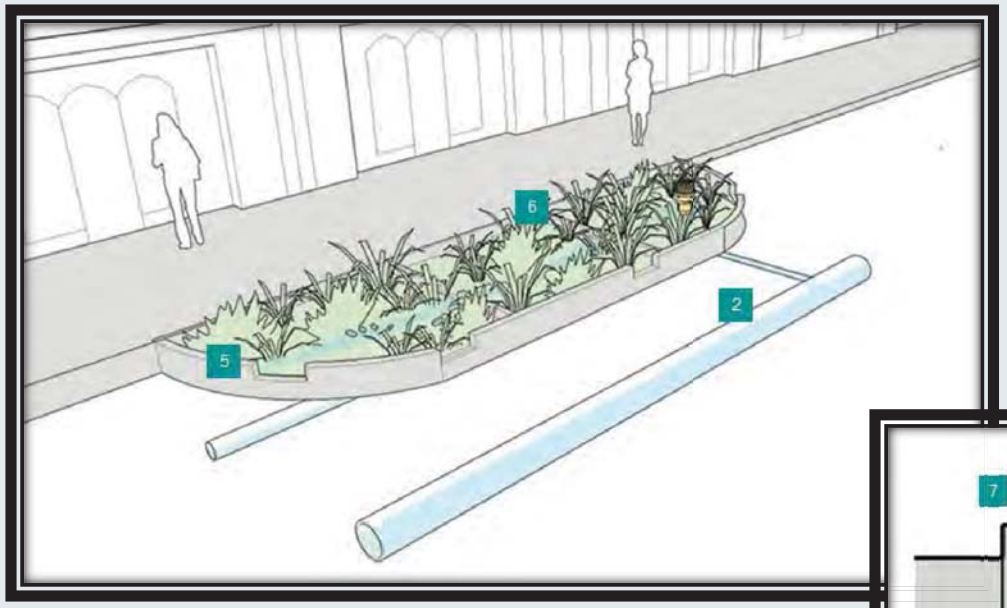
DRAINAGE/TRENCH DRAINS

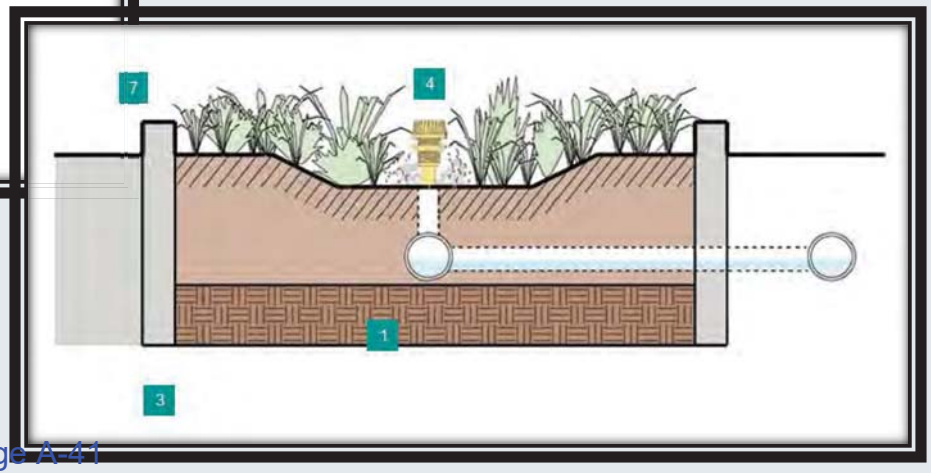
- Trench Drain considered to reduce cost & implementation
- Proper proportion trench drain to sidewalk
  - Left picture, smaller drain, attractive and proportioned
  - Right picture, wide drain, visually too dominant

DRAINAGE

DRAINAGE/LANDSCAPING

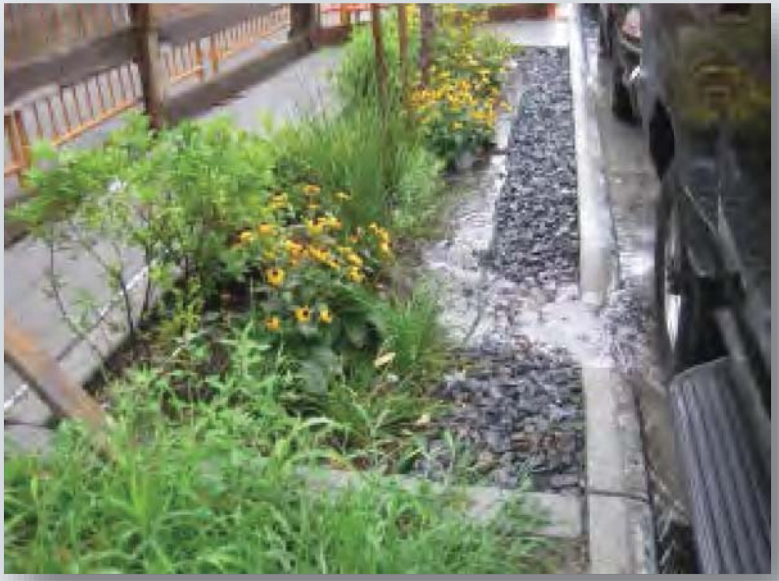
- NACTO Urban Streets Design Guide
- http://nacto.org/usdg/street-design-elements/stormwater-management/bioswales/

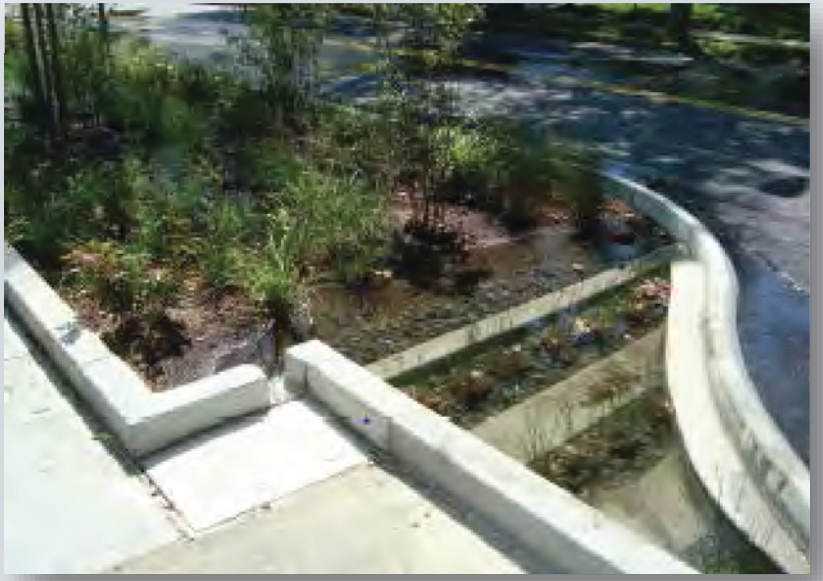




BIOSWALE DESIGN RESOURCES

- NYC Street Design Manual 6.6.1 – Stormwater-Capturing Installations





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

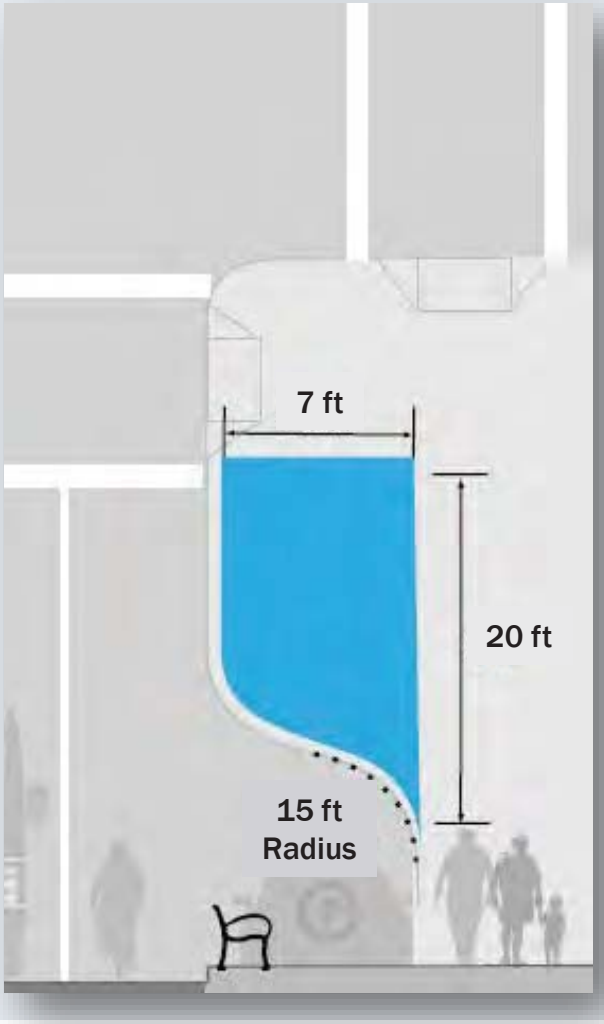
- Paving on curb extension should match the surrounding sidewalks

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)

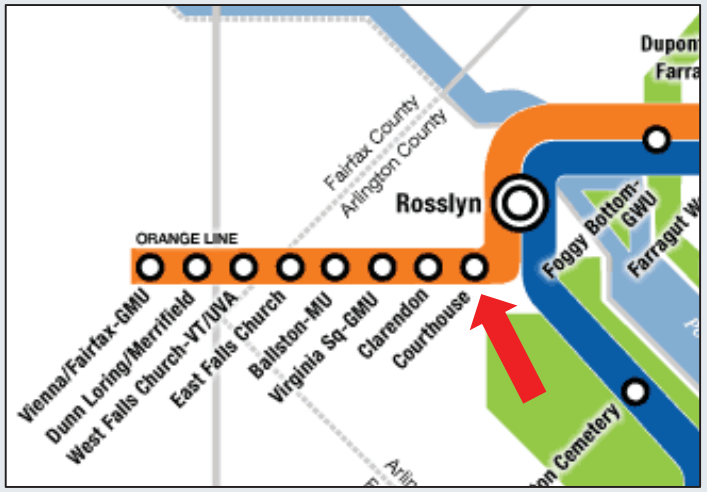
Source: "Costs for Pedestrian and Bicyclist Infrastructure Improvements: A Resource for Researchers, Engineers, Planners, and the General Public" October 2013

CASE STUDIES

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/

PEDESTRIAN SAFETY IMPACTS OF CURB EXTENSIONS: A CASE STUDY

Final Report

SPR 304-321

by

Randal S. Johnson
Department of Civil, Construction & Environmental Engineering
Oregon State University
Corvallis, Oregon

for

Oregon Department of Transportation
Research Unit
200 Hawthorne Ave. SE -- Suite B-240
Salem, OR 97301-5192

and

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15. Supplementary Notes

16. Abstract

This report documents a case study evaluating motorist yielding behavior at a crosswalk in Albany, Oregon. In 2003 the City of Albany installed curb extensions, continental markings and advance stop bars at several uncontrolled intersections along the U.S. Highway 20 one-way couplet. The City of Albany requested that an evaluation be conducted to determine if the pedestrian safety improvements functioned as intended. Since the installation in 2003, there had been no data collection effort on the operation of these features.

The focus of this study was the intersection of 4th Avenue and Lyon Street because the nearside crosswalk had a curb extension on only one side of the street, thus allowing for an analysis of motorist behavior toward pedestrians crossing from either the side with the curb extension or the side without. Specifically, this study examined the average number of vehicles that passed between the time a pedestrian arrived at the crosswalk to the time they were able to cross, the percent of vehicles that yielded at the advance stop bar, and the percent of pedestrian crossings in which a vehicle yielded.

17. Key Words	18. Distribution Statement
pedestrian safety, curb extension, bulbout, crosswalk, advance stop bar, motorist yielding behavior	Copies available from NTIS, and online at http://www.oregon.gov//ODOT/TD/TP_RES/

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Unclassified	Unclassified	32	

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

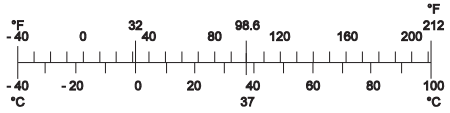
Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
In	Inches	25.4	Millimeters	Mm
Ft	Feet	0.305	Meters	M
Yd	Yards	0.914	Meters	M
Mi	Miles	1.61	Kilometers	Km
		AREA		
In^2	square inches	645.2	Millimeters squared	mm^2
ft^2	square feet	0.093	Meters squared	m^2
Yd^2	square yards	0.836	Meters squared	m^2
Ac	Acres	0.405	Hectares	Ha
Mi^2	square miles	2.59	Kilometers squared	km^2
		VOLUME		
fl oz	fluid ounces	29.57	Milliliters	mL
Gal	Gallons	3.785	Liters	L
ft^3	cubic feet	0.028	Meters cubed	m^3
Yd^3	cubic yards	0.765	Meters cubed	m^3

NOTE: Volumes greater than 1000 L shall be shown in m^3.

		MASS		
Oz	Ounces	28.35	Grams	G
Lb	Pounds	0.454	Kilograms	Kg
T	short tons (2000 lb)	0.907	Megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5(F-32)/9	Celsius temperature	°C

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
ha	hectares	2.47	acres	ac
km^2	kilometers squared	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celsius temperature	1.8C + 32	Fahrenheit	°F



* SI is the symbol for the International System of Measurement

(4-7-94 jbp)

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DISCLAIMER

PEDESTRIAN SAFETY IMPACTS OF CURB EXTENSIONS:
A CASE STUDY

TABLE OF CONTENTS

1.0 INTRODUCTION....1

1.1 BACKGROUND....1
1.2 PROBLEM STATEMENT....3
1.3 OBJECTIVE OF THE PROJECT....3

2.0 METHODOLOGIES USED....5

2.1 BACKGROUND RESEARCH....5
2.2 STUDY AREA DESCRIPTION....6
2.3 RESEARCH DESIGN....10
2.4 DATA ANALYSIS PROCEDURE....11

3.0 RESULTS....13

3.1 VEHICLES PASSING BEFORE A PEDESTRIAN-CROSS....13
3.2 PERCENT OF CROSSINGS WHERE A MOTORIST YIELDED....15
3.3 PERCENT OF VEHICLES YIELDING AT ADVANCE STOP BAR....15

4.0 OBSERVATIONS AND DISCUSSION....17

4.1 MOTORIST BEHAVIOR....17
4.2 PEDESTRIAN AND BICYCLIST BEHAVIOR....18

5.0 CONCLUSION AND RECOMMENDATIONS....21

6.0 REFERENCES....23

LIST OF FIGURES

Figure 1.0: Curb extension diagram....1
Figure 1.1: Crosswalk with continental marking and advance stop bars....2
Figure 2.0: Study area: Albany, Oregon....8
Figure 2.1: 4th Ave./Ellsworth St. facing south....8
Figure 2.2: 5th Ave./Ellsworth St. facing north....9
Figure 2.3: 5th Ave./Lyon St. facing north....9
Figure 2.4: 4th Ave./Lyon St. facing south....10
Figure 3.0: Number of vehicles that pass in NEAR lane before pedestrian-cross....14
Figure 3.1: Number of vehicles that pass in FAR lane before pedestrian-cross....14

LIST OF TABLES

Table 3.0: Results for average number of vehicles passing before a pedestrian-cross.....14
Table 3.1: Analysis results for percent of pedestrian crossings with yield.....15
Table 3.2: Analysis results for percent of vehicles yielding at advance stop bar.....15

1.0 INTRODUCTION

1.1 BACKGROUND

This study evaluates an intersection with a pedestrian crossing that is treated both with and without curb extensions and advance stop bars and investigates motorist yielding behavior. Curb extensions (Figure 1.0), also known as bulbouts, are an extension of the curb line into the roadway. They are commonly installed along streets with on-street parking and extend to the travel lane. Curb extensions have different intended purposes. They are used for improved pedestrian safety and/or traffic calming. The pedestrian safety benefits include shorter crossing distance and increased visibility for both the driver of the waiting pedestrian and the waiting pedestrian of the approaching vehicles. Curb extensions can also make pedestrian crossings more visible, especially when used in combination with high visibility markings, such as continental markings (Figure 1.1). Continental markings are a series of wide longitudinal stripes that extend the width of the crosswalk.

When the intended purpose of curb extensions is for traffic calming, they typically extend into the travel lane to reduce speeds by narrowing the lanes. A series of curb extensions at intersection or mid-lock locations is typically used to reduce speeds along a corridor. Bulbouts at intersections can reduce the speeds of turning vehicles and still maintain an adequate turning radius.

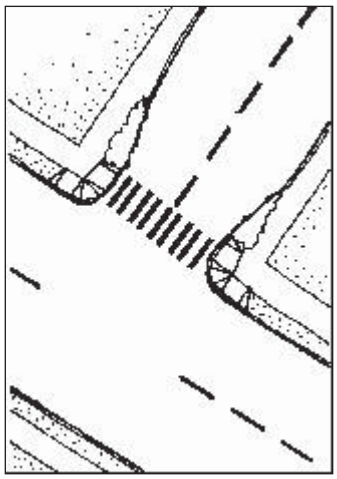

Figure 1.0: Curb extension diagram

The advance stop bars (Figure 1.1) are also evaluated in this study as a pedestrian safety feature. An advance stop bar is a stripe that is placed up to 20 or more feet upstream from the crosswalk.

A common pedestrian safety hazard that occurs on a one-way multi-lane street is when the motorist in the near lane yields at the edge of the crosswalk marking. This blocks the view of the pedestrian already in the crosswalk from the motorist in the far lane, often resulting in a failure to yield and an increase in the potential for a pedestrian-vehicle collision. This type of collision is known as a "multi-threat" collision (*Zegeer, et al. 2001*). The use of advance stop bars encourages the near lane driver to yield farther back from the crosswalk, thus maintaining a safe stopping sight distance for the motorist in the far lane.

Figure 1.1: Crosswalk with continental marking and advance stop bars

In 2003 the City of Albany installed curb extensions, advance stop bars, and striped crosswalks with continental markings on Lyon and Ellsworth Street at 4th and 5th Avenues. These streets are located in the downtown district and are part of a one-way couplet for U.S. Highway 20. The purpose of these improvements was to increase pedestrian safety at these intersection locations.

There were many issues that led to this joint Albany and Oregon Department of Transportation (ODOT) project. The intersections at 4th and 5th Avenues have no stop or yield control on the major street, which carries more than 17,000 trips per day (*Irish 2002*). High traffic volumes in combination with average and 85th percentile speeds well above the posted 25-mph speed limit make pedestrian crossing of these streets difficult and sometimes dangerous. No vehicle/pedestrian accidents had been reported in the last five years, but Albany averages just over 12 vehicle/pedestrian accidents each year for the entire city.

These intersections also provide an important pedestrian link between commercial uses in Albany's historic downtown area, government offices and services, and the residential neighborhoods in the Hackleman Historic District (*Irish 2002*). The curb extensions and striping were designed to improve crossing conditions for pedestrians with little or no impact to traffic.

It is important to note that the curb extensions in Albany were for improved pedestrian safety and not intended as traffic calming features. The design of the curb extensions terminated the edge of the bulbout two feet from the travel lanes and did not narrow the lanes or increase congestion. The benefits for pedestrians were increased visibility and shorter crossing distance.

1.2 PROBLEM STATEMENT

The City of Albany requested that a performance evaluation be conducted to determine if the pedestrian safety improvements functioned as designed. Since the installation in 2003, there had been no data collection effort on the operation of these features. This installation was extremely controversial and generated a lot of intense local debate. Some citizens deemed this project unnecessary and an inappropriate use of funds when other city streets were in disrepair.

Curb extensions are commonly used as traffic calming devices, and most studies have involved the evaluation of curb extensions as such. For example, bulbouts used to narrow travel lanes in the Dutch town of De Meern resulted in a significant reduction of the 85th percentile speeds (*Replogle 1992*). Few studies, however, have evaluated the safety of pedestrian crossings with curb extensions or developed methodologies to evaluate the safety performance beyond improved sight distance and a shorter crossing distance. One study that did evaluate bulbouts for safety in terms of behavior was the Federal Highway Administration's (FHWA) study titled *The Effects of Traffic Calming Measures on Pedestrian and Motorist Behavior* (*Huang and Cynecki 2001*). This study, however, evaluated the effect of *traffic calming* bulbouts on motorist behavior.

1.3 OBJECTIVE OF THE PROJECT

The ODOT design manual states that, "Curb extensions reduce the pedestrian crossing distance and improve the visibility of pedestrians for motorists on streets where parking is allowed." (*ODOT 2003*). These pedestrian safety benefits of curb extensions, as described in the ODOT design manual, are often the justification for their installation. The objective of this study was to further quantify the safety benefits that curb extensions provide to pedestrians by examining motorist behavior.

This study compared motorist yielding behavior of a pedestrian crossing with and without curb extensions that had continental markings and advance stop bars. The methodology used to quantify motorist yielding behavior was intended to allow the City of Albany to determine if the curb extensions, advance stop bars and continental crosswalk striping had increased the safety of pedestrian crossings, thus justifying the expense for this project. This methodology could also be adapted for use by other agencies to evaluate the safety performance of curb extensions.

2.0 METHODOLOGIES USED

2.1 BACKGROUND RESEARCH

Previous research reports were reviewed to determine the extent to which motorist behavior has been evaluated in relation to curb extensions. The most closely related study was the FHWA study titled *The Effects of Traffic Calming Measures on Pedestrian and Motorist Behavior* (*Huang and Cynecki 2001*). Of interest from this study was the effect bulbouts as traffic calming features have on pedestrian and motorist behavior. Huang and Cynecki cited previous studies that evaluated curb extensions as speed reduction measures. One such study was the evaluation of bulbouts used to narrow travel lanes in the Dutch town of De Meern that resulted in a significant reduction of the 85th percentile speeds (*Replogle 1992*). In contrast, a study of bulbouts in the Australian cities of Keilor, Queensland and Eltham, Victoria resulted in little effect on reducing vehicle speeds (*Hawley, et al. 1992*). The many studies on curb extensions as traffic calming features have shown that they can be effective in calming traffic. In their own research, Huang and Cynecki performed before and after studies of bulbouts in Cambridge, MA and Seattle, WA and treatment-and-control studies of bulbouts in Greensboro, NC and Richmond, VA. The measures of effectiveness used to measure the behaviors of pedestrians and motorists were *percentage of pedestrians for whom motorists stopped or yielded, percentage of pedestrians who crossed in the crosswalk,* and *wait time* before crossing.

The study locations in Cambridge, MA were in residential neighborhoods, while the Seattle, WA sites were on arterial streets near downtown Seattle. The percentage of pedestrians for whom motorists yielded in the Cambridge sites showed a large increase with bulbouts, but with very small sample sizes before and after the installation of the bulbout. The Seattle study showed a small decrease from 58% to 52%, but the results were not statistically significant. No explanation was given regarding possible causes for the insignificant results. The differences at the Cambridge site were also statistically insignificant from before and after the bulbout for the percentage of pedestrians who crossed in the crosswalk and wait time. The Seattle results surprisingly showed a significant decrease in the percentage of pedestrians who crossed in the crosswalk and a significant increase in wait time. The insignificant result in the wait time for the Cambridge site was attributed to low traffic volumes, so most pedestrians had little or no wait time. Fluctuations in traffic conditions are given as a possible cause for the significant results in the wrong direction for the Seattle locations.

For the Greensboro, NC and Richmond, VA treatment-and-control study, there were two treatment and two control sites for each city. One Greensboro site was along a major downtown arterial and the other was on a bidirectional two-lane street with on-street parking. Both Richmond sites were along one-way two-lane streets in residential neighborhoods. This treatment-and-control study only observed the percentage of pedestrians for whom motorists yielded and vehicle speeds. The Greensboro site resulted in a significant 1.1 mph decrease for the site with bulbouts compared to the one without. The Richmond site resulted in a significant

2.0 mph increase in the 50th percentile speed. There was no explanation of what may have caused the increase in speed. Both the Greensboro and Richmond sites had very low percentages of pedestrians for whom motorists yielded with no significant difference between the treatment and control.

Another study of importance was the FHWA's *Improving Motorists Yielding at Crosswalks on Multilane Roads with an Uncontrolled Approach* (*Zegeer, et al. 2001*). This FHWA study focused on pedestrian crash data and factors such as pedestrian and vehicle volumes, median type, crossing location, vehicle speed, and lane configuration. In the end, 229 pedestrian crashes at 2000 crossings from a 5-year period were analyzed. Interestingly, factors determined to have no effect on the pedestrian crash rate included speed limit, traffic operation (one- or two-way), marking type (continental, zebra, parallel lines) and crossing location (mid-block or intersection).

Another surprising result was that for multi-lane roads with an average daily traffic (ADT) greater than 15,000 and no raised median, there was a significant difference with a higher pedestrian crash rate for marked crossings when compared to unmarked. One possible explanation for this was that "at risk" pedestrians (children and elderly) could go to the nearest signalized crossing if there was no marked crosswalk available. Results showed that over 70 percent of pedestrians under the age of 12 and over 64 used marked crosswalks (*Zegeer, et al. 2001*).

Another notable result was that "multiple-threat" crashes occurred almost 18 percent of the time in marked crosswalks and did not occur at all with unmarked crossings. The "multiple-threat" crash occurs when there are multiple lanes of travel in the same direction and the vehicle in the near lane yields to the pedestrian and blocks the sight distance of the motorist in the other lane. This situation was present at the Albany curb extension crosswalks, thus making them vulnerable to this type of crash.

For a multi-lane road (4 or more lanes), with no raised median, speed limit of less than 35 mph, and an ADT greater than 15,000, Zegeer, et al. recommended that marked crosswalks alone are insufficient and that additional treatments should be provided. These treatments may include raised medians, traffic signals, roadway narrowing, enhanced overhead lighting, traffic-calming measures, and/or curb extensions. Lyon and Ellsworth Street through downtown Albany do not have 4 lanes, but they do have two lanes of travel in the same direction and meet all other criteria for the recommendation by Zegeer, et al. Based on this study, the curb extensions and advance stop bars installed at the crossings at 4th and 5th Avenues were warranted.

2.2 STUDY AREA DESCRIPTION

The curb extension project includes the intersections of 4th and 5th Avenues along Ellsworth and Lyon Street. (Figure 2.0). Lyon (northbound) and Ellsworth (southbound) comprise a one-way couplet of U.S. Highway 20 through downtown Albany. Both streets have two travel lanes with on-street parking on both sides. All four intersections also have a no parking zone (yellow curb marking) of approximately 40 feet on all nearside approaches. There is no stop control along Highway 20 at these intersections, but there are stop signs on the approaches of 4th and 5th

Avenues. Signalized controls are located in the core downtown area along Highway 20 between 3rd and 1st Avenues. These intersections are all located in mixed retail and commercial land use. The Hackleman Historic District residential neighborhood is located one block east of Lyon Street. Emergency fire signals are located at 6th Avenue on both Lyon and Ellsworth. A school zone also exists just downstream of the study zone on Ellsworth. Fluorescent pedestrian crossing warning signs are located near 6th Avenue, and school zone warning signs are placed at 7th Avenue.

Both directions of this couplet experience over 17,000 vehicles per day. Average speeds are known to exceed the posted speed limit through this corridor. Vehicles typically travel in platoons in both directions. The signal controls downtown set up vehicles traveling south to be in platoons. The majority of the vehicle volume on Lyon stems from westbound traffic on the shared Highway 20/99E through north Albany. Traffic arriving on Lyon from Highway 20/99E typically arrives in platoons created from signals located several miles upstream.

The intersection of 4th Ave. and Ellsworth Street (Figure 2.1) has curb extensions on both the near and far side crosswalk on Ellsworth Street. Continental crosswalks with advance stop bars are located on the major crossings, while the minor crossings only have parallel lines. The close proximity of the government offices makes this intersection an important link to the downtown shopping area. Observations show that this link has the highest pedestrian volume in the study area, although an exact count was not determined.

The 5th Avenue intersections at Ellsworth and Lyon (Figures 2.2 and 2.3) both only have near side marked crossings with curb extensions and advance stop bars. There are no curb extensions or marked crossings for the farside crosswalk. The minor crossings have parallel stripes.

This study focuses the research effort on the intersection of 4th Ave. and Lyon Street (Figure 2.4). The nearside crosswalk of this intersection provides for a unique treatment-and-control study opportunity. A curb extension has been installed at the west side of the crosswalk, but the east side has been left with the original curb line because a driveway is nearby. Similar to the intersections at 5th Avenue, the minor streets have parallel stripe markings with no curb extensions. There is also no marked farside crosswalk on Lyon Street. Pedestrian attractors for this crosswalk include the Old Armory Building, which serves as a meeting hall, located at the west end of the crosswalk and a liquor store and bank, located east of 4th and Lyon. This intersection also provides a link between the Hackleman Historic District and the downtown sector.

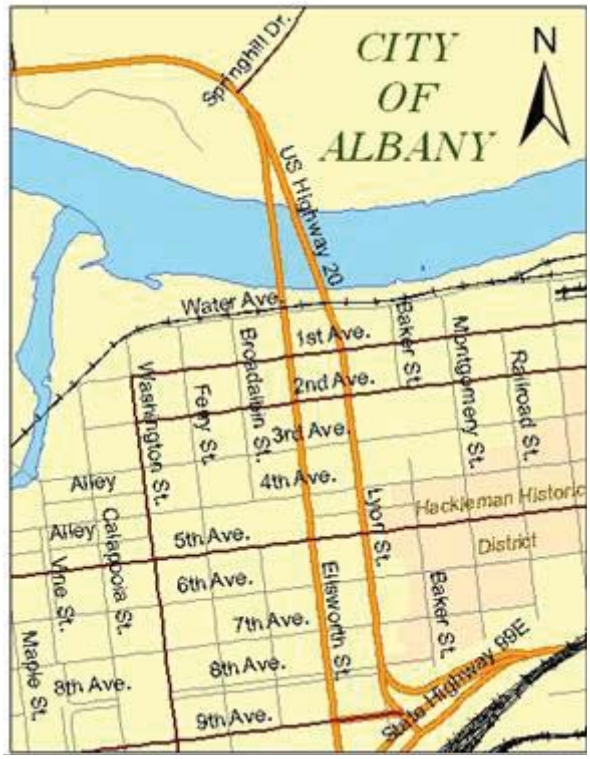

Figure 2.0: Study area: Albany, Oregon

Figure 2.1: 4th Ave./Ellsworth St. facing south

Figure 2.2: 5th Ave./Ellsworth St. facing north

Figure 2.3: 5th Ave./Lyon St. facing north

Figure 2.4: 4th Ave./Lyon St. facing south

2.3 RESEARCH DESIGN

No data had been collected prior to the installation of the pedestrian improvement features, so a before-and-after study was not possible. A treatment-and-control study was considered between the curb extension locations and the uncontrolled, unimproved crosswalks downstream on Ellsworth Street and upstream on Lyon Street. Such a design, however, would have had too many confounding variables that could have a substantial impact on the data. These variables included the presence of the emergency fire signal with "stop here on red" signs, advanced pedestrian warning signs and a school zone. Thus it was determined that the nearside crosswalk at 4th Avenue and Lyon Street with the single curb extension provided the best opportunity to measure the effectiveness of the recently installed curb extensions.

The nearside crosswalk at 4th Avenue and Lyon Street allowed for a comparison of pedestrians crossing from the curb extension side and those crossing from the side without a curb extension. This unique crossing also allowed for the evaluation of advance stop bars with and without a pedestrian waiting on a curb extension. This comparison also benefited from the same motorist population, continental marking, and visual environment.

The measures of effectiveness (MOE) used to evaluate the pedestrian improvements were:

- Average number of vehicles that pass before a pedestrian-cross
- Percent of pedestrians crossing with yield
- Percent of vehicles yielding at the advance stop bar

These MOEs were determined for the near and far lane for each crossing. Note that the near and far lanes were defined relative to the side from which a pedestrian was crossing.

Data were collected using a video camera set up approximately one block downstream from the intersection and positioned such that both approaching vehicles and pedestrians could be observed. Weather varied from cloudy to sunny on days of data collection. Crossings were only recorded during daylight hours.

The *average number of vehicles that pass before a pedestrian-cross* was determined by counting the number of vehicles that passed through the crosswalk after the pedestrian arrived at the curb line. The number of vehicles that passed was counted separately for the near and far lane for the respective side of crossing. If a vehicle yielded for the pedestrian then it was noted after counting the number of vehicles that had first passed. If X number of vehicles passed a waiting pedestrian without yielding and the pedestrian crossed in a gap in the flow of traffic, then the crossing was considered a failure to yield.

Percent of pedestrians crossing with yield was based on the proportion of crossings when a motorist yielded to a pedestrian to the total number of pedestrian crossings when traffic was present. Pedestrian crossings that occurred when no traffic was present were not included in the analysis. In some cases, traffic was only present in one lane during a pedestrian crossing. The lane clear of traffic was also not included in this analysis. Another case excluded from the analysis was when vehicles spilled back from the signal one block downstream, thus stopping vehicles and allowing pedestrians to cross between queuing vehicles.

Percent of vehicles yielding at the advance stop bar was based on the proportion of the vehicles that did yield at the stop bar to the total number of vehicles yielding to pedestrians. Vehicles that yielded more than one foot beyond the advance stop bar were considered a failure to yield at the advance stop bar.

Observations showed that pedestrian volumes at this crosswalk were moderately low with 30 to 40 pedestrians per day. Staged pedestrians were thus used to acquire a sufficient number of observations. Staged pedestrians were both male and female, wearing both dark and bright clothing. The staged pedestrians also varied their behavior to better reflect a wider range of the pedestrian population. For example, the participant would sometimes stand a little back from the edge of curb and other times step off the curb facing traffic. Both of these behaviors were observed with non-staged pedestrians, but waiting at the curb line was most prevalent. The staged pedestrians would only approach the crosswalk when a platoon of vehicles was approaching the intersection.

2.4 DATA ANALYSIS PROCEDURE

A two-sample t-test was performed on the measures of effectiveness to determine if there was a statistically significant difference in means. Basic statistics were also performed to compare the standard deviation and variation of the datasets.

3.0 RESULTS

3.1 VEHICLES PASSING BEFORE A PEDESTRIAN-CROSS

The analysis of the *average number of vehicles that pass before a pedestrian-cross* showed fewer passing for crossings from the side with the curb extension compared to crossings from the unimproved side. This reduction for the curb extension side occurred in both the near and far lanes with a statistically significant difference in means. (Table 3.0). The mean number of vehicles that passed before the pedestrian could cross from the side with no curb extension was 2.58 for the near and 2.36 for the far lane.

For pedestrians crossing from the curb extension side, the mean number of vehicles that passed was reduced to 1.81 for the near lane and 1.76 for the far, resulting in a reduction of 42.7% and 33.9% respectively. Acceptable p-values of less than 0.05 from the t-test analysis validate the statistical difference in the means. The analysis included n = 219 pedestrian crossings for the near lane and n = 214 for the far lane. There was a difference in samples sizes because the case where a pedestrian crossed and one lane was clear of traffic only counted as an observation for the lane where vehicles were present.

In both cases the average number of vehicles that passed before the pedestrian-cross was lower in the far lane as compared to the near lane. This is likely attributed to the fact that the motorist has a greater sight distance because of the increased lateral separation. Basically the driver in the far lane will be able to see the pedestrian around the on-street parking sooner than the driver in the near lane and will have more time to stop.

The near lane, however, experienced a greater reduction in the average number of vehicles that passed before a pedestrian-cross when comparing the curb extension side to the side without. This greater reduction in average number of passing vehicles likely occurred because the near lane experienced a greater improvement in sight distance over the far lane with the addition of the curb extension. The driver in the near lane always has less time to see the pedestrian and yield, even though a yellow curb is provided for adequate stopping sight distance. With the addition of the curb extension though, the sight distance between the motorist and the waiting pedestrian is as far as visibility conditions allow, since there are no obstructions.

Figures 3.0 and 3.1 show the spread of the number of vehicles that passed before a crossing in the near and far lanes respectively. In both lanes the treatment (curb extension) side had a lower mean, but they also had the overall highest number of vehicles that passed before a pedestrian cross. These high values seem to be a random event, because the observations showed that the pedestrian was in plain view and there were no other factors that were different from other crossings.

Table 3.0: Results for average number of vehicles passing before a pedestrian-cross

	Lane	Non-Curb Extension	Curb Extension	Percent difference in means	Sample Size (n)	t-test p-value	Difference in Means
Average number of vehicles that pass before pedestrian cross	Near	2.58	1.81	-42.7%	219	0.0017	Significant
	Far	2.36	1.76	-33.9%	214	0.0362	Significant

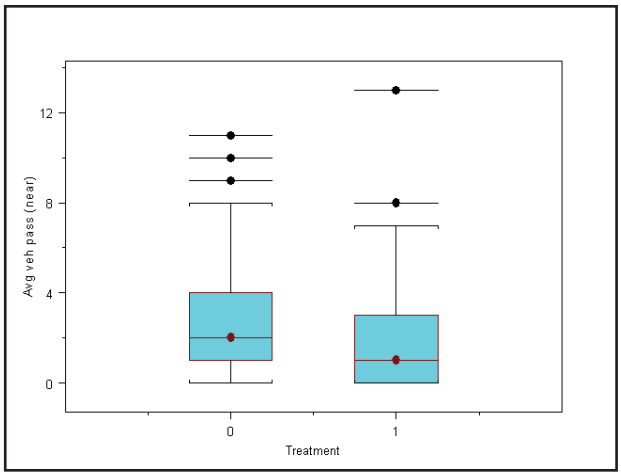

Figure 3.0: Number of vehicles that pass in NEAR lane before pedestrian-cross

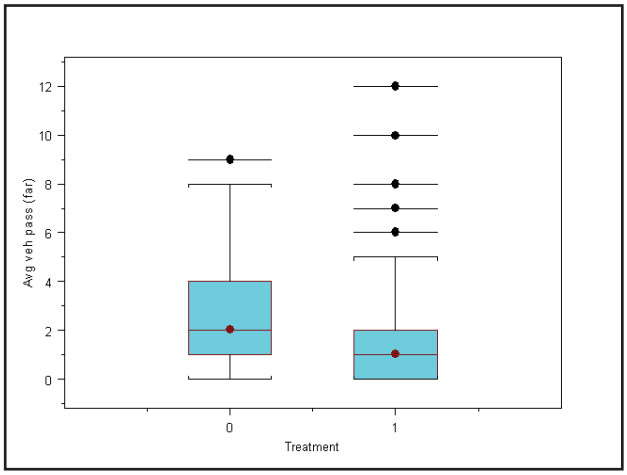

Figure 3.1: Number of vehicles that pass in FAR lane before pedestrian-cross

3.2 PERCENT OF CROSSINGS WHERE A MOTORIST YIELDED

The *percent of the pedestrian crossings where a motorist yielded* had improvements for the curb extension side in both near and far lanes (Table 3.1). This improvement was weak, however, and the t-test proved insignificant. The near lane had 65% crossing with yielding motorist for the unimproved side and 66.7% for the curb extension side for an increase in 2.7%. The far lane increased from 58.6% to 63.4% from the unimproved side to the curb extension side respectively, resulting in an increase of 7.7%. A total of 234 crossings were analyzed to determine the percent of crossings where motorists yielded. While there was a slight but insignificant improvement favoring the curb extension side, overall approximately 60 percent of the pedestrian crossings occurred when a vehicle yielded. The 60 percent yielding rate becomes even less favorable when considering that before a yield occurs, the average number of vehicles that pass before the pedestrian cross (Table 3.0) must be taken into account.

Table 3.1: Analysis results for percent of pedestrian crossings with yield

	Lane	Non-Curb Extension	Curb Extension	Percent difference in means	Sample Size (n)	t-test p-value	Difference in Means
Percent pedestrian crossing with yield	Near	64.9%	66.7%	2.7%	234	0.7729	Insignificant
	Far	58.6%	63.4%	7.7%	234	0.4489	Insignificant

3.3 PERCENT OF VEHICLES YIELDING AT ADVANCE STOP BAR

The *percentage of vehicles that yielded at the advance stop bar* also increased from the unimproved side to the curb extension side (Table 3.2). This improvement, however, was statistically insignificant with t-test p-values greater than 0.05 for both lanes. Both the near and far lanes of the control side were exactly the same at 42.6% of vehicles yielding at the stop bar. Crossings from the curb extension experienced a roughly 20% increase in both lanes to 53.8% in the near lane and 51.9% in the far lane. This increase with the curb extension is likely attributed to the fact of longer sight distance for both lanes. While this improvement trend with the curb extension was not statistically significant, overall only about half of the drivers were stopping at the advanced stop bar. The risk of "multi-threat" crashes is high on this type of road, and only having 50 percent of the "yielding" drivers stopping at the advance stop bar would likely have a minimal impact on reducing this risk. The sample size for this analysis included 99 crossings.

Table 3.2: Analysis results for percent of vehicles yielding at advance stop bar

	Lane	Non-Curb Extension	Curb Extension	Percent difference in means	Sample Size (n)	t-test p-value	Difference in Means
Percent of vehicles yielding at advance stop bar	Near	42.6%	53.8%	21.0%	99	0.2261	Insignificant
	Far	42.6%	51.9%	18.0%	99	0.3563	Insignificant

4.0 OBSERVATIONS AND DISCUSSION

Many interesting observations on the behavior of motorists, pedestrians and bicyclists were made while performing this study. These observations are both from the field and video analysis.

4.1 MOTORIST BEHAVIOR

When observing the types of motorists who would yield to pedestrians, there were several groups who appeared to consistently yield more often. One such group was public vehicles. These vehicles included school busses, county and city vehicles, public transit, DOT vehicles and emergency vehicles. More times than not, public vehicles were observed immediately yielding to pedestrians. This was as expected though, as many public employees are required to take driver education courses. Public employees may also be scrutinized by the public if they fail to obey traffic laws.

Another group of drivers who consistently yielded for pedestrians was commercial truck drivers. This was likely because most are trained professional drivers. For these drivers, failing to obey traffic laws can cost them their livelihood. There is also a known greater risk to pedestrians if they are involved in a collision with a semi-truck.

On several occasions, semi-trucks were observed abruptly stopping to yield to pedestrians. While these drivers were obeying traffic laws, this situation increased the risk of a "multiple-threat" collision when the truck yielded in the near lane. Even when these trucks did yield at the advance stop bar, the size of the trucks blocked the sight distance for both the pedestrian and any motorists in the far lane. Some pedestrians were observed stopping mid-crossing and "peeking" around the truck to see if the far lane was clear. One near "multiple-threat" crash was observed when a school bus yielded in the near lane and a vehicle in the far lane nearly collided with the crossing pedestrian.

While many professional truck drivers were observed obeying traffic laws, some delivery vehicles created another kind of hazard. Several times a day, delivery vehicles were observed parking in the "yellow curb" zone upstream to the crosswalk. While these delivery stops were only for a short duration, the sight distance was dramatically reduced, posing a hazardous threat to pedestrians. Parking in the yellow zone by non-commercial drivers was also observed on several occasions. The yellow curb prior to the crosswalk on the east end was sometimes used for short term parking for customers shopping at the liquor store. The yellow curb prior to the crosswalk on the west end was periodically used as a waiting spot for drivers waiting to pick up passengers from the Old Armory. No parking enforcement was ever observed during the four days of data collection. The occurrence of vehicles parking in these yellow curb zones was only a few times a day and only for a short duration, but when this regulation was violated a greater threat was posed to a crossing pedestrian.

Large vehicles yielding to pedestrians led to another common type of motorist behavior. As a large vehicle yielded to a pedestrian, the driver of the vehicle behind could not see why the large vehicle was slowing or stopping. If the adjacent lane was clear, then it was common to observe vehicles changing lanes at the last minute and accelerating around the larger vehicle. This is another scenario that increases the risk of a "multiple-threat" collision. Last minute lane changes appeared to be common with the general motorist behavior. A great deal of lane changing occurred when a driver was traveling below the desired speed and the adjacent lane was free of traffic ahead. Lane changing maneuvers also seemed to be more common just before an intersection when the leading vehicle slowed to turn or begin to yield.

The likelihood of a motorist yielding to a pedestrian also appeared to depend on when the pedestrian arrived in relation to the traffic stream. For example, if a pedestrian arrived at the curb just prior to a platoon arriving, then the first car often yielded to the pedestrian. If the pedestrian arrived in the middle of a platoon, then typically several vehicles would pass before one would yield; or in some cases none yielded at all. This situation was observed on several occasions, but there was insufficient data to test this theory.

Another observation made was driver inattention. A large number of motorists were talking on a cell phone while driving. Others were engaged in conversation with passengers, and some were focused on radio or other controls. Some drivers may have been able to focus on driving while performing these tasks, but many drivers were observed doing these activities and driving right past a pedestrian at the curb line without appearing to notice the pedestrian. Drivers exhibiting distracting behaviors may be one factor in the overall low yielding rate or failure to yield at the advance stop bar. Driver inattention is also one of the leading causes of traffic accidents. (*Wang, Knipling and Goodman 1996*)

While some drivers passed pedestrians without ever appearing to notice them, other drivers made eye contact with the pedestrian and then continued through the crosswalk. The reason for this blatant disregard for a pedestrian waiting at a crosswalk was unknown. This behavior and the overall low yielding percentage could be a reflection of a lack of driver education or full understanding of the yield to pedestrian law.

4.2 PEDESTRIAN AND BICYCLIST BEHAVIOR

Pedestrian behavior varied from being passive to aggressive. Those who exhibited passive behavior often stood back from the curb several feet and waited for a vehicle to yield or an acceptable gap. Pedestrians with aggressive behavior were observed stepping off the curb, facing traffic and sometimes using hand gestures to try and get vehicles to yield. Some pedestrians also showed more risky behavior by running across the street during small gaps in traffic.

Observations also showed that pedestrians were more likely to use the marked crosswalk during heavy traffic. During non-peak hours, pedestrians were observed crossing wherever convenient. However, there were some pedestrians who crossed the street at convenient mid-block locations during heavy traffic. These pedestrians were often the ones observed with risky behavior, such as running between vehicles.

The majority of pedestrians crossing from the non-curb extension side were observed waiting one step out from the curb. This may have increased their visibility, but it also left them exposed. Right turning vehicles often come close to the curb and are not expecting a pedestrian standing off of the curb. This situation is eliminated with the use of curb extensions.

Bicycle volumes through this intersection were low, but some common behaviors are noteworthy. On multiple occasions, bicyclists were observed using the sidewalks to travel southbound against traffic instead of continuing one block over and then traveling with the direction of traffic. No bicycle-pedestrian collisions were observed on the sidewalks, but the potential was still present. Bicycles crossing Lyon Street on 4th Avenue either crossed using a vehicle lane with an acceptable gap or using the crosswalk. Those using the crosswalk did not dismount from their bicycles, however. Both situations are acceptable methods according to the Oregon Bicyclists Manual, but those using a crosswalk must dismount from their bicycles (*ODOT 2000*). Motorists were never observed yielding to the bicyclists using the crosswalk, but there was also a very small sample size for this situation. Bicyclists also were able to successfully cross the street with a smaller gap than that required by a pedestrian who walked.

5.0 CONCLUSION AND RECOMMENDATIONS

The findings of this research suggest that curb extensions contribute to a significant reduction in the average number of vehicles that pass a waiting pedestrian before yielding to the pedestrian. Basically pedestrians approaching from the curb extension side experienced a vehicle yielding sooner than those coming from the non-improved side of the crosswalk. This reduction in the average number of passing vehicles yielding is best explained by the increased visibility offered by the curb extension.

A greater reduction in the number of unyielding vehicles occurred in the near lane for the curb extension side of the crosswalk. This is likely because the near lane has a greater increase in sight distance when comparing the treatment and control. While the near lane experiences a greater improvement in sight distance with the addition of the curb extension, the far lane will always have an overall greater sight distance. This explains the lower mean number of passing vehicles in the far lane for both the treatment and the control.

The change in percentage of pedestrian crossings with a yielding vehicle between the treatment and the control was insignificant but showed a weak trend towards improvement with the presence of a curb extension. Further research with a greater sample size may prove this trend significant. Regardless of significance, however, about one third of the pedestrians in this study were forced to wait for an acceptable gap to cross because no vehicle would yield. This high percentage of motorists failing to yield was possibly a driver behavior issue and not necessarily a lack of appropriate pedestrian facilities.

The change in percentage of vehicles yielding at the advance stop bar between the treatment and the control also proved insignificant, but the curb extension side experienced roughly a 20 percent increase in the number of vehicles stopping at the advance stop bar. This analysis was based on a small sample size, however, which may be the reason for the lack of statistical significance in this difference. Again though, the overall percentage with or without the improvement was only slightly over 50 percent. While there could be several reasons for this low rate, possible causes are driver behavior or perhaps a lack of visibility and understanding of the advance stop bars.

One recommendation to improve the percentages of vehicles that yield and yield at the advance stop bar is to install advance yield signs. These signs would say “Yield Here to Pedestrians” placed at the advance stop bar. Past research shows that these signs can produce a reduction in vehicle/pedestrian conflicts and an increase in motorists yielding to pedestrians at multilane crosswalks with an uncontrolled approach. (*Van Houten 2001*). Van Houten also recommends that advance stop bars be placed 15 meters (~50 ft.) from the crosswalk. The Albany advance stop bars are only 20 feet from the crosswalk.

Recommendations to address the driver behavior issues include increased driver education and enforcement of pedestrian yielding laws. If further research indicates similar motorist behavior

in relation to yielding to pedestrians, perhaps a statewide pedestrian awareness campaign may be effective. The National Highway Traffic Safety Administration's highly publicized "Click it or Ticket" campaign has been successful with increasing safety belt usage rates. (*Solomon, et al. 2003*). Another measure may be an increased focus on pedestrian yielding laws in the Oregon Driver's Manual. Increased law enforcement may be effective for spot locations such as this site. This driver population appears to have substantial commuter traffic, so the periodic presence of law enforcement may have a large impact on local driver behavior.

The presence of a curb extension at the intersection of 4th and Lyon Street resulted in a significant reduction in the mean number of vehicles that passed from the time a pedestrian arrived at a crosswalk to the time they were able to cross. While the change in the percentage of pedestrian crossings with a yielding vehicle and the percentage of vehicles yielding at the advance stop bar proved insignificant, there are other safety benefits that curb extensions provide to the pedestrian. These benefits include improved sight distance, elimination of exposure to turning vehicles and shorter crossing distance. Additional research covering a greater number of crosswalk and crossings may allow for further elaboration on motorist yielding behavior with the presence of curb extensions.

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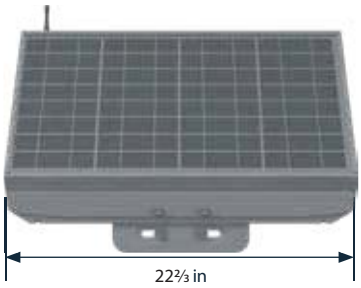
TAPCO
Safe travels.

SOLAR-POWERED RECTANGULAR RAPID FLASHING BEACON

Top-of-pole self-contained control cabinet

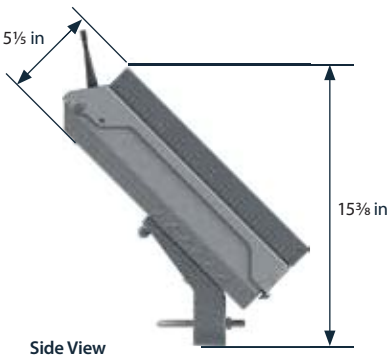
TOP-OF-POLE CONTROL CABINET

HOUSING	NEMA 3R type aluminum
SOLAR PANEL	20 watt
BATTERY	12V, up to 44Ah
BATTERY LIFESPAN	3 to 5 years, field replaceable
MOUNTING OPTIONS	Round poles: 2⅜" up to 4 ½"; Square posts: 1¾" up to 2½"
MOUNTING HARDWARE	Stainless steel hardware
WARRANTY	3-year limited battery warranty 5-year limited system warranty 10-year limited solar panel warranty



Front View

Back View



Side View

RECTANGULAR RAPID FLASHING BEACON: RRFB-XL2™

LIGHT BAR HOUSING	Black powder coated aluminum
VEHICLE LED MODULES	7" x 3", 2 arrays of 8 amber LEDs spaced 7" apart, SAE J595 class 1 certified
PEDESTRIAN LED MODULES	1¾" x ½", side-viewable, flash simultaneously with vehicle LED (optional, one or both sides)
FLASH PATTERN	WW + S (combination wig-wag and simultaneous flash)
DIMMABLE	Automatically controlled via included photocell sensor
MOUNTING HARDWARE	Various options available
WIND LOAD RATING	Up to 120mph*
OPERATING TEMPERATURE RANGE	-40˚F to 122˚F

** Dependent upon pole size and system arrangement*

Front View

Side View

BLINKERBEAM® WIRELESS COMMUNICATION

FREQUENCY	900 MHz FHSS (Frequency Hopping Spread Spectrum)
RANGE	900 feet (radio site survey recommended)
CONNECTIVITY	Crosswalk and optional advanced warning LEDs activate concurrently

ACTIVATIONS

PUSH BUTTON ACTIVATION	ADA push button, typical (<120 millisecond)
USER-ACTUATED PUSH BUTTON	XAV2-LED or Bulldog
PASSIVE DETECTION	Wireless bollards

OPTIONAL PROGRAMMING

BlinkLink®	Optional cloud software with cellular modem**

*** Dependent upon system configuration*

RRFB-XL2™

BLINKERBEAM® WIRELESS RADIO

XAV2-LED PUSH BUTTON

BULLDOG PUSH BUTTON

TAPCO (800) 236-0112 TAPCOnet.com

1026-00007 04-05-2018

DuraTherm®
A TrafficScapes™ Solution by Ennis-Flint

Inlaid Preformed Thermoplastic Crosswalks and Traffic Calming Surfaces for Asphalt

DuraTherm® is a specially-designed preformed thermoplastic material that is inlaid into an imprinted asphalt surface and thermally bonded using specialized infrared heaters. Engineered to lie slightly below the asphalt surface, DuraTherm® is protected from wear, ensuring effective service life while maintaining its attractive contemporary look for years. Not only do these streetscape enhancements provide aesthetic appeal that communities and property owners desire, safety for shared roadway users is also enhanced and regulatory requirements are not compromised.

PERFORMANCE-BASED FEATURES AND BENEFITS

- High skid/slip resistant for safety. As material wears, new anti-skid elements are exposed.
- 90-mil "grout lines" inlaid to sit slightly below the surface
- Enhanced durability provides optimum wear in adverse conditions; Snowplow friendly
- ADA compliant - Pedestrian and wheelchair friendly surface
- Low maintenance
- Design flexibility with standard and customizable colors and patterns
- Eliminates the maintenance and safety concerns of loose pavers
- All preformed thermoplastic materials are made at Ennis-Flint's manufacturing facility which is ISO 9001:2008 certified for design, development and manufacturing of preformed thermoplastic. Quality, value and long-term performance are built into the marking. Anti-skid elements are added at time of manufacturing for optimized application at the jobsite.

DuraTherm® is installed by a network of Certified Applicators so you can be confident that your design intentions will translate to fully-met expectations on the job site. A specialized pavement heater softens the existing asphalt. Templates are pressed into the surface to create the imprinted pattern. Pre-cut sections of DuraTherm® are set into these impressions. The specialized heater is used again to bond the material to the asphalt surface.

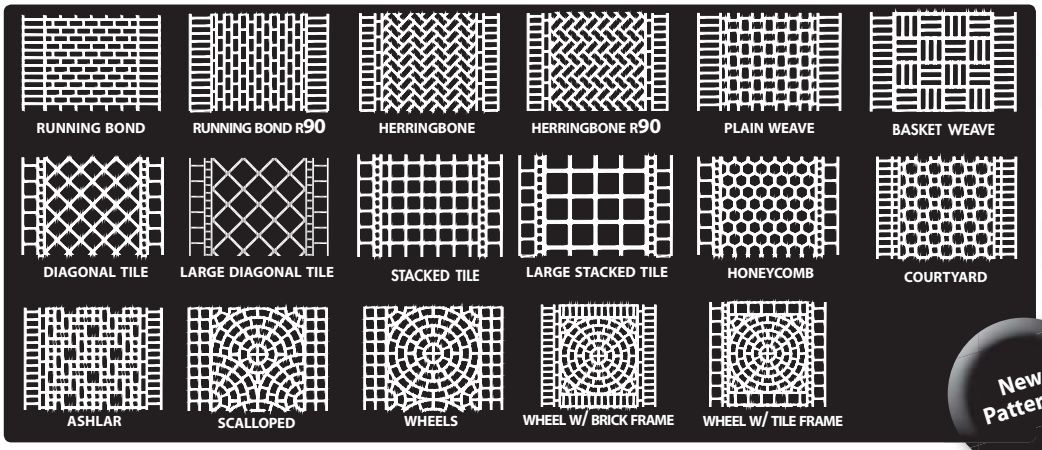
1.

2.

3.

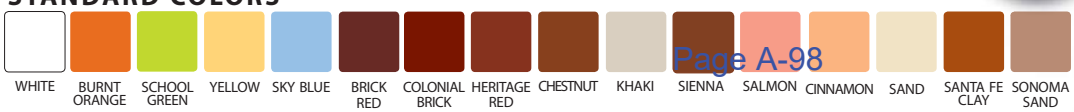
STANDARD PATTERNS

Custom patterns are available requiring a minimum purchase.



New Patterns!

STANDARD COLORS



A TrafficScapes™ Solution **by Ennis-Flint**

Interconnected, Surface-Applied Preformed Thermoplastic Logos and Surface Signage for Asphalt and Concrete

Maximize traffic guidance, increase brand awareness, enhance community pride, and promote school spirit with durable preformed thermoplastic horizontal surface signage that is engineered to last 6 to 8 times longer than paint, and even longer in areas with only pedestrian traffic. DecoMark® design and color combinations are virtually endless.

USES AND LOCATIONS

- Custom Logos
- Sidewalk Accents
- Directional Markings
- Informational Markings
- Trail Markings
- Toll Lane Markings
- Streets and Highways
- Business Parks
- Parking Lots
- University Campuses
- Driveways
- and more...

PERFORMANCE-BASED FEATURES AND BENEFITS

- High skid/slip resistant for safety. As material wears, new anti-skid elements are exposed.
- The material is flush across the surface so there are no tripping hazard
- Lasts 6 to 8 times longer than paint with a clean, crisp appearance
- 33 standard colors
- ADA compliant - Pedestrian and wheelchair friendly surface
- Eliminates the maintenance and safety concerns of loose pavers
- Precut, interconnected shapes and colors; easy to handle
- All preformed thermoplastic materials are made at Ennis-Flint's manufacturing facility which is ISO 9001:2008 certified for design, development and manufacturing of preformed thermoplastic. Quality, value and long-term performance are built into the marking. Anti-skid elements are added at time of manufacturing for optimized application at the jobsite.

Whether a basic two-color directional message or a multi-colored custom logo, each design begins with a CAD drawing linked to a stringent manufacturing process. At the time of installation, the applicator will find pre-cut sheets of interconnected material with application instructions and a diagram for proper layout. The sheets of DecoMark® material are easily lifted and positioned onto an asphalt or concrete surface for application with a propane heat torch or large heater.

Permission ©Harley-Davidson

1. 

2. 

3. 

STANDARD COLORS

COLONIAL BRICK	BRICK RED	DARK BRICK RED	COCOA	OLIVE GREEN	SYG	LEMON YELLOW
SALMON	HERITAGE RED	RED	GREEN	KELLY GREEN	LIGHT GREEN	YELLOW
CINNAMON	CHESTNUT	ORANGE	TEAL	LT. BLUE	SKY BLUE	LIGHT GREY
SAND	SIENNA	PINK	BLUE	BLACK	FIELD GREY	GREY
TAN	KHAKI	LILAC	PURPLE	WHITE		

CITY OF BLOOMINGTON
REPORT FOR THE TRANSPORTATION COMMISSION
June 19, 2018

CASE NUMBER:	SUBJECT:	ORIGINATING FROM:
INFORMATION	Summary of Citizen Comments/Complaints Received in May, 2018	Philip Allyn, PE, PTOE City Traffic Engineer
REQUEST:	Item submitted as information for the Transportation Commission. Any feedback or comments are welcome.	

STAFF RECOMMENDATION: N/A

Staff submits the following information to the Commission. Any comments or feedback is appreciated.

1. ATTACHMENTS:

a. None

2. BACKGROUND AND SUPPLEMENTAL INFORMATION:

The following comments were received by the Engineering Department between May 10 and June 10, 2018 or are updates of previous comments (additions to previous updates are **Bold-Underlined**:

1) Received request to increase parking restrictions on Lee at Chestnut due to lack of sight distance when turning from Chestnut to Lee. Called petitioner to discuss: He indicated the problem was both to north and south, and for both westbound and eastbound. Phil indicated parking currently is restricted via in-place signage: no parking on west side Lee to south all the way to Locust, no parking on east side Lee to south for ~100', no parking on east side Lee north for 80'. Parking on west side of Lee to the north is not currently restricted via signage, but City Code and State Statute restricts parking within 20' of the cross walk. We'll look into signing northwest side, but the rest needs enforcement by Police as restrictions are already in place. We'll notify the Police of the concern. He should call Police if cars are parked illegally. He indicated he has a co-worker who has similar difficulties with sight distance that he would have call me with additional information. Received call from Ms. Kelley Luckey in late April who expressed concern that the sight distance obstruction is a combination of parked cars and existing trees. Will visit site for further evaluation.

2) Received request from Dunraven Homeowner's Associate to restrict parking on west side of Glenbridge between Ballybunion and Dunloe. Letters were delivered to neighborhood requesting feedback on proposed parking ban on west side of street.

Responses received overwhelmingly favor restricting parking. Mailed letter to residents notifying them that the parking restriction would be put in place. Engineering will evaluate over next 90-120 days and incorporate into City Code provided there are no unintended consequences that arise. Signs scheduled to be installed on or after April 24; no additional comments received to date. **Continuing to monitor until August 30, 2018.**

3) Received request to review restricting parking to one side of street and install traffic calming on Tanner between Park Lake and Springfield. Speed and traffic data to be gathered to evaluate request when weather and staffing allows.

4) Received request to remove a No Parking sign in front of a house and an old utility pole which no longer has any lines on it along the back of the property. Reviewed request: parking restriction required to allow room for school buses and garbage trucks to turn around (house is on the end of a street without a cul-de-sac). Currently verifying owner of the pole, believed to be Ameren about its removal. Confirmed Ameren owned pole and contacted them about removal; also provided contact info to resident. Resident indicated school buses no longer use her street (child no longer school age) and garbage trucks use alley. **Discussed further with internal staff on sign and confirmed that parking restriction needed to allow garbage trucks to turn from the alley. Staff to replace existing faded sign.**

5) Received request to allow parking along the south side of Westport Court. Reviewed current restrictions and signing. Letters being developed to be delivered to neighborhood requesting feedback on proposed parking changes. **Feedback received in favor of allowing additional parking. Signs scheduled to be installed on or after May 3; no additional comments received to date. Continuing to monitor until September 30, 2018.**

6) Received request from multiple residents along the 1300 and 1400 blocks of Oak Street to restrict parking with a Tow Away Zone on both sides of the street from 6 am to 6 pm, Monday through Friday. Letters being developed to be delivered to neighborhood requesting feedback on proposed parking ban. **Results returned with enough votes to put in the requested parking ban. However, some of the comments against the parking ban indicated a significant hardship (i.e., at least one house without a driveway who needs to be able to park in the street). We are working to contact these individuals to discuss potential options.**

7) Received request for handicap spot on 1200 block of Oak Street. **Waiting to receive supporting documentation of plaque or license plate from requestor.**

8) Received Request for a Street Light via phone call. No location or name provided. Message left on voicemail seeking additional information, no response yet. **Left additional voicemail with no response yet.**

9) Received Request to replace faded parking restriction signs along Washington Street. **Need to visit site and evaluate.**

10) Received complaint of people driving down the alley between Van Schoick Street and Tanner Street west from Springfield Road and proceeding through a yard back to Van Schoick after the alley ends mid-block. Request for Dead End sign installed at Springfield Road. **Sign scheduled to be installed on or after May 7; no additional comments received to date.**

11) **NEW**: Received complaint of speeding and request for traffic calming on Grove Street between Clinton and Mercer. Grove is a classified street with higher traffic volumes, so it does not meet the requirements for traffic calming. Need to coordinate with Police Department for enforcement.

12) **NEW**: Received complaint of speeding on E. Oakland east of Hershey, especially around Watford. Due to hill east of Warford, can be worrisome turning from Watford onto Oakland and being overtaken. Request reduction from 40 mph to 30 mph. Completed field check. There is a hill to the east of Watford limiting the view of the intersection from westbound Oakland. There is also an existing "intersection warning" sign with a 30 mph plaque. Could consider speed reduction, but would need speed study. 85th percentile likely closer to 40 mph than 30 mph. Will gather speed data and review crash data.

13) **NEW**: Received request for increased pedestrian warnings at US 51 (Madison) and Front Street. To be reviewed and likely referred to IDOT for consideration.

14) **NEW**: Received request for clearly marked drop-off at the Arena on US 51 (Madison). To be reviewed and responded to but likely unable to provide due to moving lanes of traffic.

15) **NEW**: Received request for crosswalk warnings at East and Locust for crossing from BCPA to/from north parking lot. To be reviewed and responded to.

16) **NEW**: Received request to relocate “CT” to Front Street by Arena. Need to contact submitter and clarify.

17) **NEW**: Received request for temporary traffic signals at Rhodes Lane and US 150. To be reviewed and likely referred to IDOT for consideration.

18) **NEW**: Received four coordinated requests for an all-way stop or other pedestrian warning enhancements at Stone Mountain and College for pedestrians walking north and south to/from Tipton Park. To be reviewed and data collected.

19) **NEW**: Received complaint about truck traffic on Fort Jesse Road. Need to review.

20) **NEW**: Received request for traffic signals at Fort Jesse Road and Airport Road. Intersection currently 4-way stop with plans to signalize in near future.

21) **NEW**: Received complaint of speeding and request for “Children at Play” signs on Gill Street at pass-through-cul-de-sac west of Airport. Need to evaluate Yield sign usage for clarity.

3. STAFF RECOMMENDATION:

Staff submits the above information to the Commission. Any comments or feedback is appreciated.

Respectfully submitted,

Philip Allyn, PE, PTOE
City Traffic Engineer