# Table of Contents

Preface ................................................................................................................................. 3  
Glossary ................................................................................................................................. 4  
1 Permanent Traffic Control Signs ................................................................................................. 7  
  1.1 Regulatory Signs .................................................................................................................. 8  
  1.2 Warning Signs .................................................................................................................... 17  
  1.3 Guide Signs ....................................................................................................................... 21  
2 Pavement Markings .................................................................................................................. 30  
  2.1 Centerlines ......................................................................................................................... 30  
  2.2 Lane Widths ....................................................................................................................... 32  
  2.3 Turn Lanes ....................................................................................................................... 33  
  2.4 Stop Bars ......................................................................................................................... 36  
  2.5 Guidance and Warning Devices ......................................................................................... 37  
  2.6 Parking ............................................................................................................................ 38  
3 Traffic Signals .......................................................................................................................... 39  
  3.1 Traffic Signal Warrants and Design Elements .................................................................... 39  
  3.2 Traffic Signal Approval Process ......................................................................................... 39  
  3.3 Half Signal Guidelines ...................................................................................................... 42  
  3.4 RRFB Guidelines .............................................................................................................. 44  
4 Traffic Control and Design for Pedestrians .............................................................................. 47  
  4.1 Pedestrian Signs ............................................................................................................... 47  
  4.2 Crosswalks ....................................................................................................................... 49  
  4.3 Pedestrian Island Design ................................................................................................. 57  
5 Traffic Control for School Areas .............................................................................................. 60  
  5.1 School Signs ..................................................................................................................... 60  
  5.2 School Crosswalks .......................................................................................................... 62  
  5.3 School Traffic Signal Warrants ....................................................................................... 63  
6 Traffic Control and Design for People Biking ......................................................................... 64  
  6.1 Bicycle Signs .................................................................................................................... 64  
  6.2 Bicycle Pavement Markings ............................................................................................ 68  
  6.3 Bicycle Signals ............................................................................................................... 76  
  6.4 Bicycle Facilities ............................................................................................................. 80  
  6.5 Construction Traffic Control for Bicycles ....................................................................... 82  
7 Traffic Control and Design for Transit .................................................................................... 83  
  7.1 Signs and Markings .......................................................................................................... 83  
  7.2 Transit Stop Design ........................................................................................................... 83  
8 Traffic Calming .......................................................................................................................... 88  
  8.1 Speed Bumps .................................................................................................................... 88  
  8.2 Traffic Circles ................................................................................................................... 94  
  8.3 Curb Extensions ............................................................................................................... 99  
9 Shared Streets .......................................................................................................................... 102  
References ............................................................................................................................... 103
The PBOT Traffic Design Manual currently consists of three volumes, which can be accessed and printed in their entirety from the PBOT website:

Volume 1: Permanent Traffic Control and Design
https://www.portlandoregon.gov/transportation/article/751333

Volume 2: Temporary Traffic Control
https://www.portlandoregon.gov/transportation/article/648243

Volume 3: Traffic Signal Design Guide
https://www.portlandoregon.gov/transportation/article/643224

The City of Portland ensures meaningful access to city programs, services, and activities to comply with Civil Rights Title VI and ADA Title II laws and reasonably provides: translation, interpretation, modifications, accommodations, alternative formats, auxiliary aids and services. To request these services, contact 503-823-5185, City TTY 503-823-6868, Relay Service: 711.
Preface

PURPOSE

The Manual of Uniform Traffic Control Devices (MUTCD) sets forth the basic principles that govern the use of traffic control devices. The Portland Bureau of Transportation (PBOT) Traffic Design Manual is intended for use as a supplement to the MUTCD. It documents standard practices of the bureau and provides guidelines for specific traffic control devices not included in the MUTCD.

In this manual, the words “shall,” “should” and “may” are used to describe specific conditions. To clarify the use of these terms, the following definitions apply.

1. **SHALL**: A mandatory condition or action.
2. **SHOULD**: The practice under normal conditions.
3. **MAY**: An option where no requirement for design, application, or standards is intended.

This manual references the City of Portland Standard Construction Specifications, Special Provisions and Standard Drawings, which shall supersede information contained in this document. Current versions can be found on the Design + Construction page of PBOT’s website, which is on the PDX Streets & Infrastructure tab, under For Engineers, Contractors & Consultants:

https://www.portlandoregon.gov/transportation/40032
Glossary

ADA STANDARDS The 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design and, if any, supplemental ADA standards for application within the public right-of-way, as adopted by the US Department of Justice and US Department of Transportation.

ARTERIAL A street with a high traffic volume that forms part of the network carrying the majority of traffic entering, leaving, and moving across the city. This street type also carries mass transit and freight.

BIKE BOX A green pavement marking installed at intersections to reduce conflicts between people biking and driving. It is a green box on the road with a white bicycle symbol inside and includes green bike lanes approaching and leading from the box. People biking can stop in the green box to wait for a green signal; people driving wait behind the green box for the signal to turn green.

BIKEWAY A generic term for any road, street, path, or way that in some manner is specifically designated for bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes. As a general guide, any city street or path with bicycle lanes, sharrow, or other bicycle amenities can be considered a bikeway.

BUS PAD A highly durable area of the roadway surface at bus stops, usually constructed in concrete.

CAPITAL PROJECT A project that helps maintain or improve a city asset. Must have a total cost of at least $10,000 over the life of the project.

CITY TRAFFIC ENGINEER The City Traffic Engineer designated by the Commissioner-In-Charge of the Bureau of Transportation with duties defined in Portland City Code chapter 16.10.200.

COLLECTOR A street that connects local streets with arterials, with a higher volume of traffic than local streets. This street type may contain bus and freight routes.

CROSSBIKE Green crosswalk-like markings indicated where bikes may cross a roadway.

DELINeATORS Tall pylons mounted on the road surface or along the edge of a road to channelize traffic.

DESIGN VEHICLE The least maneuverable vehicle that routinely uses a street, used to set the characteristics of the roadway.

HIGH CRASH NETWORK The most dangerous intersections and streets evaluated by the bureau and the Vision Zero Team. Composed of High Crash Corridors and High Crash Network Intersections.
MULTILANE Four or more vehicle lanes.

MULTIPLE THREAT A condition created when a marked crosswalk crosses multiple traffic lanes going in the same direction. When vehicles in the lane(s) closer to the curb stop for pedestrians, they block pedestrians and vehicles in the lane(s) further from the curb from seeing each other. Also known as double threat on streets with only two vehicle lanes in each direction.

NEIGHBORHOOD GREENWAY Streets with lower volumes of auto traffic and lower speeds where pedestrians and people biking are given priority.

PEDESTRIAN PRIORITY STREETS City Walkways (as defined in Portland’s Transportation System Plan), neighborhood greenways, or arterials and collectors within Pedestrian Districts (as defined in the Transportation System Plan).

RAISED REFLECTIVE PAVEMENT MARKER (RRPM) Safety device used on roads that retroreflects vehicle headlights.

RECTANGULAR RAPID-FLASHING BEACON (RRFB) A pair of yellow LEDs mounted on a pole under a pedestrian crossing sign that is activated by a push-button system. Installed at crossings to make drivers more aware of pedestrians.

RURAL STREET Distinguished from urban streets by lower intensity of development and lower frequency of access. Streets with generally sparse development and relatively few driveways qualify as rural. Some examples in Portland are NW Germantown Road, NW Skyline Boulevard, SW Shattuck Road, and SE Deardorff Road.

SAFE ROUTES TO SCHOOL A partnership between the City of Portland, schools, neighborhoods, community organizations and agencies to increase safety and improve health for students and their families.

SHARROW Shared lane markings used to designate a safe and visible place to ride to people biking and to indicate the presence of people biking in the travel lane to people driving.

SIGNALS AND STREET LIGHTING The Signals, Street Lighting, Intelligent Transportation System and maintenance division of PBOT.

TACTILE WARNING STRIP A textured ground surface indicator intended to assist pedestrians who are visually impaired. One variety is the truncated dome detectable warning surface.

THROUGH STREET A street that is classified as a Local Service Traffic Street in Portland’s Transportation System Plan but functions as a collector street (higher volume of vehicles).

TRACKIT Software program used by the City of Portland to create, track and manage work orders.
TRAFFIC DESIGN Group within the Traffic Systems division of PBOT that provides traffic design and engineering services for capital projects.

TRAFFIC INVESTIGATIONS Team within the TRAFFIC OPERATIONS (see below) group of PBOT that investigates and responds to traffic-related concerns and needs from the public and other agencies. Sometimes referred to as 823-SAFE.

TRAFFIC OPERATIONS Group within the Traffic Systems division of PBOT that manages traffic flow, circulation, and safety on city streets. It provides traffic engineering review for a wide range of permits involving use of the public right-of-way. Includes TRAFFIC INVESTIGATIONS; see above.

TRANSPORTATION SYSTEM PLAN (TSP) The 20-year plan to guide transportation policies and investments in Portland. It includes street classifications (pedestrian, bicycle, transit, freight, street design, emergency response, and traffic) for all Portland streets.

UNIMPROVED STREET A street that is not constructed to the applicable standards of the City of Portland and has not been accepted for maintenance by the city.

URBAN STREET Most city streets are considered urban streets. See RURAL STREET for how to distinguish between urban and rural streets.
1 Permanent Traffic Control Signs

Part 2 of the MUTCD establishes general standards for highway signs, including design, shape, color and general application. The purpose of this chapter is to further define standards of application and installation as they apply in the City of Portland. The most current sign library documents can be found on PBOT’s internal website.

SIGN MOUNTS

<table>
<thead>
<tr>
<th>Mount Type</th>
<th>Type Description</th>
<th>Mount Code</th>
<th>Code Description</th>
<th>Locate Req’d (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1110 Wood Post</td>
<td>1</td>
<td>4” x 4” Wood Post</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>1120 Steel Pipe</td>
<td>2</td>
<td>Steel Pipe, Embedded (OBSOLETE)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2B</td>
<td>Pipe with Square Plate Sidewalk Mount (OBSOLETE)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2C</td>
<td>Steel Pipe with Embedded Breakaway Base</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2D</td>
<td>Steel Pipe with Breakaway Sidewalk Dome</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2P</td>
<td>Concrete Pedestal (Block Buster)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2S</td>
<td>Short Steel Pipe, Embedded</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2SC</td>
<td>Short Steel Pipe, Embedded, Breakaway</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2SD</td>
<td>Short Steel Pipe, Breakaway Sidewalk Dome</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2R</td>
<td>Bike Rack/Staple Rack</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2X</td>
<td>12-inch Pipe Extension for an Existing Pipe</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>1140 Power Pole</td>
<td>4</td>
<td>Utility Pole or Other Wood Pole</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>1160 Metal Pole</td>
<td>6</td>
<td>Metal Pole (Streetlight, Signal Pole)</td>
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<td></td>
</tr>
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<td></td>
<td>TM36</td>
<td>36” Surface-Mounted Tubular Markers</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TM60</td>
<td>60” Surface-Mounted Tubular Markers (used when signs are mounted to tubular markers)</td>
<td>N</td>
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<tr>
<td></td>
<td>PWF</td>
<td>Pedestrian Wayfinding</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.1 Sign Mount Types
NEW SIGN DESIGN AND FABRICATION

When a new sign is developed, the traffic engineer creates the sign and submits it through TrackIT for approval. Note that 12 square feet is the largest sign that can be designed and installed on a 2-inch pipe post and breakaway coupler assembly (ground mount).

OBSOLETE SIGNS

All obsolete signs within capital project limits should be removed and/or replaced as part of that project. Obsolete signs can also be removed or replaced by work order or as part of routine maintenance. Obsolete signs are coded as OBSOLETE in the PBOT Sign Library.

1.1 Regulatory Signs

**R1010, R1011 STOP**

GUIDANCE: 30-inch STOP signs (R1010) are used for standard installation. 36-inch STOP signs (R1011) shall be used on multilane roadways or where side roads intersect a multilane street or highway that has a speed limit of 45 mph or higher.

Criteria for STOP sign installation prescribed in the MUTCD have been modified for use in the City of Portland as follows:

Criteria for placing two-way stops at uncontrolled intersections:

A. Where the safe approach speed is less than 10 mph due to nonremovable visibility obstructions.

B. Where the collision history indicates an average of one or more reported collisions per year over a recent three-year period that can be corrected by use of STOP sign control. Such crashes include right- and left-turn collisions as well as right-angle collisions.

C. Where an engineering study indicates that the application of the normal right-of-way rule is unduly hazardous.

D. In an area of local streets bounded by through streets where the majority of intersections are controlled by STOP control, all of the remaining uncontrolled intersections may be considered for STOP control as a part of a comprehensive, area-wide “Neighborhood Stop Plan.”
1 Permanent Traffic Control Signs

Criteria for all-way STOP control:

A. Where traffic signals are justified, the multiway stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.

B. Where there is a crash history as indicated by either:

1. On a Local Service street, five or more reported crashes in a two-year period that can be corrected by a multiway stop installation. Such crashes include right- and left-turn collisions as well as right-angle collisions.

2. On through streets where within a recent two-year period the intersection demonstrates a history of at least 1.5 crashes per million vehicles entering the intersection, and the crashes would likely to have been prevented by all-way stops.

   Crash rate = \# of crashes × 1,000,000 vehicles / (average daily traffic × 365 days × # of years).

C. Minimum volumes:

1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day, and

2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour, but

3. If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the above values.

D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 above are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.
1 Permanent Traffic Control Signs

**New STOP sign installations:**

New STOP sign installations should be accompanied by temporary flags to draw attention to the new traffic control. The flags should be removed after a period of 30 days. (See MUTCD Figure 6F-2.)

**Conversion of STOP control from one side street to another or from all-way to two-way (e.g., neighborhood greenways):**

Converted STOP sign installations should be accompanied by a W1901 (CROSS TRAFFIC DOES NOT STOP) sign and temporary flags to draw attention to the change in traffic control. The flags and W1901 sign should be removed after a period of 90 days. (See MUTCD Figure 6F-2.)

**LOCATION:** In the typical position on the near-right corner of an intersection. Supplemental STOP signs may be placed in other locations if an engineering investigation indicates that circumstances warrant such an installation. A STOP sign may be flag-mounted to improve visibility.

**R1120 ALL WAY Rider**

**GUIDANCE:** These are required by the MUTCD where all approaches at an intersection are stop controlled. Supplemental 2-way, 3-way, 4-way, or other numbered riders shall not be used with STOP signs. Portland’s past practice did not include ALL WAY riders. New signage for existing locations should be upgraded when changes are made at the intersection. All other existing locations will be upgraded as a citywide effort when funding is available.

**R1200, R1220 LEFT (RIGHT) TURN PERMITTED WITHOUT STOPPING**

**GUIDANCE:** These signs are obsolete and should be replaced with R1201/R1221 (EXCEPT LEFT (RIGHT) TURN), per MUTCD.

**LOCATION:** Directly below a STOP sign.
R2000 – R2205  \hspace{1cm} \textbf{SPEED LIMIT XX Series}

\textbf{GUIDANCE:} All speed limit signs shall be 30” x 36”.

This sign is intended to inform people driving of the posted speed limit. Speed limits that differ from speeds established by Oregon Statue are established only by order of the State Traffic Engineer. Speed limit signs are not normally used to remind people driving of statutory speeds, except in situations where the appropriate basic rule speed is not obvious (such as an arterial through a business district). The MUTCD Oregon Supplement requires that all speed signs within city limits include the word “LIMIT.” Older signs that do not include the word “LIMIT” should be replaced through capital projects, operational changes (e.g., when an older speed sign needs to be relocated) or related maintenance work.

\textbf{LOCATION:}

- At the point where a posted speed changes.
- At approximately 0.5-mile intervals on streets designated as Neighborhood Collectors and higher in Portland’s Transportation System Plan (TSP).
- A short distance after major intersections.
- At the end of school zones on streets with speed zone orders. Speed zone signs should not be installed within a signed school zone.
- On neighborhood greenways. See Section 6.1, Bicycle Signs, for specific guidance on installing R2015 (SPEED LIMIT 20) signs.

R2296  \hspace{1cm} \textbf{[CAMERA Symbol] + TRAFFIC LAWS PHOTO ENFORCED}

\textbf{GUIDANCE:} This sign is used on major streets to inform drivers entering the City of Portland that photo enforcement is in use in the city. Signs are also used in advance of fixed-speed cameras.

\textbf{LOCATION:} Inside the city boundary on the right-hand side. Signs are typically posted on Major City Traffic Streets, District Collector Streets, and higher volume (more than 5,000 vehicles per day) Neighborhood Collector Streets.
R2282 is for use on state highways and freeways. At the fixed-speed camera, this sign must be posted below the speed sign and speed reader board, per Oregon Revised Statutes (ORS).

**R3060/R3060V [NO U-TURN Symbol]**

**GUIDANCE:** U-turns are prohibited by state law or Portland City Code at the following locations:

- In any intersection controlled by a traffic signal or STOP signs, unless a sign permits the turn.
- Between intersections in a city.
- Where you cannot see traffic coming from both directions for 500 feet.
- Upon any curve or upon the approach to or near the crest of a hill.
- At any other location where U-turns are prohibited by official signs or markings. The need to prohibit U-turns should be determined based on an engineering study.

These signs may be installed after an engineering investigation determines they are needed.

**LOCATION:** Near-right or far-right corner of an intersection or in the median of separated roadways.

**R3225, R3245 [LEFT/RIGHT TURN symbol] + ONLY**

**GUIDANCE:** These signs require road users in certain lanes to turn or shall indicate permitted movements from a lane. These signs shall be used where through lanes become mandatory turn lanes. Signs are not required where a turn lane is added but should be used when the curb line of the turn lane is aligned with the curb line on the far side of the intersection.

**LOCATION:** Near-right corner of the intersection to reinforce a mandatory turn movement where the curb line of the turn lane is aligned with the curb
line on the far side of the intersection. Where through lanes become mandatory turn lanes, the sign should be located at the beginning of the turn lane, designated by a solid lane line, which may be in addition to a second sign at the intersection when curbs are in alignment across the intersection. (See Section 2.3, Turn Lanes, for pavement markings and layout.)

**R3565/R3565V**  
**U TURN PERMITTED EXCEPT TRUCKS**

**GUIDANCE:** U-turns are prohibited by state law or Portland City Code unless a sign permits the turn. This sign should be used where U-turns are permitted but the intersection is too narrow to accommodate U-turns by trucks. This differs from Oregon Department of Transportation (ODOT) standard practice of using R3560 and R6100 together.

**LOCATION:** Near-right or far-right corner of an intersection, in the median of separated roadways, or overhead.

**R3600, R3620**  
**LEFT (RIGHT) LANE MUST TURN LEFT (RIGHT)**

**GUIDANCE:** PBOT no longer uses these signs. Signs R3225 and R3245 (Right/Left Arrow + ONLY) should be used instead.

**R3641, R3661**  
**CURB LANE MUST TURN LEFT (RIGHT)**

**GUIDANCE:** These signs may be used where lane-use control signs are needed on streets with part-time lanes. The mandatory lane-use control applies to the curb lane only when it is used as a travel lane. When the curb lane is used for parking, the mandatory lane-use control does not apply.

**LOCATION:** Use one R3661 sign at the entrance to the turn lane. A second sign should be placed at the intersection on the near right to reinforce a mandatory turn movement. (See Section 2.3, Turn Lanes, for pavement markings and layout.)
1 Permanent Traffic Control Signs

**R3880**  CENTER LANE LEFT TURN ONLY

**R3890**  CENTER LANE TURN ONLY Symbol

GUIDANCE: The City of Portland does not use these signs in conjunction with center turn lanes.

**R4000, R4020**  STOP HERE ON RED + [30 Degree Left/Right Arrow]

GUIDANCE: These signs are intended to supplement traffic signal control. They may be used in conjunction with a stop bar at midblock signalized crossings, bike boxes, emergency signals or other locations to clarify stop location.

LOCATION: Place sign at the location of the stop bar.

**R4023, R4024**  [STOP Symbol] + HERE + [Left (Right) Curved Arrow] + FOR + [PEDESTRIAN Symbol]

GUIDANCE: These signs shall be used in conjunction with an advance stop bar placed on the approach to a midblock, unsignalized pedestrian crosswalk.

LOCATION: Placed on the right at the stop bar. A second sign may be placed on the left side if a median is present. If a W3210 (PED symbol) sign has been post-mounted at the crosswalk, the R4023/R4024 sign shall not be placed on the same post as the W3210 or block the view of the W3210 for people driving and bicycling. R4023/R4024 signs should be laterally offset from W3210 signs if used in combination.

**R4032L/R4032R**  [STOP Symbol] + HERE + [Left (Right) Curved Arrow] + FOR + [PEDESTRIAN Symbol] (12” x 36”)

GUIDANCE: This sign is intended for use on medians to prevent blocking the pedestrian sign at the crosswalk from the...
view of people driving, which is prohibited by the MUTCD.

LOCATION: Placed on the island 30 inches from the curb, in line with the stop bar, and mounted so the bottom of the sign is at 48 inches.

R4600L/R4600R TURNING VEHICLES + [Left/Right Arrow] + [YIELD Symbol] + TO + [BIKE Symbol]

GUIDANCE: These signs may be used to remind drivers who are making turns to yield to people bicycling.

R4611, R4612 TURNING VEHICLES + [Up-Left(Right) Arrow] + / + [STOP Symbol] + FOR + [PEDESTRIAN Symbol]

GUIDANCE: These signs may be used to remind drivers who are making turns to stop for pedestrians.


GUIDANCE: These signs may be used to remind drivers who are making turns to stop for people walking and bicycling.

R5410T, R5460T KEEP LEFT (RIGHT) + [ARROW] Pedestal

GUIDANCE: These signs may be used during construction or special events to control event participants or separate traffic on multilane arterial streets.

LOCATION: Various locations on event course or along a lane line to channel traffic.
R6040    **NO CRUISING ALLOWED**

**GUIDANCE:** This sign is no longer being used. Signs should be removed through capital projects, traffic investigations or maintenance (do not replace).

R6100    **[NO TRUCKS Symbol]**

**GUIDANCE:** This sign is intended to indicate where through truck traffic is prohibited. This sign should be installed only where a documented or inappropriate truck traffic problem exists.

**LOCATION:** On the far side of the intersection, such that a truck driver can see and respond to the prohibition prior to committing the truck to enter the street. Two signs, one on each side of the prohibited street, may be posted if necessary.

R6110    **EXCEPT LOCAL DELIVERIES**

**GUIDANCE:** This sign serves as a supplement to R6100 when clarification is needed for local businesses requiring truck traffic on the prohibited street.

**LOCATION:** Directly below the R6100 sign.

R6460    **DO NOT BLOCK INTERSECTION**

R6465    **DO NOT BLOCK DRIVEWAY**

**GUIDANCE:** State law prohibits vehicles from stopping or standing within an intersection. These signs may be used at intersections where queues from a downstream signal routinely extend into intersections or driveways. Consider supplementing with pavement markings.
1 Permanent Traffic Control Signs

LOCATION: Install at a location visible to vehicles entering the intersection or near the driveway. Install on the right and left for two-lane approaches on one-way streets.

1.2 Warning Signs

Maintenance Operations will replace all obsolete word crossing warning signs with new symbol signs as maintenance requires and without a work order.

Sign size should be determined by MUTCD guidance in Table 2C-2, Warning Sign and Plaque Sizes. Generally, on streets with a posted speed of 35 mph or higher, diamond-shaped warning signs shall be 36” x 36”. This does not apply when signs are posted in medians or on both sides of the roadway.

S1120 DEAF CHILDREN

GUIDANCE: This sign is limited to use on streets directly adjacent to educational and training facilities for deaf children.

LOCATION: In advance of the boundaries of the grounds for the facility.

W1210, W1260 [Left or Right Chevron Arrow]

GUIDANCE: These signs are used to indicate the outside of a curve; a minimum of two signs should be visible to the driver at any point traveling through the curve.

LOCATION: Signs are placed on the outside of a curve.

W1500 – W1690 Intersection Warning Sign Series

GUIDANCE: These signs are used as warnings for upcoming intersections. They are not used on approaches with STOP sign control. Signs should illustrate and depict the general configuration of the intersecting roadway.

LOCATION: Minimum 800 feet in advance of intersection per MUTCD Figure 2A-4.
1 Permanent Traffic Control Signs

W1502  [Streetname] Rider

GUIDANCE: May be used with intersection warning sign or advance traffic control sign to identify name of intersecting street. A sign code should be created for each unique street name.

LOCATION: Installed below intersection warning sign.

W1700  [TRAFFIC CIRCLE AHEAD Symbol]

GUIDANCE: This sign is used as a warning for an upcoming traffic circle. It is not used on approaches with STOP sign control.

LOCATION: Sign should be installed in advance of each traffic circle.

W1901, W1911  CROSS TRAFFIC DOES NOT STOP/ONCOMING TRAFFIC DOES NOT STOP

GUIDANCE: These signs replaced W1900 and W1910. They should be used in conjunction with conversion of an all-way stop to a two-way stop or when stop control is changed to accommodate a neighborhood greenway or a neighborhood stop plan. These signs are installed when the existing stop control orientation is changed. They are installed below existing STOP signs for all-way to two-way changes or new STOP signs. Flags are mounted above the new or existing STOP sign assembly. W1901/W1911 signs and flags are normally removed after 30 days. These signs are typically not used as a permanent installation, unless it is justified for safety issues.

W2360B  BARBER POLE (no art in sign library)

GUIDANCE: Reserved for use on light-rail facilities. Should be used to mark poles that obstruct vehicle entrance onto light-rail tracks.

LOCATION: Mounted at intersection on pole adjacent to light-rail track, to the right of the traveled way.
**W2250/W2250R**  
**THRU TRAFFIC MERGE LEFT (RIGHT)**

**GUIDANCE:** This sign should be used in advance of creating a trap lane. See Section 2.3, Turn Lanes, for pavement markings.

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**W3120**  
**[BIKE Symbol]**

**GUIDANCE:** This sign should be used when only people on bicycles can be expected at a crossing. In general, W3262 (PED BIKE symbol) is used at bike crossings, since pedestrians can almost always be expected at the same crossing.

This sign should not be used with the W3140 rider (ON ROADWAY). The combination of W3120 and W3140 is obsolete and should be removed from inventory. Other signs may be considered to warn drivers of people biking in the roadway (e.g., S3085 signs, etc.)

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**W3127**  
**[BICYCLE Symbol] + [PEDESTRIANS Symbol] + [MOTORISTS Symbol] + SHARED STREET Rider**

**GUIDANCE:** Signage to be installed on shared streets; see Chapter 9, Shared Streets.

**LOCATION:** Post at each end of the narrow residential street per ORS 814.070(4).

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**W3210, W3212**  
**[PEDESTRIAN Symbol]**

**GUIDANCE:** Signage for pedestrian crossing locations should be implemented per the MUTCD.

**LOCATION:** At crosswalks, marked or unmarked:

A diagonal arrow rider (S1105 or S1106) shall be used in conjunction with the W3210 sign to indicate the location of the crossing.

**Advance crossing signs:**

At locations where crosswalks or the W3210 signs at a crosswalk are not visible, W3210 should be installed and supplemented with S1108 (AHEAD
rider). Existing advance crossing signs should be evaluated on a case-by-case basis to determine if they can be removed. Advance crossing signs located on lower speed roadways (≤ 30 mph) where the crosswalk is visible should be removed. If existing signs will remain, a supplemental S1108 (AHEAD) rider should be installed. If an advance crossing sign is missing or damaged, Maintenance Operations will contact 823-SAFE and/or create a TrackIT item for Traffic Investigations to determine if the advance sign can be removed or if the S1108 (AHEAD) rider should be added.

W3780  
**ROADWAY NOT IMPROVED**

**GUIDANCE:** This sign may be used on streets which do not have a stabilized surface and streets which have a poor-quality surface, as evidenced by potholes, poor drainage and narrow shoulders.

**LOCATION:** At the point of transition on the right-hand side. For circumstances in which some features of the unimproved roadway may present a hazard, the sign may be installed in advance of the transition and supplemented with a distance rider.

W3980  
**NOT A THROUGH STREET**

**GUIDANCE:** This sign may be used to warn people driving of when the road they are on, or about to enter, does not continue to the next major cross street and is neither a dead end (DEAD END) nor the only access to a series of internal streets (NO OUTLET).

**LOCATION:** This sign shall normally be installed at the roadside soon after an intersection for either of the following reasons:

A. To warn that the street on which the sign is posted follows a loop pathway and returns to the cross street just departed from.
B. To warn people driving in advance of an intersection on a neighborhood greenway that has had diversion devices installed, such that the street they are traveling on no longer continues to the next major cross street.
1. Permanent Traffic Control Signs

1. Such signage is not intended for diversion placed at a major cross street.
2. Such signage may take the place of temporary W5345C (NEW TRAFFIC PATTERN AHEAD) warning signs.
3. Such signage should be installed on a case-by-case basis upon request and evaluation.
4. Used for this condition, the sign shall be at least one block in advance of the diversion, but not more than three blocks in advance.

**W4035, W4085, W4105 [SPEED LIMIT XX AHEAD Symbol]**

**GUIDANCE:** A SPEED LIMIT XX AHEAD sign should be used to inform people driving of a reduced speed zone where the speed limit is being reduced by more than 10 mph or where engineering judgment indicates the need for advanced notice to comply with the posted speed limit ahead.

### 1.3 Guide Signs

In order to prevent proliferation of guide signs and to limit the cost of installing and maintaining them, the use of guide signs shall be kept to a minimum. The following policies are intended to serve as a framework for considering which destinations should be signed. Guide signs installed at public expense are for directional purposes only and not for advertisement.

**APPROVED USES FOR GUIDE SIGNS**

The following destinations should be signed as resources allow:

- Airports.
- County libraries.
- Freeway on-ramps.
- Hospitals (with 24-hour emergency services).
- Regional attractions.
- Regional transportation facilities.
- Universities and colleges (minimum annual enrollment of 1,000).
- Willamette River bridges.
Other destinations that may be considered include:

- City parks, community centers, and other public service destinations.
- Designated political boundaries such as neighborhood or business associations.
- High schools.
- Points of interest.
- Scenic drives.

These secondary uses should be signed only if they are of regional significance and/or are difficult to find.

Any facility signed on the state highway system should be signed as necessary on the Portland street system to complete the route.

**PROCEDURES FOR GUIDE SIGNS**

Guide signs will be designed and installed by PBOT, or a PBOT-authorized consultant/contractor, according to city specifications.

**NEIGHBORHOOD AND BUSINESS ASSOCIATION REQUESTS:**

Neighborhood and business associations may request guide signs designating their association boundaries. Design of guide signs for association boundaries is limited to the text name (for example: "Welcome to Montavilla") and a logo or graphic that is associated with the area. No other text message will be included. These signs are to have white lettering on a green background. The logo or graphic may incorporate other colors.

An association may make a request to Traffic Investigations for the installation of guide signs. All requests for guide signs designating association boundaries require the applicant to agree to reimburse PBOT for all costs. The applicant has the option of either hiring a private vendor to fabricate the signs according to city specifications or having the city (Maintenance Operations) fabricate the signs at the applicant's expense. In all cases, the guide signs will be installed by city crews.

To process a request for guide signs to denote association boundaries, Traffic Investigations staff will create a TrackIT. An engineer will review the proposed locations. After the locations are approved or agreed upon, the engineer will request a design for the sign. The engineer should create a project number to track all costs. The TrackIt should capture appropriate billing information from the applicant to be included in the project number request.

The applicant must provide the logo or graphic to be included in the sign. After PBOT staff has completed the design, the engineer should have the applicant review the design and agree to
proceed with fabrication and placement. The City Traffic Engineer must review and approve the final sign design before work orders are issued to fabricate and install the signs.

CAPITAL PROJECT REQUESTS:

Guide signs proposed as part of a capital project will be reviewed by the project traffic engineer based on the same conditions used for neighborhood and business association requests and will be installed according to the guidelines in Routing for Guide Signs, below. The signs will be included in the capital project plans and installed by the project contractor.

ROUTING FOR GUIDE SIGNS

The first consideration is whether the facility is signed on a state route. If so, signage to complete the route begun on the state highway should be installed. If signage on state routes is not present, city-installed guide signs are normally installed at the nearest major streets perpendicular to the destination’s street. Signs should not be installed on the street on which the facility is located. It is the responsibility of the facility’s management to properly identify the facility on-site. Signage shall be kept to an absolute minimum.

G5011 ENTERING PORTLAND + [ROSE Symbols]

GUIDANCE: ENTERING PORTLAND signs should be installed at the city limits on all non-local service streets. G5020 (LEAVING PORTLAND) signs are no longer used; existing signs should be removed.

LOCATION: At the city boundary on the right-hand side.

G7030 GROUNDWATER PROTECTION AREA

GUIDANCE: Sign was initially installed at Water Bureau’s request. PBOT does not maintain these signs, and signs should not be replaced.

STREET NAME SIGNS

Street name signs are the responsibility of Maintenance Operations. Overhead street name signs are included in the construction of new traffic signals. PBOT Standard Drawings P-400
1 Permanent Traffic Control Signs

through P-420 include hardware and mounting details for street name signs. PBOT has opted to use 4-inch letter height for street name signs, which MUTCD provides as an option for local roads with speed limits of 25 mph or less. Larger lettering should be considered for multilane roadways with posted speeds of 40 mph or more. Overhead signs shall have an 8-inch letter height. Signs installed at ODOT-controlled intersections may be required to meet ODOT standards.

G5501, G5506, G5521V Street Name Signs

STREET NAME SIGN INSTALLATION AT TWO-WAY, STOP-CONTROLLED INTERSECTION:

At stop-controlled approaches, the street name signs should be placed with the STOP sign to take advantage of the existing sign mount. This results in both the main street and cross street signs on the same post. See Figure 1.1.

Figure 1.1 Street Name Sign Installation at Two-Way, Stop-Controlled Intersection
STREET NAME SIGN INSTALLATION AT ALL-WAY, STOP-CONTROLLED INTERSECTION:

At an all-way or four-way stop-controlled intersection, the cross street name sign should be placed with each STOP sign to take advantage of the existing sign mount. This results in one double-sided sign on each post, thus showing the cross street name on the near right and far left of each approach. See Figure 1.2.

Figure 1.2 Street Name Sign Installation at All-Way, Stop-Controlled Intersection
STREET NAME SIGN INSTALLATION AT STOP-CONTROLLED T-INTERSECTIONS:

At stop-controlled approaches, the street name signs should be placed with the STOP sign to take advantage of the existing sign mount. This results in both the main street and cross street signs on the same post. See Figure 1.3.

Street Name Signs at Stop-Controlled T-Intersections

At stop-controlled approaches, the street name signs should be placed with the STOP sign to take advantage of the existing sign mount. This results in both the main street and cross-street signs on the same post.

Figure 1.3 Street Name Sign Installation at Stop-Controlled T-Intersections
STREET NAME SIGN INSTALLATION AT SIGNALIZED FOUR-WAY INTERSECTION:

Street name signs should be mounted overhead at signalized intersections, particularly where posted speeds are 35 mph or higher. Overhead signs should only be installed on new mast arms or at signals where structural analysis can be completed. If structural analysis cannot be completed, consider installing signs on a signal pole (riser) if there is room; otherwise, maintain side-mount street name signs. On one-way streets where overhead signs may not be visible to pedestrians, consider installing pedestrian-scale street name signs on some or all corners. See Figure 1.4.

Figure 1.4 Street Name Sign Installation at Signalized Four-Way Intersection
G5530, G5532V  Street Name Signs (South Waterfront District)

GUIDANCE: Signs are for use in the South Waterfront District. G5530 is for side-mount installation; G5532 is for mast-arm installation.

LOCATION: Typical street name sign installation.

G5600  [street name] + NEXT SIGNAL

GUIDANCE: Advance street name signs are typically used on Portland’s High Crash Network or on multilane streets in order to facilitate timely lane changes in preparation for turns and to provide advance warning so road users can prepare for crossing traffic.

LOCATION: In advance of signalized intersections.

G5599  [streetname sign cap]

GUIDANCE: Requests should be sent to Maintenance Operations. Requestor will be asked to provide neighborhood boundaries and requested locations, sign artwork and billing information. Sign fabrication and installation costs are the responsibility of the requestor. The city will not maintain or replace sign caps. The requestor can order extra sign caps for future replacement or installation (with installation costs being paid by requestor). Any sign cap reinstallation will take place through a public works permit or a capital improvement project.

DESIGN: Caps must be manufactured from .080-gauge aluminum in the size and shape shown below. Because of the installation method, the bottom ¾ inch of the cap can only be seen from one side. Sign color and logo design is at requestor’s discretion; however, the city reserves the right to accept or reject a sign cap design.
Figure 1.5 Decorative Sign Cap Design
2 Pavement Markings

2.1 Centerlines

MARKING NEW CENTERLINES

Centerline markings shall be placed on paved streets with a Neighborhood Collector or higher classification and one or more of the following characteristics:

A. Urban character, a traveled width of 20 feet or more, and an average daily traffic (ADT) of 6,000 vehicles per day (vpd) or greater.

B. Two-way streets with three or more traffic lanes.

C. A site-specific engineering study indicating that traffic safety would be improved by the addition of centerlines and approval of placement by the City Traffic Engineer.

Centerline markings should be placed on paved streets with a Neighborhood Collector or higher classification and one or more of the following characteristics:

A. Urban character, a traveled width of 20 feet or more, and ADT of 4,000 vpd or greater.

B. Rural character, a traveled width of 18 feet or more, and ADT of 3,000 vpd or greater.

C. A site-specific engineering study indicating that traffic safety would be improved by the addition of centerlines and approval of placement by the City Traffic Engineer.

Centerline markings shall be double yellow markings on streets without a two-way center turn lane.

RETAINING EXISTING CENTERLINES

Retain centerlines on streets where they are needed for safety. If the character of a continuous street segment is largely determined by features of horizontal or vertical curvature, or traffic-calming devices that required horizontal deflection in traffic path, then the centerline should be retained for the entire street. The intent is not to create a fragmented series of centerline segments along a street.

Centerlines should be retained on urban streets with ADT of less than 4,000 vpd and rural streets with ADT of less than 3,000 vpd that have one or more of the following characteristics:

A. A policy classification of Neighborhood Collector or higher.

B. Severe horizontal or vertical geometry that limits sight distance, where safety would be compromised by removing the centerline.
C. Traffic circles, medians, or other physical devices that require a centerline to safely channel traffic around the obstacle.

D. Approaches to traffic signals with loop detectors.

Consider changing skip centerline markings to double yellow centerline markings when appropriate (e.g., during repaving, based on a safety evaluation, etc.)

**REMOVING CENTERLINES**

Centerlines may be removed from any urban streets with ADT less than 4,000 vpd or any rural streets with less than 3,000 vpd except as noted in Retaining Existing Centerlines, above. If the street is a Local Service Street, then the centerline should be removed subject to the exceptions.

Centerlines may be removed on through streets that are classified as Local Service Streets and have ADT of less than 4,000 vpd on urban streets or 3,000 vpd on rural streets under any of the following circumstances:

A. After the street has been included in a traffic-calming project, and traffic-calming devices have been installed on the street.

B. When the street is resurfaced for maintenance.

In response to a service request and after an engineering review has determined that the removal will not have an unacceptable impact on traffic safety.

<table>
<thead>
<tr>
<th>Street Classification</th>
<th>ADT &lt; 4,000 vpd Urban ADT &lt; 3,000 vpd Rural</th>
<th>ADT &gt; 4,000 vpd Urban ADT &gt; 3,000 vpd Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Street</td>
<td>No centerline (with exceptions)</td>
<td>Centerline</td>
</tr>
<tr>
<td>Neighborhood Collector and higher classifications</td>
<td>Centerline</td>
<td>Centerline</td>
</tr>
</tbody>
</table>

Table 2.1 Centerlines Summary

There are two methods when replacing skip centerlines, straddling and painting over.

**STRADDLING:**

This option should be used when lane widths are 10 feet or less and the double yellow cannot be positioned to cover the skip line. This results in the skip line remaining between the new double yellow marking. The skip will be removed from the pavement marking inventory and not maintained, fading over time.
PAINTING OVER:

This option should be used when one or more lane widths is 11 feet or wider. The existing skip line will be painted over to avoid grinding. If lane widths are equal, either side of the double yellow can be aligned with the skip line. If the lane widths are imbalanced, the double yellow should be aligned toward the side with the wider lane.

2.2 Lane Widths

The City of Portland’s preferred lane width is 10 feet on roadways with lane markings. Lanes widths of less than 10 feet must be approved by the City Traffic Engineer. Lane widths wider than 10 feet may be necessary on:

- National Highway System routes.
- ODOT roadways.
- Roadways with horizontal curves.
- Transit-only lanes.

Lane widths wider than 10 feet may be desired for other reasons, including:

- Safety and operational reasons, such as accommodation for freight and transit vehicles, particularly within horizontal curves.
- Geometric roadway features, including intersection alignment, median islands, curb extensions, traffic calming devices or other physical devices in or near the roadway.
- Utilization of the full roadway width, in cases where the roadway width is not a limiting factor.
- Shared lanes for motor vehicles and bikes.

A National Highway System route designation.
Table 2.2 Lane Widths

Multilane facilities may have unequal lane widths. The outside lane may be wider to provide more space for large vehicles that usually occupy that lane. Where a curb is used adjacent to only one edge, the wider lane should be placed adjacent to the curb.

Buffers between opposing lanes, as with a wide, double yellow centerline or a buffered bike lane, represent space that might serve a dual purpose. There could be justification to design narrower lane and wider buffer combinations to provide a safer cross section.

LANE ALIGNMENT

At intersections, it is desirable for through lanes to be in alignment. However, if the intersection is not within a curve, the entering and exit lanes may be offset across the intersection up to one-quarter of the lane width for multilane approaches and up to one-third of the lane width for single-lane approaches. Lane line extensions may be used to help drivers navigate the offset. Offsets that are greater than those dimensions must be approved by the City Traffic Engineer.

2.3 Turn Lanes

TWO-WAY LEFT-TURN LANES

Turn arrows are not used in two-way left-turn lanes nor are signs used to designate the two-way left-turn lane.
RIGHT-TURN ADD LANE CONDITION

Includes right-turn bays established with striping, road pavement markers, road delineators, concrete or other physical improvements. Also includes added turn lanes created by parking removal in advance of an intersection with the purpose of allowing exclusive right turns.

STRIPING:

Use two arrows per right-turn lane, one at the entrance and one in advance of the intersection. If the right-turn lane is less than 75 feet in length, use only one arrow placed at the entrance to the turn lane. If the turn lane is more than 100 feet, additional arrows should be added at equally spaced intervals not exceeding 100 feet.

SIGNAGE:

Use one R2245 (RIGHT TURN ONLY) sign at the entrance to the turn lane if the turn-lane curb line is aligned with the curb line on the far side of the intersection. If the curb lines are offset no signage is required.

LEFT-TURN ADD LANE CONDITION

This includes left-turn bays established with striping, road pavement markers, road delineators, concrete or other physical improvements.

STRIPING:

Use two arrows per left-turn lane, one at the entrance and one in advance of the intersection. If the turn lane is less than 75 feet in length, use only one arrow placed at the entrance of the turn lane. If the turn lane is more than 100 feet, additional arrows should be added at equally spaced intervals not exceeding 100 feet. Turn arrows should not be installed in two-way left-turn lanes.

MANDATORY LEFT-TURN CONDITION

This includes all mandatory left-turn lanes established with striping, road pavement markers, road delineators, concrete or other physical improvements.

STRIPING:

Use two arrows, one at the entrance of the left-turn pocket and one in advance of the intersection. If the left-turn lane is less than 75 feet in length, use only one arrow placed at the entrance of the turn lane. PBOT does not place turn arrows in two-way left-turn lanes.
RIGHT-TURN OR LEFT-TURN TRAP LANE CONDITION

This consists of a through-traffic lane that becomes an entrapping lane requiring a mandatory right or left turn.

STRIPING:

Use two arrows per trap lane, one at the entrance of the trap lane and one in advance of the intersection.

SIGNAGE:

Use one R3225/R3245 (LEFT/RIGHT TURN ONLY) sign at the entrance of the trap lane. If the mandatory turn lane’s curb line is aligned with the curb line on the far side of the intersection, then a second R3600/R3620 sign should be placed at the intersection to reinforce the mandatory turn movement. Use one W2250/W2250R (THRU TRAFFIC MERGE LEFT (RIGHT)) sign in advance of the entrance to the turn lane.
2.4 Stop Bars

Stop bars supplement regulatory STOP signs by regulating where vehicles should stop and should be installed at the following locations:

- On approaches to signalized intersections that do not have crosswalk markings.
- At intersection approaches where an advance stop location is needed to provide clearance for left-turning vehicles.
- On uncontrolled multilane approaches to crosswalks, to improve the visibility of pedestrians for approaching drivers and reduce the risk of multiple threat-type collisions with pedestrians. When used for this purpose, stop bars shall be installed with the R4023/R4024 sign (STOP HERE FOR PEDESTRIAN).
- On stop-controlled approaches where a combination of limited visibility and intersection geometry results in poor compliance.
2 Pavement Markings

- At railroad crossings. When used for this purpose, 24-inch stop clearance lines shall be installed.

2.5 Guidance and Warning Devices

RAISED REFLECTIVE PAVEMENT MARKERS

Raised reflective pavement markers (RRPMs) may be used to supplement pavement markings and are generally reserved for High Crash Corridors and roadways with horizontal curves that result in lane departure crashes. They are also used where specified as standard markings for traffic circles and curb extensions.

DELINEATORS

Delineators, such as tubular markers and Carsonite posts, may be used to guide traffic or separate bike lanes and shared paths from moving traffic. Per the MUTCD, delineation is particularly beneficial at locations where the alignment might be confusing or unexpected, such as at lane-reduction transitions and curves. Delineators are effective guidance devices at night and during adverse weather, including snow events, as they remain visible when pavement markings may be covered. They are considered guidance devices rather than warning devices and may be used on long continuous sections or through short stretches where there are changes in horizontal alignment. ODOT Standard Drawings TM570, TM571 and TM576 provide guidance for installation of delineators. MUTCD Figure 3F-1 also provides guidance on placement.

TACTILE WARNING STRIPS

All newly constructed curb ramps shall have a tactile warning strip or truncated dome detectable warning surface installed as an element of the new ramp construction. The requirement for and design of tactile warning strips is the responsibility of the civil designer. The following provides background on the application of tactile warning surfaces for pedestrian and bicycle facilities.

Black and white domes were allowed in “design” districts in the past. However, black and white domes can be problematic for those with low vision and may appear as a hole in the ground. Additionally, over time white domes become gray and become indistinguishable from the surrounding concrete. To resolve those issues, the default color will be yellow. White will be available on special projects where a maintenance agreement has been set up with the city (e.g., the bus mall) to make sure the domes are properly cleaned and maintained. Any other exceptions must be approved in writing by the PBOT Director.

In the past, the City of Portland has used green tactile warnings on ramps that are either used exclusively by people on bicycles or are shared by people walking and bicycling. New guidance
2 Pavement Markings

requires yellow tactile warnings to be used across the full width of shared bicyclist and pedestrian ramps. Ramps designated for bicyclist use only do not require tactile warnings but may be delineated with green to distinguish them as bike ramps.

In multiuse path environments, 12-inch-wide yellow tactile strips may be used to separate pedestrian and bicycle areas.

2.6 Parking

PBOT has historically used “T” tick marks and yellow curb to delineate parking spaces in metered areas. In unmetered areas, PBOT has used a 4-inch white line to delineate parking from bike lanes. Both practices are now obsolete. The following guidelines are used for marking parking spaces:

- In metered areas, no markings are required for parking spaces. Yellow curb may be used to delineate no parking areas at intersections, as determined by Parking Control staff.

- In unmetered areas, no markings are required. If parking width is substandard (less than 8 feet), a 4-inch white line may be used to encourage vehicles to park close to the curb.

- Curbside parking next to bike lanes requires no markings. If space allows and parking turnover is high, a buffered area should be considered between the bike lane and the parking lane. See Buffered Bike Lanes in Section 6.2, Bicycle Pavement Markings, for guidance on buffer design.

- Parking lines are required for parking-protected bike lanes, including beginning and end lines for parking and a 3-foot buffer next to the bike lane. For parking sections longer than 100 feet, a parking guide line is required.

- If needed, a “P” symbol (PBOT Standard Drawing P-434) can be used to delineate new parking areas when parking is not next to the curb. If used, the “P” symbol should not be maintained.

- Where angle parking is allowed, some guidance should be provided. At a minimum, angle marks should be provided at the beginning and end of the parking area. Alternatively, each parking space can be marked, or a parking line every few spaces for a longer stretch of angle parking.
3 Traffic Signals

Guidance provided below is intended to help PBOT traffic engineers navigate the process for approving traffic signals and other actuated traffic control devices. The PBOT Traffic Signal Design Guide outlines PBOT practices regarding City of Portland traffic signals and street lighting at signalized intersections. It also provides guidance on plan presentation and content in order to maintain consistency in design. The PBOT Traffic Signal Design Guide can be found online at the following link: https://www.portlandoregon.gov/transportation/article/643224.

3.1 Traffic Signal Warrants and Design Elements

One or more of the traffic signal warrants identified in the MUTCD must be met unless the traffic signal meets the criteria for special applications. An analysis of compliance with each warrant should be part of a traffic signal engineering investigation, which should demonstrate that installation of a traffic signal will improve the overall safety and operation of the intersection. ODOT’s Traffic Manual provides additional guidance on information that may be included in traffic signal investigations.

PROTECTED LEFT TURNS

Protected left-turn phasing is PBOT’s default practice at new or upgraded traffic signals on the High Crash Network. Protected left-turn phasing may also be warranted at other signalized locations, based on guidance in ODOT’s Traffic Manual.

LEADING PEDESTRIAN INTERVAL

Leading pedestrian intervals are PBOT’s default practice at new or upgraded traffic signals on the High Crash Network. They may also be warranted at other locations. An engineer in PBOT’s Signals and Street Lighting Division must review and recommend leading pedestrian interval requests.

3.2 Traffic Signal Approval Process

The City Traffic Engineer and the Signals and Street Lighting Manager must approve all new or modified signals in the City of Portland. (The State Traffic Engineer must approve all new or modified signals and all signals slated for removal on state highways.) ODOT’s Traffic Manual provides information on the traffic signal approval process and specific information to be included in the required traffic signal engineering investigation. The following elements should be considered in all signal requests and modifications:

- Traffic volumes.
- Traffic signal warrants analysis.
- Conceptual traffic signal design.
3 Traffic Signals

- Safety analysis.
- Operational analysis.
- Documentation of TSP consistency.
- Evidence of support from another agency.
- Application for state highway approach.

The Traffic Signal Approval Form must be submitted for all new, temporary, hybrid, half, bicycle and portable signals, as well as Rectangular Rapid-Flash Beacons (RRFBs) and removals of signals. On state highways, this form is also required for signal modifications and removal requests. The Traffic Signal Approval Form must be initialed by the Signals and Street Lighting Engineering Supervisor, the Traffic Operations Supervisor and the Traffic Design Section Supervisor. The City Traffic Engineer and the Signals and Street Lighting Division Manager must approve and sign the form.

An example of PBOT’s Traffic Signal Approval Form (without letterhead) is shown on the following page. A copy of the Traffic Signal Approval Form (with letterhead) and approval process can be obtained from the Traffic Design Section directories.

ODOT’s signal operation approval forms can be found at:

www.oregon.gov/ODOT/Engineering/Pages/Signals
## Traffic Signal Approval Form

**Project Name:**

**Project/Permit/TrackIt #:**

### Background Information:

**Analyzer Name:**

**Analysis Date:**

**Signal Location:**

**Distance to Nearest Signal:**

### Signal Type:

- Conventional Signal
- Bike Signal
- Pedestrian Hybrid Beacon
- Rectangular Rapid Flashing Beacon
- Signal Removal

### Supporting Documents Attached (check all that apply):

- MUTCD Traffic Signal Warrant Analysis
- NCHRP Report 562 Worksheet
- Operational Analysis (i.e. Synchro)
- Diagram of Intersection (aerial/drawing)
- Traffic Data
- 24-hr Entering Volume Count
- Turning Movement Count
- Pedestrian Count
- Pedestrian Gap Study
- Other (specify):

### Staff Report:

### Staff Recommendation:

### Acknowledgment:

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</tr>
<tr>
<td></td>
<td>TRO Supervisor</td>
</tr>
<tr>
<td></td>
<td>SSL Engr Supervisor</td>
</tr>
</tbody>
</table>

### Approval:

- □ Approved
- □ Not Approved

**Signature:** __________________________

**Date:** ____________

*Signals & Street Lighting Division Manager*

**Signature:** __________________________

**Date:** ____________

*City Traffic Engineer*

### Approval Comments: (Required only if decision does not agree with staff report and/or comes with conditions.)
3.3 Half Signal Guidelines

PBOT uses half signals to protect pedestrian and bike crossings at intersections with high-volume arterials, typically along pedestrian and bike routes to schools and near transit stops. Existing research finds that half signals result in similar compliance and crash rates to fully signalized locations.

Half signals include all of the following features:

A. Major streets are controlled by regular red-yellow-green vehicle indications.
B. Marked crosswalks are provided across the major street and controlled by regular walk-don’t walk pedestrian indications.
C. Minor streets are controlled by STOP signs.

Portland half signals generally feature two pedestrian crossings. Major street signals remain green unless a pedestrian actuates the pedestrian phase. This changes the vehicle signal to a red indication and provides a walk indication on the pedestrian signal.

Under the authority of Portland City Code 16.10.200 B., the City Traffic Engineer regards half signals as compliant with the MUTCD, because MUTCD Section 4D.34 provides that STOP signs at signalized intersections are allowed when an extremely low potential for conflict exists with a minor street within the intersection. To maintain an extremely low potential for conflict, PBOT installs half signals at locations where major streets intersect minor streets with low volumes and may prohibit left turns and/or through movements to and from minor streets.

PBOT follows the MUTCD 2009 Edition sections listed below to evaluate the appropriateness of half signals:

- Section 4C.01 Studies and Factors for Justifying Traffic Control Signals.
- Section 4D.34 Use of Signs at Signalized Locations.
- Section 4F.01 Application of Pedestrian Hybrid Beacons.

CRITERIA

Portland considers half signals at locations where National Cooperative Highway Research Program (NCHRP) Report 562 indicates that the traffic control for a pedestrian and bicycle crossing should include a circular red indication for motor vehicles on the major street at the crossing location.
Half signals are recommended at all of the following locations:

A. Where major streets intersect minor streets and the minor street has an approximate ADT volume of 1,500 motor vehicles or less. This is in line with PBOT’s guidelines for neighborhood greenways that aim to limit vehicle traffic to 1,000 ADT (ideal), 1,500 ADT (acceptable) or 2,000 ADT (maximum). At new half signal locations where the major street is a multilane roadway, the minor street needs to be restricted to right-in, right-out motor vehicle movements only (i.e., motor vehicle left turns to and from the minor street should be prohibited with physical barriers such as concrete median islands).

B. Where intersections meet guidelines in MUTCD Section 4F.01, Application of Pedestrian Hybrid Beacons, to determine appropriate locations for pedestrian half signals. These guidelines rely on the following factors: major street vehicle speeds, major street volumes and major street crosswalk lengths, as well as pedestrian volumes crossing the major street.

C. Where an engineering study finds that the intersection of the major street and the minor street does not meet MUTCD Warrants in Section 4C.01, Studies and Factors for Justifying [full] Traffic Control Signals, and/or a full signal could attract motor vehicles trips to the minor street that would not be compatible with the City of Portland’s TSP designation for Local Service Traffic Streets.

D. Where the use of STOP signs to control low-volume approaches is supported by the MUTCD in Section 4D.34, Use of Signs at Signalized Locations, which notes that STOP signs shall not be used in conjunction with any traffic control signal operation unless a minor street or driveway is located within or adjacent to the area controlled by the traffic control signal and an extremely low potential for conflict exists.

DESIGN GUIDELINES

Left turns and/or through movements to and from minor street approaches may be prohibited in cases where there are safety concerns due to crash history or features such as offset intersections, crosswalk placement or visibility obstructions. Safety concerns also exist when motor vehicles turning left from a major multilane roadway onto the side street are in conflict with people crossing the side street. To accommodate a half signal in those cases, the minor street needs to be restricted to right-in, right-out motor vehicle movements only. Motor vehicle left turns to and from the minor street should be prohibited with physical barriers such as concrete median islands. To maintain left-turn motor vehicle access at multilane locations, a full signal with protected left-turn phasing should be considered.
3.4 RRFB Guidelines

New RRFBs should only be installed at locations where NCHRP Report 562 recommends “active when present,” enhanced or high-visibility improvements and the installation has been approved by the City Traffic Engineer and the Signals and Street Lighting Manager. RRFB installations are considered experimental by the Federal Highway Administration (FHWA) and must also meet MUTCD Conditions of Interim Approval (issued March 2018).

MUTCD ALLOWABLE USES

A. An RRFB shall only be installed to function as a pedestrian-actuated conspicuity enhancement.

B. An RRFB shall only be used to supplement a post-mounted or overhead W11-2 (Pedestrian), W11-15 (Bicycle/Pedestrian) or S1-1 (School) crossing warning sign with a diagonal downward arrow (W16-7p) plaque, located at or immediately adjacent to a marked crosswalk.

C. Except for crosswalks across the approach to or egress from a roundabout, an RRFB shall not be used for crosswalks across approaches controlled by YIELD signs, STOP signs, traffic control signals, or pedestrian hybrid beacons.

D. In the event that sight distance approaching the crosswalk at which RRFBs are used is less than deemed necessary by the engineer, an additional RRFB may be installed on that approach in advance of the crosswalk, as a pedestrian-actuated conspicuity enhancement to supplement a W11-2, W11-15 or S1-1 warning sign with an AHEAD (W16-9p) or distance plaque. This additional RRFB shall be supplemental to and not a replacement for RRFBs at the crosswalk.

GUIDELINES

Since RRFBs cannot be coordinated with other RRFBs or traffic signals, they should be located at least 600 feet from adjacent traffic signals or other RRFBs to minimize conflict and avoid queue spillback from adjacent devices. If the distance between two devices is less than 600 feet, an engineer must provide justification for the recommendation.

If RRFBs are proposed at an intersection with marked crosswalks on both sides of the intersection (nearside and farside), the RRFBs should be located at the nearside crosswalk only for each direction of traffic. Pedestrian push buttons should be provided at both nearside and farside crosswalks and should trigger both sets of RRFBs when actuated.
PROCEDURES

1. The initial warrant investigation should include the following items:

   a. Hourly traffic volume counts on the street to be crossed during peak pedestrian crossing activity.

   b. Hourly pedestrian and bicycle volume counts at the crossing location. These can be actual pedestrian and bicycle volumes or expected volumes related to projects (e.g., neighborhood greenways). Bus boardings can be used as a proxy to gauge pedestrian activity.

   c. Photographs of the location and/or a scaled base map or aerial photo of the proposed crossing location. Map should include distance to nearest traffic signals, nearest bus stop locations, and presence of street lighting, other rapid-flashing beacons, and other crossing improvements.

   d. List of adjacent land uses and pedestrian generators. If the area is residential, signal engineers should evaluate for potential light spillover into nearby homes.

   e. NCHRP Report 562 Worksheet for existing conditions and proposed design. A summary spreadsheet for various NCHRP inputs is acceptable.

2. Complete the Traffic Signal Approval Form and process per Section 3.2, Traffic Signal Approval Process.

3. Work with the Signals and Street Lighting Engineer to identify design issues associated with RRFB installation.

   a. If beacons are proposed on multilane roadways, overhead beacons should be considered. If overhead beacons cannot be constructed, a median island must be constructed on both sides of the RRFB for protection of pedestrians and RRFB equipment.

   b. MUTCD Conditions of Interim Approval for Sign/Beacon Assembly Locations:

      • For any approach on which RRFBs are used, two W11-2, W11-15 or S1-1 crossing warning signs (each with RRFB and W16-7p plaque) shall be installed in each direction at the crosswalk, one on the right-hand side of the roadway and one on the left-hand side of the roadway. On a divided highway, the left-hand side assembly should be installed on the median, if practical, rather than on the far-left side of the highway.
• An RRFB shall not be installed independent of the crossing signs at the crossing location. The RRFB shall be installed on the same support as the associated W11-2, W11-15 or S1-1 warning sign and plaque.

c. If bus stops are present, TriMet review is required.

d. Street lighting should always be reviewed at proposed RRFB locations to ensure adequate lighting at crosswalks.

e. RRFBs on two- or three-lane roads should preferably be designed with back-to-back side-mount assemblies. If installed on median islands, the islands should be large enough to provide offset from RRFBs to minimize RRFBs being knocked down by turning vehicles. Design should include two median islands with crosswalk and RRFB in between to protect pedestrians and RRFB equipment. Utilize access management for side streets and driveways as necessary.
4 Traffic Control and Design for Pedestrians

4.1 Pedestrian Signs

S2060  NO PEDESTRIAN CROSSING

S2090  [PEDESTRIANS PROHIBITED Symbol]

GUIDANCE: The city no longer uses these signs to close crosswalks. These signs should be replaced with S2062 (below) as part of capital projects. ODOT still uses S2060 and may require this sign for crosswalk closures along their facilities.

S2062  CROSSWALK CLOSED

GUIDANCE: This sign is intended to establish a crossing prohibition where crossing would otherwise be legal. It is normally used at intersections where the geometry or signal operation is such that closing one or more crosswalks would improve pedestrian safety and traffic flow. Positive guidance signs may be used as an alternative or supplement to S2062.

LOCATION: Two signs may be mounted back to back parallel to the street where the crossing is prohibited, such that one sign faces the sidewalk area and the other faces across the street. Sign assemblies should be placed on both sides of the street, except at the top of a T-intersection where the signs are not required. On the near side, an S2110 sign (PEDESTRIANS USE MARKED CROSSWALK) could be posted in addition to S2062. These may be installed on modified bike racks to block the crosswalk or end of sidewalk, per PBOT Standard Drawing P-407.

S2092  [NO PEDS CROSSING TRACKS Symbol]

GUIDANCE: This sign is used by TriMet where pedestrian crossings of tracks are prohibited—most often at intersections where existing legal crosswalks are closed by light-rail.
S2103  
**SIDEWALK ENDS**

**GUIDANCE:** This sign is intended to warn pedestrians of a trip or slope hazard at the terminus of a sidewalk segment.

**LOCATION:** This sign may be installed at the end of a sidewalk section that terminates with a trip or slope hazard. It may be mounted perpendicular to the street directly in front of the sidewalk terminus. The sign may be installed on a modified bike rack per PBOT Standard Drawing P-407 to block the end of the sidewalk.

An S2090 (PEDESTRIANS PROHIBITED symbol) sign may be used in lieu of an S2103 sign if a safety hazard exists beyond the closure point.

S2110  
**PEDESTRIANS USE MARKED CROSSWALK**

**GUIDANCE:** Sign used to prompt pedestrians to utilize existing marked crosswalk.

S2120  
**PEDESTRIANS USE SIDEWALK**

S2130  
**THIS SIDEWALK IS FOR PEDESTRIAN MOVEMENT ONLY PLEASE KEEP CLEAR...**

**GUIDANCE:** Installed at the direction of the PBOT Director in locations where there are distinctly unsafe factors.

S2270  
[PEDESTRIAN Symbol] + [Left/Right Double Arrow]

**GUIDANCE:** Used as positive guidance to show pedestrians where to cross when nearby crosswalks are closed.

S3002  
[PEDESTRIAN Symbol]

**GUIDANCE:** Used in conjunction with directional arrows to guide pedestrians along an off-street path.
4.2 Crosswalks

MARKED CROSSWALKS

PURPOSE:

Marked crosswalks indicate to pedestrians the appropriate route across a street, facilitate crossing by the visually impaired, indicate to drivers the clear area for pedestrian crossing, and remind turning drivers of potential conflicts with pedestrians.

PedPDX and the city’s Crosswalk Evaluation Guidelines provide guidance for installation of marked crosswalks on city streets, including appropriate spacing of marked crossings and appropriate level of crossing treatment. PBOT also uses the following references when designing crosswalk treatments:

- MUTCD 3B.18.
- Portland Pedestrian Design Guide.
- Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations (Zegeer, 2005).

In general, the city follows the guidelines below for applications outside the central city.

**Signalized intersections:** All crosswalks should be marked unless crossings are prohibited for safety reasons on a specific leg of the intersection.

**All-way stop intersections:** All crosswalks should be marked where there are existing pedestrian facilities. Crossings may be prohibited for safety reasons on a specific leg of the intersection.

**Transit stops:** Crosswalks should be evaluated at transit stops. Evaluation should include coordination with TriMet to ensure transit stop will remain in place for the foreseeable future, an engineering study to determine appropriate crosswalk enhancement level and a review of street lighting.

**Unsignalized intersections:** At unsignalized intersections, crosswalks may be marked for any of the following purposes:
4 Traffic Control and Design for Pedestrians

A. Helping pedestrians find their way across a complex intersection.

B. Directing pedestrians to the shortest route across traffic with the least exposure to vehicular traffic and traffic conflicts.

C. Helping pedestrians position themselves where they can best see and be seen by approaching traffic.

D. Consolidating the area(s) of conflict in areas of high pedestrian activity.

**Midblock locations:** Crosswalks may be marked where there is sufficient existing or future demand for crossing and PedPDX spacing guidelines are met.

**School crossings:** School crosswalks may be marked where the crossing is identified as part of a Safe Routes to School plan approved by the school and PBOT and the school has indicated a commitment to provide crossing patrols for the location.
Pedestrian Crossing Installation Guidelines
City of Portland
March 2016

Figure 4.1 Pedestrian Crossing Installation Guidelines Flowchart

* Exceptions to the 4000 vpd threshold may be made for School Crossings that are patrolled.
** Minimum 20 pedestrians or people on bikes crossing per hour in any one hour.
CROSSWALK TREATMENTS:

All proposed marked crosswalks require engineer review and approval. Traffic engineers must ensure that all proposed marked crosswalks have the appropriate level of treatment. NCHRP Report 562 and Safety Effects of Marked Vs. Unmarked Crosswalks at Uncontrolled Locations (Zegeer, 2005) should be used to determine site-specific pedestrian improvements. The Zegeer report summarizes guidelines for marking crosswalks based on safety and risk (below).

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Table 4.1 Safety Effects of Marked Vs. Unmarked Crosswalks at Uncontrolled Locations Excerpt

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* These guidelines include intersection and midblock locations with no traffic signals or stop signs on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.

** Where the speed limit exceeds 40 mi/h (64.4 km/h) marked crosswalks alone should not be used at unsignalized locations.

C = Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites. It is recommended that a minimum of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) exist at a location before placing a high priority on the installation of a marked crosswalk alone.

P = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

N = Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased due to providing marked crosswalks alone. Consider using other treatments, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.

*** The raised median or crossing island must be at least 4 ft (1.2 m) wide and 6 ft (1.8 m) long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and American Association of State Highway and Transportation Officials (AASHTO) guidelines.
CROSSWALK DESIGN:

When a study determines that a crosswalk can be marked at an intersection, crosswalks should be marked on both sides of the intersection. If this is not feasible at an enhanced crossing on a multilane roadway (where “multiple threat” is present), the nonenhanced crossing must be posted as closed. On a two- or three-lane roadway where an enhanced crossing is not warranted, per NCHRP Report 562, the unmarked crossing may remain open as a legal crosswalk. Parking shall be removed for a minimum of 20 feet in advance of marked (and unmarked) crosswalks, per PedPDX. Where travel lanes are adjacent to the curb, crosswalk markings should be set back a minimum of 2 feet from the edge of the travel lane.

The City of Portland uses continental crosswalk markings at all marked crosswalks, unless parallel crosswalks are specified due to unique conditions. Typical continental markings consist of 2-foot wide, 9-foot long bars on 5-foot centers. Minimum crosswalk width is 6 feet but can be widened in 3-foot increments to fit conditions. Skewed crossings should have bar lengths that provide for an effective perpendicular width of approximately 9-12 feet (minimum 6 feet). (Three-foot increments are specified to match preformed cold-thermoplastic materials.)

PBOT is in the process of converting parallel markings to continental markings citywide. Maintenance Operations is responsible for converting crossings during paving projects. Other markings will be upgraded through capital improvement projects or by work order, as specified by an engineer. Where parallel lines currently exist and no road repaving or striping removal is planned, continental markings may be installed and centered between existing transverse lines (removal of the existing parallel lines is not required).

Parallel crosswalk markings may still be used at signalized intersections if geometric conditions warrant. These markings consist of two 1-foot wide lines placed 6 to 20 feet apart, transverse to the vehicle path.

On uncontrolled multilane approaches, advance stop bars should be used to supplement crosswalks, 20 to 50 feet from the crossing. This distance should maximize visibility of pedestrians to address the multiple-threat potential. Stop bars are optional where crosswalks are marked every block. Parking should be prohibited between the stop bar and crosswalk.

A 4-inch, solid double white lane line should also be used in advance of crosswalks on uncontrolled multilane approaches (optional where crosswalks are marked every block). The length of the solid double white lane line should be based on the safe stopping sight distance for the posted speed limit of the roadway; refer to the American Association of State Highway and Transportation Officials (AASHTO)’s Policy on Geometric Design of Highways and Streets, Table III-1. See table below:
Other factors to consider in the design and placement of crosswalk markings include:

- The location of existing crosswalks.
- The presence and need for street lighting.
- The need for on-street parking removal beyond 20 feet.
- The presence of ADA-compliant ramps and the need for new or modified ADA-compliant ramps.
- The location of transit stops.
- The level of treatment needed to meet PBOT Crossing Spacing Guidelines.
- The legal location of crossings under Oregon law.

Crosswalk locations are signed in accordance with the latest edition of the MUTCD and guidelines provided in Section 1.2, Warning Signs, of this manual. See examples of marked crosswalks in conjunction with pedestrian islands in Section 4.3, Pedestrian Island Design.

**CROSSWALK VISION CLEARANCE**

On uncontrolled approaches to legal crossings at intersections on High Crash Corridors and pedestrian priority streets, on-street parking will be set back a minimum of 20 feet per [City Traffic Engineer directive](#). Geometric conditions or high speeds may require additional parking removal beyond 20 feet.

Parking removal can be accomplished through:

A. Constructing curb extensions long enough to effectively meet the parking setback.

B. Posting no parking signs on the approach to the crosswalk. Signs are not required where parking is already prohibited due to driveways or other physical elements that preclude parking within the desired setback.

C. Installing visually permeable uses such as stormwater management facilities, low-use...
bicycle or motorcycle parking or other facilities.

Parking setback requirements do not automatically apply at traffic signals or STOP signs. Visibility conditions at approaches to controlled pedestrian crossings will continue to be evaluated on a case-by-case basis. Safe Routes to School pedestrian routes may require higher order design treatments, and the Safe Routes to School program may establish design guidelines for school pedestrian routes that include parking setbacks on controlled approaches to crosswalks.

Parking setback requirements at unmarked legal crosswalks within metered districts will apply only to streets that are posted 30 mph or greater. All changes to on-street parking for vision clearance in metered districts will require an engineering analysis to determine parking setback requirements and will be based on a safety determination by a PBOT traffic engineer using objective data and other evidence as the basis for changes or modifications.

Vision clearance at crossings on roadways with center-strip paving and no curbs requires a PBOT traffic engineer review to determine parking removal needs. On center-strip paved roadways with unpaved shoulders that are 16 feet or wider and where vehicles are parked 7 feet or more from the edge of the travel way, parking removal is not required. The width of the shoulder provides for adequate stopping sight distance around the parked vehicle.

**CROSSWALK REMOVAL**

As streets are repaved, existing uncontrolled marked crosswalk locations and school crossings should be evaluated. If the crosswalk markings are no longer needed, they should be removed.

If removal of crosswalk markings is needed when there is no near-term opportunity to coordinate the removal with repaving, the markings may be removed by appropriate removal methods. Care should be taken to ensure that the markings are effectively removed and remnants of the markings are not easily visible to pedestrians.

**CROSSWALK CLOSURE**

Crosswalks should only be closed if the location is unsafe for pedestrians to cross or at offset intersections where there are multiple legal crossings and clarity is needed to show pedestrians the optimal location(s) to cross. Where crosswalks are closed, S2062 (CROSSWALK CLOSED) signs should be posted at corners where a legal crossing exists. At the top of T-intersections, where pedestrian ramps or crossings would not be expected, S2062 signs should not be installed.

The City Traffic Engineer must approve all proposed crosswalk closures. A traffic engineer must initiate the closure request during the design phase for capital improvement and public works projects or through a traffic investigation. That engineer is responsible for the following process:
1. Identify crosswalks that should be closed for safety reasons, for crossing simplification at offset intersections, or for other reasons. If ADA ramps are being evaluated, work with the civil engineer to coordinate ramp locations and design.

2. Prepare Crosswalk Closure Documentation Form and supporting documentation as appropriate (site plan, sight distance exhibit, etc.).

3. Meet with the City Traffic Engineer for briefing if needed.

4. Route form with supporting documentation for City Traffic Engineer signature.

5. Email single PDF of signed form and supporting documentation to Traffic Operations administrative support to document the closure in TrackIT. (Note: Crosswalks closed through Traffic Operations will already have a TrackIT to document the closure.)

6. Send an email to the civil engineer to include with the ADA Ramp Report, if needed to justify the absence of ADA-compliant ramps.

7. Save a copy to the project, permit folder or TrackIt.

An example of PBOT’s Crosswalk Closure Documentation Form is shown on the next page. The most recent version of the form can be obtained from the ADA page of the PBOT website.

Crosswalk Closure Documentation Form

<table>
<thead>
<tr>
<th>Background Information:</th>
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<tbody>
<tr>
<td>Project Name:</td>
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<tr>
<td>Traffic Engineer Name:</td>
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<tr>
<td>Crosswalk Location/Corridor:</td>
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</tbody>
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<table>
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<tr>
<th>Reason for Closure:</th>
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<tbody>
<tr>
<td>☐ Safety</td>
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<tr>
<td>☐ Inadequate sight distance</td>
</tr>
<tr>
<td>☐ Dual permissive turns</td>
</tr>
<tr>
<td>☐ Crash history</td>
</tr>
<tr>
<td>☐ Aligned with high volume driveway</td>
</tr>
<tr>
<td>☐ No receiving ADA ramp</td>
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<td>☐ Other</td>
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</tbody>
</table>

| ☐ Conflict |
| ☐ Center running LRT tracks |
| ☐ Crossing blocked on one side |
| ☐ Other |

| ☐ Consolidation/Organization |
| ☐ Multiple crosswalks due to offset intersection |
| ☐ Unusual intersection geometry |
| ☐ Enhanced crossing on one leg of intersection |
| ☐ Other |

| Staff Report and Recommendation: |

| City Traffic Engineer Approval: |
| ☐ Approved | ☐ Not Approved |

<table>
<thead>
<tr>
<th>Signature:</th>
<th>Date:</th>
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City Traffic Engineer

Approval Comments: (Required only if decision does not agree with staff report and/or comes with conditions.)
4.3 Pedestrian Island Design

ISLAND DESIGN ON MULTILANE ROADWAYS

1. Typical island should have at least a 30-foot tangent length and 8-foot width. Minimum island tangent length is 20 feet; minimum island width is 6 feet (do not use minimum length and minimum width together). Provide 1-foot shy distance to edge of travel lane.

2. Island noses shall be painted yellow and have 36-inch yellow tubular markers as object markers. If the nose is circular, three tubular markers should be used (at the front and corners of the island); if the nose is rectangular, two tubular markers should be used (on the corners of the island).

3. Marked crosswalks should be accompanied by a W3210 (PED symbol) sign and S1105/S1106 (diagonal arrow) for each travel lane.

4. All uncontrolled crosswalks with multilane approaches (where multiple threat is present) shall be accompanied by a stop bar and double white lane lines. The stop bar should be placed 20 to 50 feet in advance of the crossing. Prohibit parking between the crosswalk and the stop bar. The length of the double white lane lines is based on the safe stopping sight distance.

5. When stop bars are used, an R4023/R4024 (STOP HERE FOR PEDESTRIANS) sign must be used. A full-sized sign should be used at the curb and a smaller version (R4032) should be used on the island, where possible. The sign on the island should be mounted at 4 feet, if...
possible; consider offsetting sign post toward stop bar.

6. When islands are in two-way left-turn lanes, the TWL-ISL/R-2 standard drawing detail shall be used to alert drivers that they should not be driving in the center lane. Where driveways are adjacent to the island, consider painting the tangent curb yellow and adding red, monodirectional RRPMs on the side of the island facing the driveway. For busy commercial driveways, consider posting R3245 (RIGHT TURN ONLY) or R3020 (NO LEFT TURN) signs.

ISLAND DESIGN WITH SINGLE-LANE APPROACH

![Figure 4.3 Island with a Single-Lane Approach](image)

1. Typical island should have at least a 30-foot tangent length and an 8-foot width. Minimum island tangent length is 20 feet; minimum island width is 6 feet (do not use minimum length and minimum width together). Provide 1-foot shy distance to edge of travel lane.

2. Island noses shall be painted yellow and have 36-inch tubular markers as object markers. If the nose is circular, three delineators should be used (at the front and corners of the island); if the nose is rectangular, two delineators should be used (at the corners of the island).

3. Marked crosswalks should be accompanied by a W3210 (PED symbol) sign and S1105/S1106 (diagonal arrow) for each travel lane.

4. When islands are not in two-way left-turn lanes or striped medians, an R5440 (KEEP RIGHT) sign should be used. Bottom of sign should be installed at 5 feet and should be offset so as
not to block pedestrian sign at crosswalk.

5. When traffic must shift around an island, centerline striping should diverge using standard shifting tapers with bidirectional reflectors.
5 Traffic Control for School Areas

PURPOSE

School-area traffic control devices are intended for use at all primary and middle schools and should not be used at prekindergarten facilities or daycare centers. School-area traffic control may be provided at high schools with school grounds that abut collector or arterial streets.

5.1 School Signs

Per the MUTCD, school warning signs shall have a fluorescent yellow-green background with black legend and border unless otherwise provided for a specific sign.

**S1100G, S1099**

**[SCHOOL (ADVANCE WARNING) Symbol]**

**GUIDANCE:** A school warning sign shall be installed in advance of all school crosswalk installations, except at stop-controlled crosswalks. School warning signs shall also be installed in advance of all S1010G (SCHOOL SPEED LIMIT 20) installations. School warning signs should be installed in advance of locations where school buildings or grounds are adjacent to the street.

S1099 shall be used on streets with three or more lanes, streets where the posted speed is 40 mph or greater, or streets posted at 35 mph where additional visibility is desired.

**LOCATION:** In accordance with the diagrams in the MUTCD.

**S1002A**

**WHEN CHILDREN ARE PRESENT Rider**

**S1002B**

**SCHOOL DAYS / 7AM - 5PM**

**S1004**

**WHEN FLASHING Rider**

**GUIDANCE:** An S1004 rider shall be mounted below the S1010G (SCHOOL SPEED LIMIT 20) sign.
S1010G  
**SCHOOL SPEED LIMIT 20**

**GUIDANCE:** This sign shall be installed adjacent to all active school facilities. These signs may be omitted on streets where adjacent school grounds are not readily apparent due to conditions that restrict access from the street (e.g., topographic conditions where the school grounds are at a significantly different elevation than the roadway, etc.).

**LOCATION:** In accordance with the diagrams in the MUTCD.

S1100G + S1105G/S1106G  
**School Crosswalk Warning Assembly**

**GUIDANCE:** The school crosswalk warning assembly shall be posted at all marked school crosswalks, except at stop-controlled crosswalks.

**LOCATION:** At the crossing location on the right-hand side. May be installed on the left-hand side at median islands or one-way streets or to supplement the right-side signs in special cases.

S1108G  
**AHEAD Rider**

**GUIDANCE:** The AHEAD rider shall be installed with all school advance warning signs.

**LOCATION:** In accordance with the diagrams in the MUTCD.

S1110  
**END SCHOOL ZONE**

**GUIDANCE:** This sign shall be used to indicate the end of a 20 mph school zone on a local street that does not have a posted speed or on a local street posted 20 mph. The appropriate SPEED LIMIT XX sign shall be used to indicate the end of a school zone if the street has a posted speed sign.
5 Traffic Control for School Areas

LOCATION: Opposite the S1010G (SCHOOL SPEED LIMIT 20) sign that begins the zone for the opposite direction, but not within the school zone.

S1120 DEAF CHILDREN

GUIDANCE: This sign is limited to use on streets directly adjacent to educational and training facilities for deaf children.

LOCATION: In advance of the boundaries of the grounds for the facility.

S1301 [SCHOOL BUS STOP AHEAD Symbol]

GUIDANCE: The S1301 sign should be installed in advance of locations where a school bus, when stopped to pick up or discharge passengers, is not visible for 500 feet in advance and where there is no opportunity to relocate the bus stop to provide 500 feet of visibility.

5.2 School Crosswalks

School crosswalks may be marked at schools where the crossing is identified as a part of a Safe Routes to School plan approved by the school and PBOT and the school has indicated a commitment to provide crossing patrols for the location.

The engineering investigation shall be made at the request of the school administrator. New school crosswalks shall be considered upon receipt of a written request from the principal. The written request for schools should indicate a commitment that the requested crossing location will be patrolled.

Upon verification by a school that a crosswalk is no longer patrolled and is not expected to be needed in the future, an engineering investigation should be conducted to determine whether to convert the school crosswalk to a pedestrian crosswalk or to remove it. In either case, all inappropriate signs and markings should be removed.

School crosswalk markings shall be standard continental crosswalk markings and shall be of permanent material.

OVERHEAD SCHOOL CROSSWALK SIGNS

Overhead signs should be installed over any designated school crosswalk that is controlled by a signal that is pedestrian actuated only. The S1105 or S1106 riders shall not be used overhead.
5.3 School Traffic Signal Warrants

The warrant for a school signal is established in the MUTCD (Warrant 5). The criteria for establishing the need for school crossing control is given in Section 7A.03 of the MUTCD. These criteria consider the delay between adequate gaps in the traffic stream. A recommended method for determining the frequency and adequacy of gaps in traffic can be found in the Traffic Control Devices Handbook from the Institute of Transportation Engineers (see MUTCD Section 1A.11, Relation to Other Publications).
6 Traffic Control and Design for People Biking

Portland is one of the nation’s leaders in developing safe, effective bike infrastructure. The Portland Bicycle Plan for 2030 indicates where bike facilities are required or desired. The City of Portland has adopted the MUTCD and the National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide for the design of bicycle facilities in the City of Portland. The MUTCD sets forth the basic principles that govern the use of traffic control devices. The NACTO Urban Bikeway Design Guide provides additional design guidance for the development of bicycle facilities. The following websites and publications also provide additional design guidance for bike facilities:

- AASHTO Guide for the Development of Bicycle Facilities
- FHWA Separated Bike Lane Planning and Design Guide
- MassDOT Separated Bike Lane Planning & Design Guide
- Portland Protected Bicycle Lane Planning and Design Guide

The Bicycle Design section of the Traffic Design Manual is intended for use as a supplement to the MUTCD and NACTO Urban Bikeway Design Guide. It documents standard practices of the bureau and provides guidelines for specific, bicycle-related traffic control devices and facility design considerations.

6.1 Bicycle Signs

**R2015 + S2600**

SPEED LIMIT 20 and [BICYCLIST Symbol] + Neighborhood Greenway + [PEDESTRIAN Symbol] Rider

GUIDANCE: Oregon state law permits local jurisdictions to post streets 20 mph if they meet all of the following criteria.

A. The street carries an ADT of less than 2,000 vpd.

B. The street has an 85th-percentile speed that does not exceed 30 mph.

C. The street has been marked for the presence of people walking or bicycling (S2600).

D. Portland City Council has passed an ordinance that identifies the street as a 20 mph roadway.
LOCATION: R2015 signs accompanied by S2600 riders shall be posted on approved streets as follows:

A. After intersections with streets of higher classification (or streets that function like a roadway of higher classification).

B. After intersections at which the designated roadway is offset and undergoes a name change.

C. Other than in Situations A or B, at 1/4-mile intervals.

Note: Lateral shifts in designated roadways shall not be signed unless the route segment exceeds 600 feet in length.

S3000   BIKE ROUTE

GUIDANCE: This sign is no longer used and has been replaced by the S5001 series.

S3040, S3060  [BIKE Symbol + STOP (YIELD) Symbol]

GUIDANCE: Where conditions require people bicycling, but not people driving, to stop or yield, the STOP or YIELD sign should be placed or shielded so that it is not readily visible to people driving or S3040 or S3060 should be used.

LOCATION: S3040 signs shall be installed on shared-use paths at points where people on bicycles are required to stop. S3060 signs shall be installed on shared-use paths at points where people on bicycles have an adequate view of conflicting traffic as they approach the sign and where people on bicycles are required to yield the right of way to that conflicting traffic.

Option: A 30-inch STOP sign or a 36-inch YIELD sign may be used on shared-use paths for added emphasis.

S3120   WALK BIKES (no art in sign library)

GUIDANCE: May be used at locations where it is appropriate for people on bicycles to walk their bicycles or travel at pedestrian speeds.
S3190  
[BICYCLE Symbol] + YIELD TO + [PED Symbol]

GUIDANCE: Used where people on bicycles and pedestrians share a substandard sidewalk or shoulder.

S3390  
[Intersection diagram with bike box and arrow] + [BICYCLE Symbol] + LEFT TURN BOX

GUIDANCE: Used to inform people on bicycles that a left-turn bike box exists and how to position themselves in it.

S3620  
EXCEPT BICYCLES Rider

GUIDANCE: May be used with regulatory signs (such as R5100 or R3245) to allow bicycles to make movements which are prohibited for motor vehicles.

LOCATION: Install below regulatory sign.

S3660, S3661  
[BIKE Symbol] + USE PED SIGNAL (CROSSING)

GUIDANCE: Used at locations where people on bicycles are required to use the pedestrian crosswalk (S3661) or proceed on the pedestrian signal indication (S3660).

LOCATION: Install at crossing where the sign is visible to people on bicycles.

S3632, S3633  
[BIKE Symbol] + BIKE SIGNAL

GUIDANCE: Used at locations where an exclusive signal with actuated control is provided for bicycles.

LOCATION: Locate the sign to identify the signal for people on bicycles. Use 12” x 18” sign for nearside installation and 18” x 24” sign for farside installation.
Traffic Control and Design for People Biking

S3700L/S3700R  [RR TRACKS ADVANCE BIKE WARNING Symbol]
GUIDANCE: Used where rails curve across a roadway where people may be bicycling and there is no room to define an acceptable crossing angle.

S3701/S3701R  BIKE LANE ENDS (Symbol)
GUIDANCE: Used to denote the end of a marked bike lane or to prepare people on bicycles to merge with vehicle traffic ahead.

S3720  [BIKE WARNING SLIPPERY Symbol]
S3710  TRACKS SLIPPERY WHEN WET Rider
GUIDANCE: Used to remind people on bicycles to use caution as rail tracks are slippery when wet. S3710 may be added below S3720 but shall not be used alone.

S3730  [TRAM TRACKS BIKE WARNING Symbol]
GUIDANCE: Install at locations where tracks cause a pinch point for people on bicycles (e.g., approaching a streetcar platform where the tracks move next to the curb).

S5001  [BIKE Symbol] + [Destinations, arrows, times, distances vary]
GUIDANCE: Replaces S3000. Used for wayfinding along bike routes and neighborhood greenways.
LOCATION: The PBOT Bike Coordinator has a map of locations and a spreadsheet with bike destinations, with distance in miles and minutes. Coordinate
sign legend and location with Bike Coordinator. Nearest destination should be placed at the top of the sign.

**W3120**

[BIKE Symbol]

GUIDANCE: This sign should be used when only people on bicycles can be expected at a crossing. In general, W3262 (PED BIKE symbol) is used at bike crossings, since pedestrians can almost always be expected at the same crossing.

**W3265, W3267R/W3267L**

LOOK + [arrow] + [bicyclist symbol]

**W3268**

[left arrow] + LOOK + [right arrow] + [right-facing bicyclist symbol] + [left-facing bicyclist symbol]

GUIDANCE: Consider including these signs when bicycle movements may not be expected or where there is a documented crash history. The right or both arrow signs should be considered when there is a contraflow bike facility crossing an intersection or driveway.

LOCATION: Locate sign where it would be most visible to drivers and to draw attention to the contraflow or unexpected bicycle movement condition.

**P1841**

[NO PARKING Symbol] + IN BIKELANE

GUIDANCE: Only for use in areas where chronic illegal parking continues after additional bike symbols or other pavement markings have been installed.

### 6.2 Bicycle Pavement Markings

Bicycle-related pavement markings are detailed in ODOT Standard Drawing TM503 and PBOT Standard Drawings P-435 through P-437.
BIKE SYMBOLS IN BIKE LANES

The bike lane stencil should be installed at the beginning of every bike-lane facility and approximately every 500 feet thereafter. Markings should also be placed after every signalized intersection. Additional stencils may be used to further clarify the lane use (e.g., vehicles parking in the bike lane, parking-protected bike lanes, high right-turn volumes from a through/right lane, etc.). Bike stencils are typically positioned 30 feet from intersections to avoid the path of turning vehicles.

SHARED LANE MARKINGS

Shared lane markings (sharrows) may be considered in any of the following locations:

- Neighborhood greenways.
- Shared right-turn lanes.
- Short connections between established bikeways where space for bike lanes is insufficient.

Sharrows should not be used to establish a bikeway on long, high volume or high speed (40 mph or higher) roadways.

Sharrows should be offset from the curb based on the following table. Offsets are measured from face of curb to centerline of sharrow.
Additional design considerations include:

- At the end of each corridor segment, the first sharrow (“End Sharrow”) should be oriented for bikes exiting the greenway. Sharrows are then spaced from there.

- At intersections where the bikeway bends, jogs, or meets another bikeway, a modified sharrow, as shown on PBOT Standard Drawing P-437, should be used as the End Sharrow.

- Supplemental sharrows may be considered at the entry to the shared street, if needed for clearer wayfinding.

- Where two greenways intersect, use bikeway intersection sharrows, as shown on PBOT Standard Drawing P-437, as the End Sharrow.

Engineering judgement should be exercised when there is vertical/horizontal curvature or unusual geometry to ensure adequate guidance for people on bicycles and driver awareness. Adjust all spacing as necessary to avoid sharrow placement within intersections and crosswalks, in front of driveways, or on top of speed bumps or utilities.

**SHARROW PLACEMENT IN SHARED RIGHT-TURN LANES:**

In shared right-turn lanes, place sharrows in the transition space prior to the right-turn storage area and in between the two right-turn arrows in the turn lane. Include an S3085 (BICYCLES MAY USE FULL LANE) sign at the beginning of the right-turn lane and an R3635 (RIGHT LANE MUST TURN RIGHT EXCEPT BICYCLES) sign at the end of the right-turn lane.

---

**Table 6.1 Sharrow Curb Offsets**

<table>
<thead>
<tr>
<th>STREET WIDTH (W)</th>
<th>CURB OFFSET (X)</th>
<th>ON STREET PARKING</th>
<th>NO PARKING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BOTH SIDES</td>
<td>ONE SIDE</td>
<td></td>
</tr>
<tr>
<td>18'</td>
<td>12.0' / 4.5'</td>
<td></td>
<td>5.5'</td>
</tr>
<tr>
<td>20'</td>
<td>13.5' / 5.5'</td>
<td></td>
<td>6.0'</td>
</tr>
<tr>
<td>22'</td>
<td>14.5' / 6.0'</td>
<td></td>
<td>6.5'</td>
</tr>
<tr>
<td>24'</td>
<td>15.0' / 6.0'</td>
<td></td>
<td>6.5'</td>
</tr>
<tr>
<td>26'</td>
<td>16.5' / 7.0'</td>
<td></td>
<td>7.0'</td>
</tr>
<tr>
<td>28'</td>
<td>18.0' / 7.5'</td>
<td></td>
<td>7.5'</td>
</tr>
<tr>
<td>30'</td>
<td>19.5' / 8.0'</td>
<td></td>
<td>8.0'</td>
</tr>
<tr>
<td>32'</td>
<td>21.0' / 8.5'</td>
<td></td>
<td>8.5'</td>
</tr>
<tr>
<td>34'</td>
<td>22.5' / 9.0'</td>
<td></td>
<td>9.0'</td>
</tr>
<tr>
<td>36'</td>
<td>24.0' / 9.5'</td>
<td></td>
<td>9.5'</td>
</tr>
</tbody>
</table>
OFF-STREET PATHWAY MARKINGS

Off-street pathway markings shall be used only on shared facilities that are for the exclusive use of people walking and bicycling. They are intended to provide guidance to people walking and bicycling as to their expected positioning as they travel along the facility. Typical applications may include:

- Facilities with a high volume of people walking and bicycling.
- Path entrances where users may queue or there is a mixing zone.
- Multiuse paths or shared sidewalks with people walking in both directions and bicyclists riding in one direction (see section below, Bike Route on Sidewalk Markings, for guidance on short connections where people on bicycles are directed to use the sidewalk).

“BIKE” and “PED” marking details are included in PBOT Standard Drawing P-435. The typical application is the large size (30”), with smaller markings (18”) used in constrained environments.

PLACEMENT:

Off-street path markings shall be placed at the beginning of the path. Markings should be spaced with consideration to the volume of users, typically every 125 feet. Consider more frequent spacing in the presence of vertical or horizontal curvature or unusual geometry to ensure adequate path-user awareness. Additional design considerations include:

- Placement of markings to avoid driveways or less visible locations.
- Additional signs, such as S3190 (BICYCLE YIELD TO PED) or S3160 (KEEP LEFT BIKE/RIGHT PEDESTRIAN), in constrained or less visible locations.
- Supplemental 4-inch white pavement markings to separate modes where pedestrian and/or bicyclist volumes are moderate.

BIKE ROUTE ON SIDEWALK MARKINGS

Bike route on sidewalk markings may be used when people on bicycles are directed onto a sidewalk for a short distance – typically no longer than a city block. The markings assist with wayfinding for people on bicycles and alert people walking that bike traffic may be present. These markings are typically spaced at 35-foot intervals with the arrow pointing in the direction of bike flow. Consider tighter spacing in segments with curves or limited visibility. See pavement marking detail “B-SWALK” on PBOT Standard Drawing P-435. Consider supplemental signs (i.e., S3190 (BICYCLE YIELD TO PED), etc.) in constrained conditions.
CONTRAST PAVEMENT MARKINGS

Contrast markings should be used when markings are installed on light-colored surfaces, such as fresh concrete. White pavement markings can be manufactured or retrofitted with black outlines to enhance visibility when installed upon a light surface. Commonly used contrast pavement markings are included on PBOT Standard Drawings P-435 and P-436; however, any pavement marking can be manufactured or retrofitted with a black contrast outline.

WORD MESSAGE PAVEMENT MARKINGS

Word messages (e.g. SLOW) may be used on off-street paths, or occasionally on roadways, to communicate a message to people on bicycles. Word messages may either supplement signage or stand alone. A text height of 1 foot is generally adequate, though larger text may be appropriate at higher bicycle speeds. Ensure adequate vertical spacing between words if message is intended to be read as people on bicycles pass over it (bottom to top).

BUFFERED BIKE LANES

Buffered bike lanes should be considered based on the NACTO guidelines. Buffers should be designed according to the table below:

<table>
<thead>
<tr>
<th></th>
<th>Buffer 2’ or less</th>
<th>Buffer more than 2’ and less than 4’</th>
<th>Buffer 4’ or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next to parking</td>
<td>Two longitudinal 4” white lines, no hatching</td>
<td>3’ typical to allow for door swing. Two 4” white lines; 45-degree, 4”-line hatching* optional.</td>
<td>Two 4” white lines with 45-degree, 4”-line hatching.*</td>
</tr>
<tr>
<td>Next to motor vehicle lane</td>
<td>Two longitudinal 8” white lines, no hatching</td>
<td>Two 8” white lines; 45-degree, 8”-line hatching* optional.</td>
<td>Two 8” white lines with 45-degree, 8”-line hatching.*</td>
</tr>
</tbody>
</table>

* Hatch spacing is typically 40 feet on center. Tighter spacing should be considered in curved or hilly sections, or where engineering judgement indicates.

Table 6.2 Buffered Bike Lane Design

BIKE BOXES

Bike boxes are used to reduce right-hook crashes at high-conflict signalized intersections.
Caution should be used in considering a bike box to reduce right-hook crashes. Certain roadway conditions, such as a downhill approach, can lead to bicycles overtaking vehicles at a higher rate of speed on the green light. Crashes have been found to increase in these types of conditions.

Bike boxes may be used on approaches to signalized intersections where one or more of the following conditions are met:

A. There is a combination through and right-turn lane for vehicles to the left of a through bike lane, and the cross-product of peak hour right-turning vehicles with through and right-turning bicycles equals 5,000 or more.

B. The crash history indicates an average of two or more reported crashes over a five-year period of a type susceptible to correction by use of bike box.

C. Bicycle priority is desired in the form of a queue jump.

D. Engineering judgment indicates that a bike box would improve the safety of an approach due to complexity of intersection geometry, high percentage of right-turning large vehicles or other factors.

PBOT Standard Drawing P-436 provides design details for installing bike boxes.

**BICYCLE TURN BOXES**

Bicycle turn boxes may be used at signalized intersections. Consider installing a bike turn box on streets with bike facilities and any of the following conditions:

A. Intersections with cross streets that have bike facilities.

B. High bicycle turn volumes (existing or expected).

C. Intersections of two bike facilities.

D. Standard turn movements requiring people on bicycles to cross tracks at a shallow angle or lean while turning across tracks. (AASHTO considers 70 degrees a shallow angle, but PBOT experience suggests 45 degrees may be adequate if the bike is proceeding straight.)

E. Signalized intersections along a protected bike lane or where heavy volumes (queue spillback) on the bike facility street make movement into the turn lane difficult.

F. Prohibited left turns for vehicles.

G. Shared-use paths or bike tracks leading people on bicycles to the intersection with no provision to move into a left-turn lane or the travel lane to turn left.
PBOT Standard Drawing P-436 provides design details. Bicycle detection must be considered in bike turn boxes at signals.

SIGNAGE:

If a turn box is installed, it should be accompanied by S3390 (LEFT TURN BOX) signs. Locate the sign at the intersection, preferably on the corner nearest the box. The sign should be accompanied by flags for 30 days after turn box installation.

Locate a permanent sign in advance of an intersection where a box is marked and any of the following conditions exist:

A. Intersections with tracks that present a hazard for standard left-turn movements.
B. Streets with multiple lanes where people on bicycles would need to move left to turn left.
C. Streets where the standard left turn is prohibited.
D. Single-lane approaches where poor visibility does not allow people on bicycles to see the left-turn bike box.

GREEN-COLORED BIKE FACILITIES

FHWA has granted Oregon interim approval for the optional use of green-colored pavement in marked bike lanes and in extensions of bike lanes through intersections and traffic conflict areas. Jurisdictions using green-colored pavement under this interim approval must agree to comply with the technical conditions detailed below and to maintain an inventory list of all locations where green-colored pavement is installed.

GENERAL CONDITIONS:

The use of green is optional. The following design and installation requirements shall apply and shall take precedence over any conflicting provisions of the MUTCD.

ALLOWABLE USES:

Green may be used within a bike lane or within an extension of a bike lane to enhance the conspicuity of the bike lane or extension.

The use of green under this interim approval is limited to the following applications:

A. Green may be installed within bike lanes as a supplement to the other pavement markings that are required for the designation of a bike lane. Green shall not be used instead of a bike lane line or instead of bike symbol and arrow pavement markings. The
green may be installed for the entire length of the bike lane or for only a portion (or portions) of the bike lane. Green may be installed as a rectangular background behind word, symbol, and arrow pavement markings in a bike lane as a means of enhancing the conspicuity of these word, symbol, and arrow pavement markings.

B. If a pair of dotted lines is used to extend a bike lane across an intersection, driveway or ramp, green may be installed between these lines as a supplement. Green shall not be used instead of these dotted lines to extend a bike lane across an intersection, driveway or ramp. Green may be installed for the entire length of the bike lane extension or for only a portion (or portions) of the bike lane extension. The green may be dotted in a manner that matches the pattern of the dotted lines, thus filling in only the areas that are directly between a pair of dotted line segments that are on opposite sides of the bike lane extension.

C. If a pair of dotted lines is used to extend a bike lane across the beginning of a turn bay, where drivers who desire to turn must cross the bike lane when moving out of the through lane to turn, green may be installed between these lines as a supplement to the lines. Green shall not be used instead of these dotted lines to extend a bike lane across the beginning of a turn bay. Green may be installed for the entire length of the bike lane extension or for only a portion (or portions) of the bike lane extension. Green may be dotted in a manner that matches the pattern of the dotted lines, thus filling in only the areas that are directly between a pair of dotted line segments that are on opposite sides of the bike lane extension.

DESIGN:

Green-colored pavement must meet specifications for chromaticity and luminance in the MUTCD Interim Rule:

- Green-colored pavement may be retroreflective, but there is no requirement or recommendation that it be retroreflective.

- If green paint or other marking materials applied to the roadway surface are used to simulate green-colored pavement, consideration should be given to selecting pavement marking materials that will minimize loss of traction for people on bicycles.

Except as otherwise provided above, all other provisions of the MUTCD that are applicable to colored pavements shall apply to green-colored pavement.

CROSSBIKE MARKINGS

“Crossbikes” are a PBOT-approved marking consisting of green bars that highlight the extension of a bikeway through an intersection. They are only applied with continental crosswalks. (See previous section, Green-Colored Bike Facilities, for guidance on bike lane extensions.) Green crossbikes, together with crosswalks, are intended to make it clear to people driving that this is
a location where there is a concentration of people walking and bicycling across the street. People driving are not legally required to stop for people biking through the crossbike. People on bicycles can use the crossbike, or they can use the crosswalk by dismounting their bicycle and walking it or riding at pedestrian speed. Under Oregon law, a person driving is required to stop for people walking or bicycling slowly through a standard crosswalk when the person driving is given adequate time to stop.

DESIGN:

- Crossbikes should not be installed without a continental crosswalk.
- The crossbike consists of 2-foot wide, 5- to 6-foot long green bars on 5-foot centers (typical) and should parallel the ladder crosswalk. Longer bars should be considered for skewed crossings to provide an effective width of 5-6 feet.
- Eight-inch white markings must be installed at each end of each green bar. If the bars are directly connected to a crosswalk, then the crosswalk serves as one end of the white marking.
- Crossbikes may be connected to continental crosswalks or separated.
- Crossbikes should be located to generally match the likely crossing route of a person on a bicycle. Consideration should be given to removing on-street parking on the downstream side of the crossbike marking, where the marking would potentially direct a user into a parked vehicle.
- Crossbikes should be accompanied by the combined W3262 (PED BIKE symbol) and S1105/S1106 (diagonal arrow) sign assemblies.
- Consideration should be given to removing any existing on-street parking (up to 20 feet) on the downstream side of the crossbike marking, where the marking would potentially direct a user into a parked vehicle.

6.3 Bicycle Signals

INTERIM APPROVAL FOR BICYCLE SIGNALS

Bicycle signals may be considered where there is a need to separate vehicle and bicycle movements. Oregon jurisdictions, including the City of Portland, have interim approval from FHWA to use bicycle signals according to the following requirements (see interim approval for full requirements).

GENERAL CONDITIONS:

The use of a bicycle signal face is optional. Such use shall be limited to situations where bicycles
moving on a green or yellow signal indication in a bicycle signal face are not in conflict with any simultaneous motor vehicle movement at the signalized location, including right (or left) turns on red.

DESIGN OF BICYCLE SIGNAL FACES:

Layout: The layouts and arrangements of the bicycle signal face shall be in accordance with the following provisions:

- Only the bicycle symbol shown on pages 6-7 in the 2004 Standard Highway Signs book is to be used for bicycle signal indications. The symbol shall only be positioned horizontally and shall face to the left.
- Circular signal indications and bicycle signal indications shall not be used on the same traffic signal face.
- Arrow signal indications and bicycle signal indications may be used on the same traffic signal face but are not required if people on bicycles are only allowed to make lawful turning movements.

Size: The provisions of Section 4D.07 of the MUTCD apply to the sizes of bicycle signal faces except as follows:

- There shall be three nominal diameter sizes for bicycle signal indications: 4 inches, 8 inches, and 12 inches.
- All signal indications in a bicycle signal face shall be of the same size, including both signal indications that display arrows and signal indications that display bicycle symbols.
- Four-inch signal indications shall only be used in supplemental, post-mounted, nearside bicycle signal faces. Nearside bicycle signal faces may alternatively be either 8-inch or 12-inch.

Placement: The provisions of Sections 4D.13 through 4D.16 of the MUTCD apply to the placement of the bicycle signal faces, except as follows:

- As a specific exception to Item A in Paragraph 1 of Section 4D.11 of the MUTCD, a minimum of one primary bicycle signal face shall provide traffic control for the bicycle movement, even if a bicycle through movement exists.
- The primary bicycle signal face shall have either 8-inch or 12-inch signal indications, even if it is located at the near side of the signal-controlled location.
- When the primary bicycle signal face is located more than 80 feet beyond the stop line, a supplemental nearside bicycle signal face should be provided.
- Bicycle signal faces should be placed such that visibility is maximized for people on bicycles and minimized for adjacent or conflicting vehicle movements. Visibility-limited
bicycle signal faces may be used; if they are, the signal faces shall be adjusted so that people on bicycles for whom the indications are intended can see the signal indications.

- A bicycle signal face should be separated vertically or horizontally from the nearest motor vehicle traffic signal face for the same approach by at least 3 feet.

**Mounting height:** The provisions of Section 4D.15 of the MUTCD apply to the mounting height of bicycle signal faces, except as follows:

- The bottom of the signal housing (including brackets) of a bicycle signal face that is not located over a roadway shall be a minimum of 7 feet above the sidewalk or ground. If supplemental signage is installed below the bicycle signal face, the minimum mounting height to the bottom of the supplemental sign shall be 6 feet.

- If 4-inch signal indications are used in a supplemental, post-mounted, nearside bicycle signal face, the bottom of the signal housing (including brackets) shall be a minimum of 4 feet and a maximum of 8 feet above the sidewalk or ground.

**OPERATION OF BICYCLE SIGNAL FACES:**

The provisions of Part 4 of the MUTCD apply to the operation of bicycle signal faces, except as follows:

**Timing:** The provisions of Section 4D.26 apply to the duration of the yellow change and the red clearance intervals of a bicycle signal phase, except as follows:

- The minimum duration of the yellow change interval shall be 3 seconds.

- The maximum duration of the yellow change interval should be 6 seconds.

- If discernible nonconcurrent activations or terminations of phases for motor vehicle traffic and bicycle signal indications are necessary, visibility-limiting devices should be used on the bicycle signal face.

**Turning movements:** The following provisions apply to turning movements for people on bicycles:

- In cases where it is necessary to prohibit certain turning movements by people on bicycles, the bicycle signal face shall use a combination of red and yellow bicycle symbol (or arrow) signal indications and green arrow signal indications. In the presence of a bicycle signal face, the prohibition of bicycle turning movements shall not solely be through the use of movement prohibition signs, modifications thereof, or the use of plaques that supplement movement prohibition signs.

- As a specific exception, the simultaneous display of a straight-through green arrow signal indication in a bicycle signal face and a circular red signal indication in a motor vehicle signal face for the same approach shall be permitted. If the green arrows in the
bicycle signal face can be seen by drivers in the adjacent lane(s), consideration should be given to using visibility-limited bicycle signal faces.

WARRANTS FOR BICYCLE SIGNAL FACES:

No new traffic signal warrant(s) specific to bicycle signal faces or in addition to those already provided in Chapter 4C of the MUTCD are associated with this interim approval. Engineering judgment is to be exercised in determining whether or not it would be advantageous or beneficial to have an existing location implement a bicycle signal face.

For the purpose of warrant analyses, provisions for classifying bicycles are provided in Paragraph 15 of Section 4C.01 and Paragraph 2 of Section 9D.01 of the MUTCD.

REGULATORY SIGNAGE:

An S3632/S3633 (BIKE SIGNAL) sign shall be installed immediately adjacent to every bicycle signal face that is intended to control only people on bicycles, including signal faces that are comprised of all bicycle symbol signal indications, all arrow signal indications, and every combination thereof.

PROHIBITED USES:

The following are among the applications of bicycle signal faces that shall not be permitted under this interim approval:

A. Pedestrian hybrid beacons. Bicycle signal faces shall not be used in any manner with respect to the design and operation of a pedestrian hybrid beacon.

B. Shared lane markings only. Bicycle signal faces shall not be used for controlling any bicycle movement that is sharing a lane with motor vehicle traffic.

C. Exclusive bicycle phases that permit "scramble" phases. Bicycle signal faces shall not be used to provide a bicycle phase that stops all motor vehicles and pedestrians at the signalized location in order to allow multiple bicycle movements from multiple conflicting directions.

BICYCLE DETECTION

Bicycle detection must be considered at signals where bike facilities are present. If bike/turn boxes are present, they should contain bicycle detection. Appropriate pavement markings (i.e., a bike-lane stencil, bike box, etc.) should accompany the bicycle detection to guide people on bicycles to the appropriate place to activate the detection. Per the MUTCD, a bicycle signal actuation sign (R10-22) may be installed where markings are used to indicate the location where people on bicycles should be positioned to actuate the signal. If a sign is installed, it should be placed at the roadside adjacent to the marking.
RRFBS FOR BIKE CROSSINGS

RRFBS can be designed to accommodate bike crossings. The assembly should include W3262 (PED BIKE symbol) signs and should consider push buttons that are easily accessible for people on bicycles. Refer to Section 3.4, RRFB Guidelines.

6.4 Bicycle Facilities

Portland follows NACTO guidance for selecting all ages and abilities bikeways. New or enhanced bikeway designs should use this guidance as a starting point.

<table>
<thead>
<tr>
<th>NACTO's Contextual Guidance for Selecting All Ages &amp; Abilities Bikeways</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roadway Context</strong></td>
</tr>
<tr>
<td>Target Motor Vehicle Speed</td>
</tr>
<tr>
<td>Any</td>
</tr>
<tr>
<td>Less relevant</td>
</tr>
<tr>
<td>≤ 10 mph</td>
</tr>
<tr>
<td>≤ 20 mph</td>
</tr>
<tr>
<td>≤ 25 mph</td>
</tr>
<tr>
<td>Greater than 6,000</td>
</tr>
<tr>
<td>Greater than 26 mph †</td>
</tr>
<tr>
<td>Greater than 6,000</td>
</tr>
<tr>
<td>High-speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts</td>
</tr>
<tr>
<td>Any</td>
</tr>
</tbody>
</table>

*While posted or 85th percentile motor vehicle speed are commonly used design speed targets, 95th percentile speed captures high-end speeding, which causes greater stress to bicyclists and more frequent passing events. Setting target speed based on this threshold results in a higher level of bicycling comfort for the full range of riders.

† Setting 25 mph as a motor vehicle speed threshold for providing protected bikeways is consistent with many cities’ traffic safety and Vision Zero policies. However, some cities use a 30 mph posted speed as a threshold for protected bikeways, consistent with providing Level of Traffic Stress level 2 (LTS2) that can effectively reduce stress and accommodate more types of riders.18

‡ Operational factors that lead to bikeway conflicts are reasons to provide protected bike lanes regardless of motor vehicle speed and volume.

Table 6.3 NACTO Urban Bikeway Design Guide Excerpt
PROTECTED BIKE LANES

Design of protected bike lanes should follow guidance provided in the Portland Protected Bicycle Lane Planning and Design Guide, which identifies seven categories of protected bike lanes from simple delineator-separated bike lanes to sidewalk-level protected bike lanes.

Design guidelines for parking-protected bike lanes are covered in the next section.

PARKING-PROTECTED BIKE LANES

Where there is enough roadway width, parking can provide protection for bike lanes. Consideration should be given to the number of driveways, side streets and transit stops to determine if parking will provide adequate protection and still serve adjacent parking needs.

Where parking protection is feasible, design details should include the following:

- Parking delineation lines, including beginning and end lines.
- Parking/buffer lines should continue straight through residential driveways. At commercial driveways, the buffer should be tapered to the bike-lane line (mimicking a driveway wing) and dashed through the driveway throat (see example below).

![Figure 6.1 Parking/Buffer Lines at a commercial driveway](image)

- Minimum 3-foot buffer between parking and the bike lane. Delineators may be used in the buffer area and should be 36 inches (white or yellow to match the lane line) with two reflective bands and a spring base. Delineators should be placed 1 foot from the travel lane or parking lane.

- NO PARKING signs are recommended in commercial areas and optional in residential areas. If used, parking signs should be installed on 60-inch delineators (white or yellow) with sign mounts.

- A parking guide line for parking segments longer than 100 feet. This should be a 4-inch white line, 5 feet long, placed every 100 feet.

- If needed, use a “P” symbol (PBOT Standard Drawing P-434) to delineate new parking areas away from the curb. If used, the “P” symbol should be installed in paint and not maintained.
• Parking removal for adequate sight distance. Parking should be removed per the following guidance:

<table>
<thead>
<tr>
<th></th>
<th>Leading</th>
<th>Farside</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intersections</strong>*</td>
<td>60 feet</td>
<td>20 feet</td>
</tr>
<tr>
<td><strong>Driveways</strong>*</td>
<td>30 feet</td>
<td>20 feet</td>
</tr>
<tr>
<td>At mailboxes</td>
<td>Varies, allow postal access</td>
<td>Varies, allow postal access</td>
</tr>
<tr>
<td>At bus stops</td>
<td>10:1 taper, 100 feet typical</td>
<td>5:1 taper, 60 feet typical</td>
</tr>
</tbody>
</table>

*Measured from side-street curb face or driveway throat.

Table 6.4 Parking Removal for Parking-Protected Bike Facilities

**RAISED CYCLE TRACKS – Under Development**

**PATHWAYS – Under Development**

**BIKE FACILITIES IN RAIL ENVIRONMENTS – Under Development**

**6.5 Construction Traffic Control for Bicycles**

PBOT policy requires that construction work zones must accommodate pedestrian and bicyclist movement. The PBOT Temporary Traffic Control Manual provides guidance on the accommodation of people bicycling in construction work zones.
7 Traffic Control and Design for Transit

7.1 Signs and Markings

“T,” DIAMOND, AND “LRT” PAVEMENT MARKINGS

The “T” and diamond lane markings are obsolete and have been replaced by “LRT.” “LRT” is used to designate lane usage for both light-rail and streetcar. PBOT Standard Drawing P-435 provides design details.

NEW BUS ZONE REQUESTS

Requests for new zones are sent to Parking Control for approval. If the zone is approved, Parking Control will install signs.

BUS ZONE MAINTENANCE REQUESTS

All maintenance requests for zone poles, curb tape, back zone signs and faded or misaligned street striping will be sent directly to Maintenance Operations.

7.2 Transit Stop Design

Coordination with TriMet is required when designing or adjusting existing bus stops and bus zones. TriMet’s Bus Stop Guidelines (July 2010) provide guidance for bus stop placement and design. Stops are placed at locations:

A. That are safe for passengers and vehicles.

B. That are easily accessible by the surrounding neighborhood, major transit generators and/or intersecting transit services.

C. Where improvements in safety, convenience and/or reduced trip times outweigh negative impacts.

Locations must meet all of the above criteria for transit stop placement.
### Table 7.1 Preferred Placement for Transit Stops

<table>
<thead>
<tr>
<th>Situation</th>
<th>Preferred Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any signalized intersection where bus can stop out of travel lane</td>
<td>Farside</td>
</tr>
<tr>
<td>If bus turns at intersection</td>
<td>Farside</td>
</tr>
<tr>
<td>Intersection with many right turns</td>
<td>Farside</td>
</tr>
<tr>
<td>Complex intersection with multiphase signals or dual turn lanes</td>
<td>Farside</td>
</tr>
<tr>
<td>If nearside curb extension prevents vehicles from trying to turn right in front of bus</td>
<td>Nearside</td>
</tr>
<tr>
<td>If two or more consecutive stops have signals</td>
<td>Alternate nearside and farside (starting nearside) to maximize advantage from timed signals</td>
</tr>
<tr>
<td>If there is obvious, heavy, single-direction transfer activity</td>
<td>One nearside, one farside to eliminate crossing required to transfer</td>
</tr>
<tr>
<td>If blocks are too long to have all stops at intersections</td>
<td>Midblock*</td>
</tr>
<tr>
<td>Major transit generators not served by stops at intersections</td>
<td>Midblock*</td>
</tr>
<tr>
<td>Midblock pedestrian crossing defined by refuge island and/or striping</td>
<td>Midblock*</td>
</tr>
<tr>
<td>Transit center</td>
<td>Off-street</td>
</tr>
<tr>
<td>Major transit generator that cannot be served by on-street stop, or where ridership gain will far outweigh inconvenience to passengers already onboard</td>
<td>Off-street</td>
</tr>
</tbody>
</table>

*Midblock bus stops are generally less desirable than stops at intersections; however, they must be considered when suitable nearside and farside options are unavailable.*
BUS ZONES OR OTHER PARKING RESTRICTIONS

A bus stop is not considered accessible unless the bus can reach the curb. Bus zones, no parking areas and other parking restrictions are often necessary to ensure access. Bus zones or no parking areas are required when:

A. It is determined that a stop must be accessible.

B. Parking is allowed at the stop.

C. There is no justification for a curb extension, stop move or stop deletion.

D. Buses lay over.

NEARSIDE BUS ZONES:

Preferred length is 90 feet measured from the bus stop sign. In extreme circumstances, nearside bus zones can be shortened to 60 feet; however, buses may not be able to clear the travel lane. At signalized intersections, the bus should stop a minimum of 15 feet from the pedestrian crossing so that approaching drivers will be able to see pedestrians using the crosswalk. The area between crosswalk and bus stop must also prohibit parking.

FARSIDE BUS ZONES:

Preferred length is 90 feet measured from the crosswalk. In all instances, the rear of the bus must clear the crosswalk. Farside zones can be shortened to 60 feet; however, buses may not be able to clear the travel lane. Bus stops with multiple routes require longer zones. When two buses must be accommodated frequently, zones should be 100 feet long. Each additional bus requires another 50 feet in length.

MIDBLOCK BUS ZONES:

Preferred length is 100 feet measured from the bus stop sign. A minimum length for midblock zones is determined on a site-by-site basis. These zones are infrequently used but are found on “super blocks,” often opposite of T-intersections in high-density areas and along mid- and lower-density area roadways with few intersections.

Bus zones must be clearly marked. Parking control, including signage and marking, is City of Portland jurisdiction. Generally, bus zones are marked by P2500L/P2500R (NO PARKING BUS ZONE) signs at the beginning and end of the zone. At farside zones, TriMet bus stop signs are often used to indicate where the bus should stop (to allow enough space to pull out). A P1000 (NO PARKING) sign may be added at the front of a bus zone to clearly define ambiguous frontage (e.g., between a zone and a driveway or a zone and a fire hydrant). The City of Portland may apply yellow tape to the curb tops in bus zones to further define the space.
CURB EXTENSIONS INCORPORATING TRANSIT STOPS

Curb extensions have several benefits for transit:

- They provide buses with access to the curb from the travel lane without deviation (no pulling in or merging), thereby reducing dwell time.
- They can reduce nearside stop turning conflicts on two-lane roads by blocking through traffic.
- They provide patron waiting and boarding areas separated from pedestrian movements on sidewalks.
- They provide room for stop amenities or other streetscape features.
- They visually designate a street as a pedestrian-friendly transit corridor.

Following are the general requirements for transit stop curb extensions:

- Extensions must provide a minimum of 32 feet of curb line free of ramps, wings and curb returns. At farside extensions, the bus must be clear of the crosswalk, requiring a minimum of 42 feet of clear curb line.
- A 6’ x 8’ clear space must be defined at front and rear door locations for ramp deployment and wheelchair maneuvering.
- Bus shelters, poles, trees, benches, trash cans and other amenities must be placed a minimum of 3.5 feet clear of the curb face.

The placement of hydrants, bike racks, artwork, drinking fountains, non-transit signs and poles and other street furniture must be carefully considered and coordinated with TriMet. There is significant potential for conflict with transit operations when too many items end up on an extension.

BUS PULLOUTS AND BUS PADS

A bus pullout’s primary function is to move buses out of travel lanes where they might impede traffic flow. TriMet does not actively pursue the placement of bus pullouts at regular bus stops because it reduces the efficiency of transit service. TriMet will consider accepting pullouts at bus layovers (where buses park for several minutes) or at selected bus stops on roads with at least two of the following:

A. Posted speed limits at or above 40 mph.
B. Ridership above 35 daily boardings or 6 daily lift boardings.
C. Potential safety issues.

Concrete bus pads are often incorporated into pullout designs but are also used at curbside bus stops. Bus pads are considered on a case-by-case basis but are generally found at stops with frequent service, significant ridership, or where heavy bus braking and acceleration is necessary.

**EXCEPT BUS SIGNAGE, QUEUE JUMP SIGNALS AND BUS-ONLY LANES**

These treatments should be pursued on major routes or high-frequency bus routes with significant traffic delays during peak periods. EXCEPT BUS signage is the most common treatment where a nearside bus stop at a signalized intersection uses a right-turn pocket. Queue jump signals are used in conjunction with an EXCEPT BUS queue jump lane (especially when there is no farside lane) to provide safe merging into the traffic lane. Bus-only lanes provide exclusive right of way to bypass congestion but are only used when adequate right-of-way is available. Each treatment has differing effectiveness based on the individual circumstances. Detailed analysis of issues such as traffic volume, ridership, safety, right-of-way, and delay to transit are required.
8 Traffic Calming

The city had a robust traffic-calming program in the 1990s, which was eliminated due to budget cuts. Traffic-calming elements are still used routinely in capital project designs and quick-build safety projects.

8.1 Speed Bumps
There are three types of speed bumps that have been adopted for use by the City of Portland:

14-FOOT SPEED BUMP:
Limited to use on streets classified as Local Service in Portland’s TSP. See PBOT Standard Drawing P-440.

22-FOOT SPEED BUMP:
Also known as speed tables. For use on streets classified as Neighborhood Collectors, as defined in the TSP. Twenty-two-foot speed bumps may also be used on higher volume or higher speed Local Service Streets. See PBOT Standard Drawing P-441.

SPEED CUSHIONS:
For use on streets that are designated as Major or Secondary Emergency Response Streets in the TSP. (Consultation with the designated Fire Bureau representative is required.) Speed cushions may be designed with three sections or four sections (Figures 8.1 and 8.2). The first allows emergency responders to bypass the bump by traveling over the centerline, while the second allows emergency responders to bypass the bump by staying within lane lines. Three-section speed cushions should be installed along straight sections of roadway, while four-section speed cushions should be installed along curved sections of roadway. Four-section speed cushions should also be used on high-volume roadways. Speed cushions should be a minimum of 50 feet from median islands; distance should be confirmed with AutoTurn to ensure that fire vehicles can navigate the bump properly and return to the travel way prior to the median island.
Figure 8.1 Three Speed Cushion Layout Design
DESIGN GUIDELINES

The following are general standards and guidelines that apply to all speed bump applications. There may be situations that do not meet all criteria.

PREVAILING SPEED:

Fourteen-foot speed bumps should not be placed on streets with 85th-percentile speeds exceeding 40 mph. Twenty-two-foot speed bumps should not be placed on streets with 85th-percentile speeds exceeding 50 mph. The engineer shall consider phased installation of speed bumps on streets with extreme speeding problems. Phased installation would place every other speed bump first and infill the remaining speed bumps one to three months later.
STREET CLASSIFICATION:

Speed bumps shall not be constructed on streets classified higher than Neighborhood Collector in the TSP nor should they be constructed on streets classified higher than Transit Access. See the TSP for guidance regarding the maintenance of existing speed bumps on streets classified higher than Neighborhood Collectors or Transit Access Streets. Only speed cushions may be constructed on streets designated as Major or Secondary Emergency Response Streets in the TSP and only after consultation with the designated Fire Bureau representative.

STREET GRADE:

Speed bumps may be installed on street sections with a longitudinal grade of up to 8 percent. Installation of speed bumps on street sections with a grade up to 12 percent shall be decided on a case-by-case basis and only after an engineering evaluation has ensured that such installations will not create excessive risks to traffic safety. Speed bumps shall not be placed on streets with longitudinal grades in excess of 12 percent.

PROXIMITY TO CURVE:

Prior to placing speed bumps on a curved roadway, an engineering evaluation should be conducted to ensure that the speed bump installation, in conjunction with the posted speed of the curve, would accommodate safe vehicle passage. Speed bumps shall not be placed on horizontal curves with radii less than 100 feet. Special attention shall be paid to the placement of speed bumps on crest vertical curves, in accordance with the section below on Signage.

STREET CONDITION:

Maintenance Operations should inspect all streets prior to any proposed speed bump construction. Maintenance Operations will determine if the existing street pavement material is adequate to support speed bumps or if pavement maintenance is required. If it is determined that improvements or maintenance are required, that work shall be completed before permanent speed bumps are constructed.

UNIMPROVED STREETS:

Speed bumps may be installed on paved streets without curbs that are maintained by the city, unless otherwise prohibited by these guidelines. After construction on streets without curbs, the engineer may consider the installation of roadside delineators to deter a confirmed problem with driver circumnavigation of a speed bump.

TRAVEL LANES:

Speed bumps shall not be placed on streets with more than two through-travel lanes. Turn lanes, bike lanes and parking lanes shall not be counted as through-travel lanes.
SPACING:

Speed bumps shall be installed in a series (minimum of two) and spaced according to an evaluation of traffic data as well as the physical street section. Speed bumps spaced more than 600 feet apart have significantly less effect on driver speeds, though street grade restrictions per the section above on Street Grade may necessitate such lengthy spacing. The standard spacing for speed bumps is 280 to 320 feet apart, with closer spacing chosen for more severe speeding problems. Fourteen-foot speed bumps at standard spacing will typically reduce the average 85th-percentile vehicle speed along the length of the project street to 25 mph. Twenty-two-foot speed bumps at standard spacing will typically reduce the average 85th-percentile vehicle speed along the length of the project street to 28 to 32 mph. Average 85th-percentile vehicle speeds at speed bumps will usually be less than the speeds between the speed bumps. Speed bumps are typically placed 150 feet to 200 feet away from the intersecting streets that define the boundaries of the project but should be no closer than 100 feet to any boundary street. For intersecting streets internal to the project boundaries, speed bumps are placed a sufficient distance away such that turning vehicles will cross the speed bump squarely, without any skew. When STOP signs exist internal to a project street segment, speed bumps are typically placed 200 feet from the STOP sign.

DESIGN:

The size or length of a speed bump is measured along the centerline of the street. Both 14-foot and 22-foot speed bumps are constructed to a maximum height of 3 inches above the existing street surface (+/- 0.5 inch) in accordance with standard plans P-440 or P-441. Speed bumps shall normally be constructed across an entire street width, leaving 12 to 18 inches adjacent to the curb clear for drainage. Speed bumps are normally constructed to within 6 inches of the edge of the pavement on streets without curbs. All speed bumps shall have tapered edges adjacent to the curb or edge of pavement. Edge tapers shall be 12 inches wide. Speed cushions have the same dimensions as a standard 14-foot speed bump, except that gaps in the bumps are provided at the width of the fire truck wheel base so emergency vehicles can traverse the bumps with minimal impact.

PAVEMENT MARKINGS:

Each speed bump shall be marked with the speed bump marking in accordance with PBOT Standard Drawing P-435. Markings may be rolled in on traditional speed bumps but are burned down on speed cushions to conform to gaps in the bumps. Existing double yellow centerlines and bike lanes may be installed on top of any speed bump that covers those markings.

SIGNAGE:

W2600 (BUMP) signs shall be installed at each end of the project street segment, typically 100 feet, but not less than 75 feet, in advance of the first speed bump approached by people driving. Below each W2600 sign, an S1108 (AHEAD) rider shall be installed so that people driving can
expect to encounter speed bumps. When speed bumps are placed on a crest vertical curve, consideration shall be given to placement of a supplemental W2600 sign for the direction of travel in which visibility of the speed bump is obscured. Unless otherwise stated, all roadside signs for speed bumps shall be placed a minimum of 8 feet above the local surface as measured to the bottom of the lowest sign.

DRIVEWAYS:

Speed bump locations shall be chosen to maintain driveway access, with the minimum clearance from a residential driveway throat being 5 feet and the minimum clearance from a commercial driveway throat being 20 feet.

PARKING:

Parking removal is not required at speed bumps.

DIVERSION:

If diversion is a concern, streets adjacent to the project street that are identified as potential vehicle diversion routes (usually parallel streets) may be monitored before and after construction on the project street.

BUS STOPS AND BUS ZONES:

Speed bumps shall be placed away from transit vehicle stops. This helps to ensure that passengers will not be transitioning between standing and sitting when the bus traverses a speed bump, minimizing the potential for passenger injury. To the greatest extent possible, speed bumps should be located so that transit vehicles are not traversing them at an angle.

UTILITIES:

Speed bumps should not be placed closer than 20 feet to underground utility access points. Under constrained circumstances, 5-foot spacing may be justified. Speed bumps should be located to avoid placement over water, sewer and natural gas service connections, as well as water valves, gas valves or other utility valves. Before initiating a speed bump project, local utility companies shall review the proposed project street for pending utility construction. All pending utility work that involves street resurfacing shall be completed, and the street resurfaced, before construction of permanent speed bumps.

CONSTRUCTION TOLERANCES:

Permanent speed bumps must be constructed per the appropriate standard plan to within a tolerance of +/- 0.5 inch in height.
8.2 Traffic Circles

Traffic circles are distinguished from roundabouts in that traffic circles are small, do not have raised splitter islands, and usually have stop control on one of the intersecting streets. The city installed many traffic circles when there was an active traffic-calming program. PBOT now specifies mini-roundabouts or other traffic control devices in lieu of traffic circles. New traffic circles require approval by the City Traffic Engineer or the City Engineer.

DESIGN GUIDELINES

Traffic circles require drivers to travel around the island in a counterclockwise direction. The following are general standards and guidelines that apply to all traffic circle designs. There may be situations that do not meet all criteria.

GRADE:

Traffic circles shall not be constructed on street sections with longitudinal grades more than 10 percent. Vertical curves may be introduced to reduce approach and depart street grades or to accommodate the cross slope of the circular roadway.

STREET CLASSIFICATION:

Traffic circles may only be constructed on streets classified as Local Service Traffic Streets that are not designated as Major Emergency Response Streets in the TSP.

PROXIMITY TO CURVE:

Traffic circles may be constructed at intersections that include horizontal or vertical curvature. Sight distance approaching a traffic circle on a crest vertical curve shall be reviewed for safety.

CIRCLE CURB:

Traffic circle curbs shall be constructed to include a wide portion that is mountable, called a truck apron, for the occasional large truck that will need to travel through the intersection but will not fit in the travel lane (Figure 8.3). When using the mountable curb, large vehicles are expected to travel at less than the typical operational speed. The mountable curb section should include a texture or treatment that deters pedestrian and passenger vehicle use. Traffic circle mountable curb normally slopes away from the central island curb with a 2 percent slope.

DESIGN VEHICLE:

Typically, the outside mountable curb radius around a traffic circle shall be designed to accommodate the through movements of an SU-30 vehicle on the pavement surface. Where a transit route exists on the street, the mountable curb radius should accommodate the through movement of a B-40 design vehicle without requiring the B-40 to traverse the mountable curb. A B-40 design vehicle will also be used to evaluate fire truck turns, both left and right, in front of the traffic circle. The traffic circle non-mountable curb radius shall be designed to
accommodate the through movements of a WB-40 truck on the through street, using the truck apron as a driving surface.

![Figure 8.3 Traffic Circle Curb Cross Section](image)

TRAVEL LANES:
The typical travel lane is 13 feet wide. Existing corner radii of the intersecting streets may be increased to accommodate the largest traffic circle possible, to increase deflection and reduce vehicle speed. The engineer shall review the statutory pedestrian crossings at the intersection for conflicts with the resulting circular lane operation.

PEDESTRIAN CROSSINGS:
Safety of pedestrians near traffic circles is a function of vehicle speed and visibility. Vehicle speed reductions are maximized in proportion to the amount of deflection achieved to travel around the circle, which is a function of circle diameter and entry geometry. Standard crosswalks typically overlap with the circular roadway described and should be offset away from the circular roadway. It is preferable that corner curb ramps be relocated to the center of standard-width continental crosswalk markings (Figure 8.4).
BIKE LANCES:

Bike lanes may be marked in the circular roadway of a traffic circle for the through street, outside the standard travel lane width if the through street is sufficiently wide. Bike lanes that are dropped approaching a traffic circle shall be discontinued upstream of the beginning of the gore striping. When bike lanes end approaching a traffic circle, people on bicycles shall merge with through traffic and a warning sign (S3701) shall be provided.

SIGNAGE:

All traffic circles shall use W1700 (TRAFFIC CIRCLE AHEAD) signs and W4040 (20 MPH) riders not less than 100 feet in advance of the statutory crossing on the through street. All traffic circles shall use City of Portland traffic circle KEEP RIGHT OF CIRCLE signs (R5500 through R5500C) to direct vehicle traffic around the circle. KEEP RIGHT OF CIRCLE signs are centered in the traffic circle behind the non-mountable curb and may be placed 6 inches above the surface (see Figure 8.5). Where parking removal is necessary, appropriate signage shall be used.
Figure 8.5 Traffic Circle Signage and Marking

PAVEMENT MARKINGS:

Figures 8.5 and 8.6 illustrate required pavement markings for traffic circles:

- Narrow double yellow centerline striping shall be placed on through streets a minimum of 20 feet in advance of the gore striping.

- A 4-inch yellow gore stripe shall be placed approaching the traffic circle on through streets. Gore stripe markings shall approximate a parabolic curve. The depth of the curve shall be one-half the traffic circle radius, and the stripe shall begin at least 40 feet from the nearest intersecting street’s curb line and end at the first edge of a pedestrian crossing.

- Bike lanes that are discontinued at the gore striping shall be skip-striped for the last 20 feet before the gore striping.

- Yellow RRPMs shall be placed just to the left of the gore stripe at 5 feet on center.
• Yellow RRPMs shall be placed on the street surface in front of the mountable circle curb for approaching vehicles at 24 inches on center. Yellow RRPMs in front of the mountable traffic circle curb shall be oriented such that each driver approaching can observe the right half of the circle marked with yellow RRPMs.

• Yellow RRPMs shall be placed at the highest point of the mountable circle curb for approaching vehicles at 24 inches on center. Yellow RRPMs on top of the mountable traffic circle curb shall be oriented such that each driver approaching can observe the left half of the circle marked with yellow RRPMs.

![Figure 8.6 RRPM Placement](image)

LANDSCAPING:

Landscaping in traffic circles is permitted and encouraged. Landscaping shall be reviewed to ensure that visibility conflicts with pedestrians and traffic control signs are minimized. Street trees placed in traffic circles shall be deciduous only and centered in the circle so that visibility of pedestrians is maximized. The City Forester shall review and approve the type of deciduous tree to be placed in each traffic circle.

PARKING REMOVAL:

A minimum of 20 feet of parking removal is required at the edge of roadways near traffic circles to meet PedPDX guidelines and to provide for adequate vehicle passage around the circles. A B-40 vehicle is commonly used to determine minimum parking removal limits to preserve fire truck access.
MAINTENANCE:

Maintenance responsibility for landscaping in traffic circles, after the establishment period, shall be determined prior to construction approval. Maintenance Operations shall provide periodic maintenance of traffic circle signs and pavement markings as necessary.

8.3 Curb Extensions

Curb extensions are commonly used to improve pedestrian crossing opportunities and pedestrian visibility. Curb extensions improve pedestrian crossing opportunities by reducing the distance a pedestrian must cross at street level and improving visibility of pedestrians. Curb extensions are also used to enhance bikeway crossings, transit stops, and streetscapes, as well as to provide space for ADA-compliant pedestrian ramps.

DESIGN GUIDELINES

The following are general standards and guidelines that apply to all curb extension designs. There may be situations that do not meet all criteria.

ANALYSIS:

Curb extensions are typically used at locations where the ability of a pedestrian to cross a street is deficient due to traffic volume or length of crossing. NCHRP Report 562 is used to determine the availability of crossing opportunities for the given location and will help determine if curb extensions will increase crossing opportunities and pedestrian safety. The engineer should consider the local pedestrian population when selecting the pedestrian speed to account for unusual situations. Curb extensions may also be used in other situations not related to pedestrian crossing deficiency. Such circumstances should be noted in the project files.

PROXIMITY TO CURVE:

Before placing curb extensions along a horizontally or vertically curved roadway, an engineering evaluation should be conducted to ensure that the curb extension installation, in conjunction with the posted speed of the curve, would accommodate safe vehicle passage and safe pedestrian crossing. Special attention shall be paid to the placement of curb extensions on the inside of horizontal curves to minimize the potential for vehicle collision with the curb extension. Crossings on the inside of curves should be evaluated for sight distance to ensure that pedestrians can see approaching traffic and people driving can see pedestrians waiting to cross.

LENGTH:

Curb extensions are typically constructed with the minimum tangent length needed to provide pedestrian curb ramps at the crossing. Leading curb extensions should be designed so that the length results in 20 feet of parking removal to enhance visibility at crosswalks and intersections. Curb extensions must be 42 feet long to accommodate a transit stop.
WIDTH:

Curb extensions should be constructed such that the lane-width guidelines in Section 2.2, Lane Widths, are met. Curb extensions constructed in the shadow of a parking lane are typically 6 feet wide to provide a 2-foot buffer to the edge of a travel lane but could be narrower or wider depending on site conditions and turning movements.

BIKE LANES:

On designated City Bikeways, curb extensions should provide for a full-width (minimum 5 feet wide) bike lane next to the extension.

CURB:

The transition from the existing curb to the curb extension shall be accomplished using a reverse curve with a minimum radius of 10 feet. Corner curb radii shall accommodate the expected design vehicle for the use and classifications of streets involved. Civil design will determine curb height, which is typically 6 inches but may be reduced to 4 inches to achieve other design goals.

ENHANCED VISIBILITY:

Pavement markings shall be installed per PBOT Standard Drawing P-434 to increase visibility.

- White, 36-inch surface-mounted tubular markers shall be used in place of RRPMs next to swales or other vegetated areas where vehicles could get stuck if they traverse the curb. Refer to PBOT Standard Drawing P-434 for placement. Surface-mounted tubular markers may be used instead of RRPMs at other locations where additional delineation is needed.

- A 4-inch white fog line may be installed in advance of the curb extension to guide away from the curb. This line should be a minimum of 15 feet long and can be used as part of the 20 feet of parking removal if a shorter curb extension is installed. A 4-inch fog line may also be used as delineation where farside extensions are not preceded by a nearside curb extension.

- Signage may also be used to increase the visibility of a curb extension, particularly farside curb extensions that are not preceded by a nearside curb extension.

LANDSCAPING:

As curb extensions are typically placed on streets with high traffic volumes, pedestrian visibility is important. Landscaping in curb extensions is permitted and encouraged. Landscaping in curb extensions shall be chosen such that the maximum growing height is 18 inches and shall be reviewed to ensure that visibility conflicts with pedestrians, traffic control devices and
nighttime illumination are minimized. Street trees may be placed in curb extensions and should be offset upstream of the crosswalk edge a minimum of 15 feet, so that visibility of pedestrians at the roadside is maximized (Figure 8.7).

![Tree Clearance Upstream of Crossing](image)

**Figure 8.7 Tree Clearance Upstream of Crossing**

**BUS STOPS AND ZONES:**

Curb extensions may be constructed at bus stops or in bus zones. Representatives of the local transit authority shall review proposed construction of curb extensions in bus zones. Where a bus stop coincides with a proposed curb extension, the tangent curb shall be 42 feet, per the TriMet Bus Stop Guidelines, to accommodate front and rear doors of a standard TriMet bus. In order to accommodate access, concrete sidewalk connections from both the front and rear bus doors to the existing sidewalk shall be provided and shall be a minimum of 6 feet wide.

**PARKING REMOVAL:**

Curb extensions are often constructed where on-street vehicle parking might normally occur. At uncontrolled approaches to an intersection, curb extensions should be constructed to effectively remove 20 feet of parking to meet PedPDX guidelines for pedestrian visibility and to provide visibility clearance for side-street traffic. No parking signs may be installed at curb extensions where recurrent illegal parking occurs.

**DRIVEWAYS:**

Curb extensions may be constructed to include existing driveways.
9 Shared Streets

Shared streets are a low-cost option to improve residential streets that do not include sidewalks. This street design requires all modes of travel to share the paved roadway. Shared street design must meet the following conditions:

- Traffic volume of 500 vpd or less.
- Pavement width of 16 to 18 feet.
- Adequate sight distance.

Shared street design includes the following design elements:

- Traffic calming to ensure a low-speed environment.
- At-grade binder curbs adjacent to the asphalt pavement, if civil design determines they are needed.
- Posted speed limit of 15 mph per ORS 811.105(2)(a) (a shared street is a “narrow residential street” as defined by ORS 801.368).
- Shared street signs posted at each end of the narrow residential street per ORS 814.070(4).
- Adequate street lighting to ensure good visibility of pedestrians.

Additional design requirements are currently under development.
References

**GENERAL REFERENCES**

- FHWA Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations (2005)
- FHWA Separated Bike Lane Planning and Design Guide (2015)
  - Interim Approval 21—Rectangular Rapid-Flashing Beacons at Crosswalks (2018)
  - Interim Approval for Optional Use of a Bicycle Signal Face (2013)
  - Interim Approval for Optional Use of Green-Colored Pavement for Bike Lanes (2011)
- Oregon Supplement to the 2009 Edition
- ODOT Standard Drawings
- Oregon Revised Statutes (ORS)
- TriMet Bus Stops Guidelines (July 2010)

**CITY OF PORTLAND REFERENCES**

- 2010 City of Portland Special Provisions
- 2010 City of Portland Standard Construction Specifications
- PBOT Sign Library
- PBOT Traffic Design Manual, Volume 2: Temporary Traffic Control
References

PedPDX (June 2019)
Portland Bicycle Plan for 2030 (2011)
Portland City Code
Crosswalk Evaluation Guidelines
Portland Protected Bicycle Lane Planning and Design Guide (2019)
Portland’s Transportation System Plan (May 2018)
Standard Drawings & Details