



INTRODUCTION

Portland's Safe Routes to School (SRTS) initiative envisions a future where all students and families can choose walking and biking as safe, convenient, accessible, and healthy options for getting to and from school and around their neighborhoods.

This Toolkit gives a basic overview of the most common safety tools the Portland Bureau of Transportation (PBOT) uses on streets around schools. These design tools make Portland's streets safer for walking and biking, with a special focus on supporting kids walking and biking to school.

Each local safety challenge must be evaluated individually, and may include solutions beyond those included in the Toolkit.

All SRTS projects will be designed using applicable City, State and Federal design manuals and guidelines.



Cover photo by ODOT Photo/Video 2018

THE 'SIX E'S' OF SAFE ROUTES

Our Portland SRTS initiative uses a comprehensive "six E" approach, with our commitment to equity serving as an overarching principle (like an umbrella!).

The engineering treatments within this document are important and essential to improving safety and comfort for families across Portland. However, they require the other "E's" for a truly well-rounded approach.

As the needs of every community are unique, individual schools may require more emphasis on different components.



EQUITY
Distribute resources equitably to reduce health and wealth disparities



ENCOURAGEMENT
Activities to promote walking, biking, and rolling to school



EDUCATION
Transportation safety & skills education in the classroom



EVALUATION
Student travel surveys and program assessment



ENFORCEMENT
Partnership with Portland Police to reduce speeding around schools



ENGINEERING
Improvements to streets, signs, and signals around schools

COMMON SAFETY TOOLS

These are the common safety tools explained throughout the Toolkit. They have been categorized by how they are used to address traffic challenges.

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USING THIS TOOLKIT

What's the right tool for the job?

PBOT has many street design tools available to make routes to school safer and more welcoming. They can work alone or together to improve a variety of safety conditions.

This Toolkit will answer the following questions for each treatment type:

What challenges does it address?

- What safety challenges will this tool help to improve?

What is its purpose?

- What is the tool meant to do, how does it work, and how does it address the safety challenges?

How do we decide where to use it?

- What is the criteria for deciding where this and other tools might be used?
- What kind of streets need this tool? Busy multilane highways, quiet neighborhood streets, or both?

How much does it cost?

Typical project costs. Some may cost more or less depending on their unique design and conditions. Costs may be lowered when designed and built as part of larger street projects.

Costs Key:

\$	\$200 - \$2,000
\$	\$2,000 - \$5,000
\$	\$5,000 - \$50,000
\$	\$50,000 - \$100,000
\$	\$100,000 - \$500,000

What can contribute to higher costs?

• Rebuilding sidewalks, streets, driveways, or new, ADA-compliant curb ramps

• Stormwater drainage needs

• Detailed design processes or traffic studies

• Accessing underground electric lines for power (typically requires deconstructing the sidewalk)

• Public processes/design review for complex or controversial projects

• Coordinating with property owners, businesses, and community organizations

• Right-of-way acquisitions

How long does it take?

We'll provide the typical time a treatment takes to plan and build.

Simple projects like adding signs or paint can happen in as little as six months. More complex projects are typically designed and engineered in the first year, and installed the next. Very complex or controversial projects can take anywhere from three to ten years.

Changes to the street impact pedestrians, bicyclists, transit, and drivers. It takes time to plan, design, and build projects to ensure safety tools work well for everyone, and are designed appropriately for their given locations.

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PBOT
PORTLAND BUREAU OF TRANSPORTATION

SIDEWALKS



Many Portland streets in outlying neighborhoods still lack sidewalks. Sidewalks give pedestrians a comfortable space to walk that can be raised up and away from the road. Sidewalks should be wide enough for multiple people and wheelchairs to pass each other comfortably, and should be maintained in good condition.



Sidewalks give pedestrians their own safe, level walking surface.



Landscaping can buffer the sidewalk from the street.



Poorly maintained sidewalks can create tripping hazards.



Sidewalks are cheaper to build on streets with existing curbs.



What challenges does it address?

- Without a sidewalk, people walking end up mixing with cars and bikes in the same road space.
- Streets with lots of fast moving traffic create a hazardous and unpleasant environment for people walking.

What is its purpose?

- Make walking safer and more comfortable, by giving pedestrians their own dedicated, slow-speed space away from cars and bikes.
- Sidewalks are usually raised to reinforce separation from cars. They can also provide an area away from car traffic for children to play or learn to ride a bike.

How do we decide where to use it?

The busier the street and the faster the traffic, the more important it is to have complete sidewalks.

When planning we consider:

- Is the existing road paved or unpaved? On unpaved or very steep streets, we are more likely to consider [alternative walkways](#).
- Is there already an existing curb? Existing curbs make new, conventional sidewalks less expensive to build.
- Equity factors, such as: Where are car-

- ownership rates lower, or where do more people with disabilities live?
- What is the character of the street? In some neighborhoods, residents prefer the more rural character of streets without sidewalks. We will consider [alternative walkways](#) on these streets.
- Where do people want to walk, now and in the future?
- Future developments: Developers often have to build new sidewalks as a requirement for development permits.

Other considerations

- Landscaping, bike racks, benches, and other sidewalk furnishings can provide further buffering between pedestrians and street traffic and make walking more pleasant.

Sidewalk Maintenance

Property owners are responsible for keeping the sidewalks next to their property in good condition. This includes removing overgrown plants, clearing snow and ice, and making repairs to the sidewalk surface when it's damaged.



Suitable on these street types:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
✓	✓	✓

May be combined with:

Any safety tool for Crossing the Street (Pages 12-37)
Any safety tool for Slowing Down Drivers (Pages 38-43)
Lighting (strongly recommended) (Pages 44-45)
Creative Street Design (may be used at intersections for street crossing improvements or reclaiming space) (Pages 46-47)

How much does it cost?

- \$\$ On streets that already have a curb (see photo on facing page)
- \$\$\$\$\$ Full new sidewalks

How long does it take?

- 4+ years With or without existing curb on street

ALTERNATIVE WALKWAYS



It's not always feasible to build a conventional sidewalk, due to time, costs, or street character. In such cases we will consider other approaches for creating safer walking routes. These include protected shoulders, paved paths, or trails.



Wheel stops protect the shoulder from cars.



Thick white lines along a wide shoulder also create space.



Reflective wands indicate a separated walking or biking space.



Pedestrian shared streets have specific width and design requirements to ensure safe travel conditions for active modes.

Examples in Portland

SE 91st Pl
SW 19th Ave
NE 70th Ave



What challenges do they address?

- Without a sidewalk, pedestrians end up mixing with cars and bikes in the same street space, which creates a less safe situation for people walking.
- Portland is missing approximately 350 linear miles of sidewalk on our busiest streets. These gaps are often some of our most expensive needs, as many of these locations lack stormwater infrastructure and sufficient right-of-way width.
- Due to the expense of traditional sidewalks, addressing network gaps with traditional concrete sidewalks will take many years.

What is their purpose?

- Lower-cost and alternative-walkway designs will provide critical pedestrian safety improvements sooner to more residents who need them now.
- In addition to costing less than a conventional concrete sidewalk with a full curb and gutter, lower-cost pedestrian walkways can also provide a more context-sensitive approach for different neighborhoods.
- On low-to-moderate volume streets, a painted walkway alone can provide a more comfortable place to walk. At higher traffic volumes or speeds, physical separation should be used to provide comfort and safety.

How do we decide where to use them?

- We prioritize school walk routes, hilly areas, and less-improved streets.
- Locations that lack stormwater infrastructure or sufficient right-of-way width, or that have substantial physical or environmental constraints, that make traditional pedestrian infrastructure cost prohibitive.
- We prioritize roadways with excess pavement width, that can be reorganized to provide walking space. If roadway widening is necessary costs go up significantly.
- Narrow streets with very low vehicle counts and low speeds may meet requirements for a pedestrian shared street. Pedestrians share the road with cars and bicycles, but speed limits are set at 15 MPH and the street must meet specific design parameters.

Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)

May be combined with:

Any safety tool for Crossing the Street (Pages 12-37)
Any safety tool for Slowing Down Drivers (Pages 38-43)
Lighting (strongly recommended) (Pages 44-45)
Creative Street Design (Pages 46-47)

How much do they cost?

\$ - \$\$\$ Depending on type of improvements, length of roadway, shoulder width, etc.

How long does it take?

1-3 years

PAVED PATHS



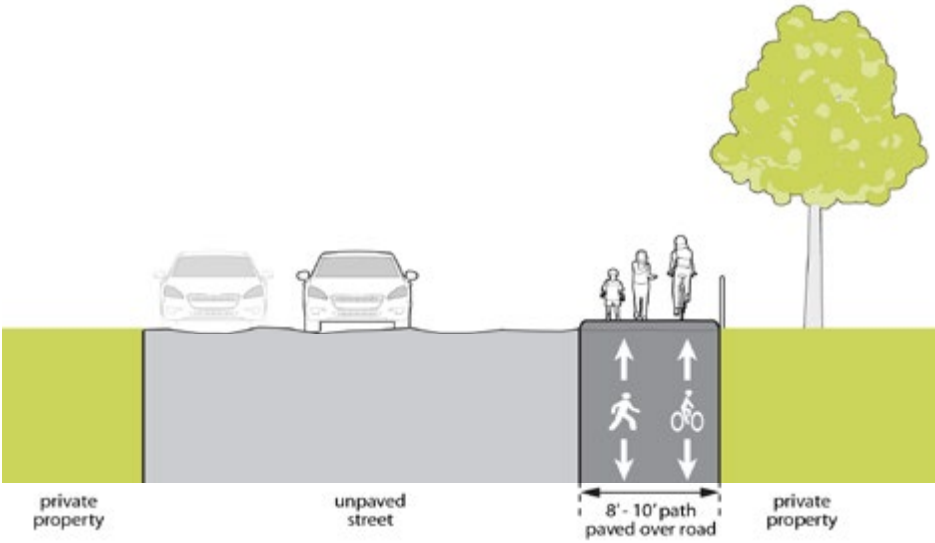
Paved paths can provide a dedicated space for people walking and biking on an unpaved route such as a gravel road or through a park. The even, hard path surface can make walking and biking more enjoyable and accessible. Paths can also be used to provide pedestrian and bike connections between two streets.



Sometimes a pathway through a park provides the most direct route to school for kids who are walking or biking.



Two streets are connected by this right-of-way path in North Portland.



A paved path running along one side of an unpaved street. This dedicated space for walking and biking provides a relatively clean, level surface away from cars.

Examples in Portland

- Pier Park between N James & N Bank
- NE 70th Ave, between NE Emerson & NE Sumner
- NE Going St, between N Commercial & N Gantenbein



What challenges does it address?

- Unpaved routes can be uneven, wet, or muddy, and leave the walking route unclear.
- Travel along unpaved surfaces can be difficult for people using mobility devices, walking with strollers, biking, or using scooters.
- Unpaved streets often mean pedestrians and cars share the same road space.

What is its purpose?

- Gives pedestrians and bicyclists their own space separated from cars on unpaved streets.
- Provides an even, hard travel surface that is easier to keep clear of mud, debris, and tripping hazards.
- Can link existing walking and biking routes that have gaps between them, or create a shorter, more direct walking route.
- Typically meant to be used for travel in both directions, by pedestrians and bikes.

How do we decide where to use it?

- When **Primary Investment Routes** travel along unpaved streets. The rest of the street would remain unpaved, which could limit the number and travel speeds of cars using the street.
- When a Primary Investment Route travels through a park that doesn't already have paved paths.
- Sometimes we will work with private property owners to create a new path or gate on the edge of a private property, to link existing routes or neighborhoods.

Suitable on these types of streets:

Neighborhood Streets	Busy streets (2 - 3 lanes)	Major Thoroughfares (4+ lanes)
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Not an on-street treatment, but may run parallel to a street. Paved paths may cross any street type; careful design is needed at crossings.

May be combined with:

Any safety tool for Slowing Down Drivers (strongly recommended at major street crossings) (Pages 38-43)
Lighting (strongly recommended) (Pages 44-45)

Pedestrian trail improvements

Portland has many existing urban pedestrian trails that serve as important links for people of all ages walking through the city's neighborhoods.

Trail improvement recommendations include:

- Rebuilding or updating stairs
- Clearing vegetation
- Clearing an adequate walkway



Stairways and walkways need regular maintenance and sometimes updating. Trails need regular care to keep from becoming overgrown.

Examples in Portland:

- Trail between SW 45th Ave and SW Admiral Ct
- Trail between SW Lowell Ct and SW 48th Pl

Note that the City strives for paved paths wherever possible, however sometimes a pedestrian trail is the only option. Pedestrian trails are not always ADA accessible, as shown in the above photos. Pedestrian trails can be stairways or unpaved. In those cases, there are ADA accessible alternative routes on City streets.

How much does it cost?

\$\$ - \$\$\$ Varies depending on length and design

How long does it take?

1 - 3 years Varies depending on length and design



MARKED CROSSWALKS



Every street crossing at an intersection is legally a crosswalk, whether marked or not. We mark crosswalks with white stripes to raise driver awareness of people crossing the street, and to direct people who are walking to the best place to cross.



Marked crosswalk with ADA-compliant curb ramps on both sides.



Mid-block school crosswalk.



An advanced stop line pulls cars back from the crosswalk to increase visibility.



What challenges does it address?

- Even though every intersection is legally a crosswalk (unless a sign prohibits crossing), people driving may not look for crossing pedestrians unless there is a marked crosswalk.

What is its purpose?

- Shows drivers where to expect people crossing the street.
- Helps direct people walking to the best place to cross the street.
- Helps indicate a walking route to school.

How do we decide where to use it?

- We always mark crossings at intersections with traffic signals.
- We generally use them sparingly, prioritizing them for crossings on streets with more car traffic in locations where many people walk and bike.
- We mark all crossings on [Primary Investment Routes](#) within a 1/4 mile distance from a K-12 school.
- When adding a new marked crosswalk we also put up crosswalk [warning signs](#) (unless there is a traffic light or stop sign). Crosswalks adjacent to a school are given school crosswalk [warning signs](#).

Other considerations

- Are there curb ramps that meet the Americans with Disabilities Act (ADA) requirements? If not, they will need to be added or rebuilt.
- If the new marked crosswalk crosses more than two lanes of traffic, other safety improvements may be needed (see multiple-threat callout).
- How well can an approaching driver see people about to cross the street? Where visibility is poor, parking restrictions and other approaches may be needed.
- Is the crosswalk well lit at night? Lighting may need to be added.
- Number and speed of cars:
 - Busy streets or fast traffic may require more safety features on top of marking the crosswalk.
 - If fewer than 4,000 vehicles use the street per day, PBOT generally doesn't mark the crossing.

Distance yourself

PBOT traffic standards keep marked crosswalks 300 feet (about a block) apart from each other.



Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
✓	✓	✓

May be combined with:

Warning Signs (Required)
Stop Sign (and Advanced Stop Line, see call-out box this section)
Parking Restrictions
Curb Bulb
Crossing Island
RRFB Crossing Beacon
PHB Crossing Beacon
Improve Signalized Intersections
Speed Bumps (can create a raised crosswalk on a speed bump, or use speed bumps in advance to slow cars)
Mini Circles

How much does it cost?

\$	Marking the crosswalk only
\$\$\$	Marked crosswalk + new curb ramps/other safety improvements

How long does it take?

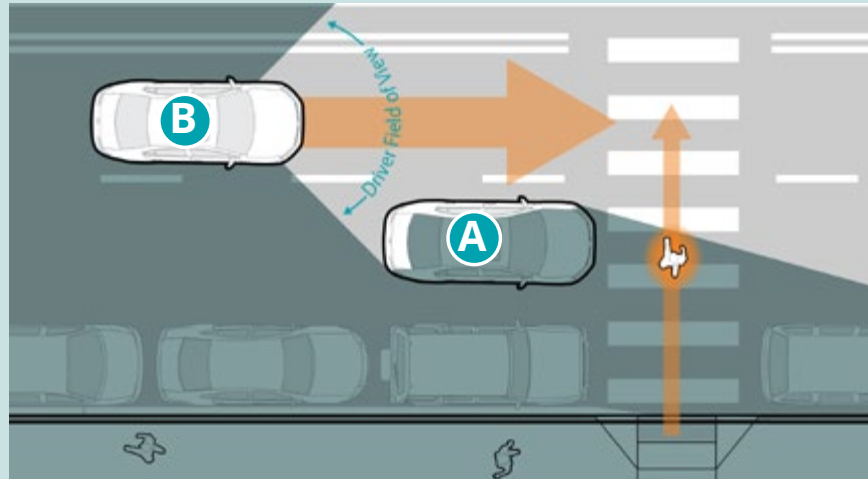
< 1 year	Marking the crosswalk only
1 - 2 years	Marked crosswalk + new curb ramps/other safety improvements

Multiple threat

A multiple threat is created when a marked crosswalk crosses multiple traffic lanes going the same direction.

When Car A stops at the crosswalk, it blocks the pedestrian and Car B from seeing each other, creating a dangerous situation.

Here, we typically add additional safety features such as [RRFB](#) and [PHB crossing beacons](#), pedestrian signals, [crossing islands](#), [curb bulbs](#), and advanced stop lines (see below).

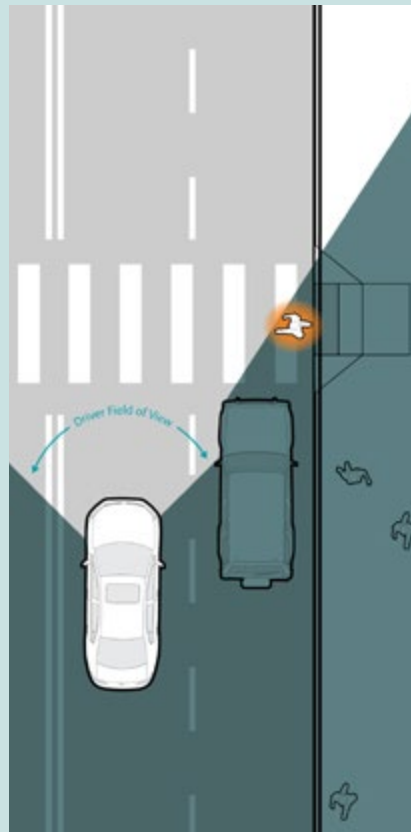


Advanced stop lines

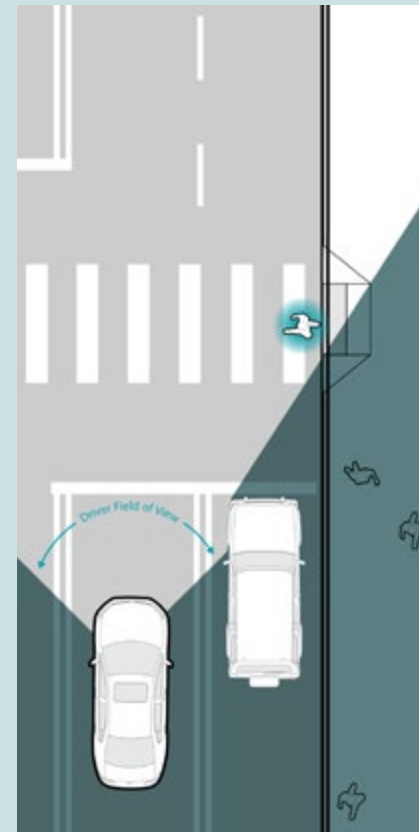
Advanced stop lines (ASLs) are painted lines that direct drivers to stop for pedestrians further back from the crosswalk, helping improve visibility and creating a more comfortable crossing for the pedestrian.

We typically use ASLs on busier streets with higher traffic speeds, and when there is a multiple threat at a crosswalk. In some cases we will also add a double white line to prevent cars from changing lanes as they approach the crossing.

ASLs can be used with other crossing tools, such as [crossing islands](#) and [RRFB beacons](#). They can also be used at signalized intersections.



No advanced stop line.



Advanced stop line improves pedestrian visibility.

Accessible curb ramps

Every crosswalk, marked or unmarked, is required to have curb ramps on both sides to help people transition between the sidewalk and the street, especially children, families pushing strollers, the elderly, and people with mobility challenges. All curb ramps must meet requirements of the Americans with Disabilities Act (ADA).

Like most cities, Portland has some crosswalks with outdated curb ramps and some lacking ramps altogether.



Accessible curb ramps at an unmarked crosswalk on a neighborhood street.

Whenever street projects are done at a crossing, such as repaving or adding other safety tools, it triggers the requirement to update the curb ramps. This can significantly increase the time and cost of a project.

Raised crosswalk

A crosswalk can be raised up by marking it over a [speed bump](#).

Benefits:

- Slows cars down right at the crosswalk where slow speeds are most important.
- Increases driver awareness of the crosswalk and people crossing

Considerations:

- PBOT ensures emergency vehicles and buses won't be impacted by raised crosswalks.
- Some raised crosswalk designs may impact stormwater drainage.



Raised crosswalk on a speed bump.

Updating crosswalks

In Portland, many crossings at intersections with traffic signals are marked with two simple lines (called a transverse crosswalk).

Moving forward, we will be updating all marked crossings to high visibility ladder bar—also called continental—crosswalks (see photo).



High-visibility crosswalk near a school.

Crosswalk maintenance

Portland crosswalk markings are made from a durable, reflective material. Over time car traffic can wear away the markings and they may need to be reapplied. Citywide, we prioritize maintenance based on the condition of the crosswalk.

WARNING SIGNS



There are a variety of warning signs to alert drivers of pedestrian, bicycle, or school crossings. They are used at most pedestrian crossings, and are required with some pedestrian safety features.



Pedestrian crossing signs are yellow and have four sides.



School crossing signs have five sides and are fluorescent yellow.



Bike and pedestrian crossing signs are yellow and have four sides.



Warning signs are helpful where crosswalks are less expected.



What challenges do they address?

- When there isn't a traffic signal or stop sign, drivers often fail to stop for pedestrians crossing the street at a crosswalk.

What is their purpose?

- Alert drivers to expect pedestrians and bicyclists crossing the street, and encourages drivers to yield.
- Give advanced warning to roadway users when traffic calming or traffic-control devices are present.
- Research shows that pedestrian warning signs make other pedestrian safety features more effective.

How do we decide where to use them?

- We add them whenever installing a new **marked crosswalk** at a location without a traffic signal or stop sign.
- Often included at crossing locations with **curb bulbs** and **crossing islands**, and are always included with **RRFB** and **PHB crossing beacons**, and pedestrian signals.
- Pedestrian crossing warning signs come in three varieties (see pictures on facing page):
 - School-focused crossing signs picture two students walking. They are used at marked crossings adjacent to a K-12 school.

- Bike and pedestrian crossing signs picture a pedestrian and a bicyclist. They are used at marked crossings for **Neighborhood Greenways** and multi-use paths.
- Pedestrian crossing signs picture a person walking. They are used at marked crossings where school crossing and bike and pedestrian crossing signs don't apply.

Maintenance

Warning signs can become blocked by leafy branches and bushes. Maintenance is sometimes required to keep the signs visible.

Portland residents can call 503-823-1700 to report visibility issues caused by vegetation.



Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
✓	✓	✓

May be combined with:

Marked Crosswalk (and Advanced Stop Line)
Stop Sign
Parking Restrictions
Curb Bulb
Crossing Island
RRFB Crossing Beacon
PHB Crossing Beacon
Improve Signalized Intersections
Speed Bumps
Mini Circles

How much do they cost?

\$ New warning sign and post only

How long do they take?

< 1 year New warning signs only

STOP SIGNS



Stop signs are used at intersections that have vehicles approaching from three or more directions. They are used to control traffic, reduce conflicts between people using the roads, and tell travelers who has the right of way. Drivers are more likely to properly give pedestrians the right of way at crosswalks that have a stop sign.



All-way stop with marked crosswalks.



Stop sign at a neighborhood street crossing with a busier street.



Stop sign and painted stop line giving priority to a Neighborhood Greenway.



When sight lines are obstructed, advisory signs warn drivers that they will need to stop soon.



What challenges do they address?

- Without stop signs it can be difficult for drivers and pedestrians to know whose turn it is to go at an intersection. Intersections without stop signs can work at very low-traffic intersections, but at busier intersections this can be confusing and create problems.
- When drivers aren't required to stop at an intersection they tend to be less vigilant in looking for pedestrians.

What is their purpose?

- Stop signs manage the traffic of drivers, pedestrians, and bicyclists by assigning who has the right of way at an intersection. They may be used to manage traffic on one street while letting the other street flow freely, or to manage both streets.
- Drivers are required to come to a complete stop.

How do we decide where to use them?

- We track how many cars, pedestrians, and bikes use an intersection and assess the intersection's crash history.
- If stop signs are needed:
 - When one street is busier than the other we use two-way stop signs to stop traffic on the quieter street.
 - When all streets are equally busy we look at street classifications and crash history.
- Other things we consider include:
 - Visibility and sight lines at the different intersection approaches.
 - Giving priority to SRTS Priority Investment Routes or low-traffic [Neighborhood Greenways](#).
- Optionally, stop lines on the street can show drivers where to stop.

Re-orienting stop signs

We try to minimize stop signs on [Primary Investment Routes](#) for two reasons:

- 1) This gives priority to the walking route while requiring cross traffic to stop, which increases pedestrian safety on the route.
- 2) Too many interruptions to the walking route, such as waiting for passing cars at too many cross streets, can frustrate pedestrians and discourage walking.

In order to increase safety and minimize interruptions, we consider re-orienting existing two-way stop signs on walking routes so that traffic on the cross street is stopped and the walking route is given priority. Note that if this also leads to increased car traffic or speeds on the walking route, [speed bumps](#), [mini circles](#), or traffic diverters may be used to slow down or discourage cars.



Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
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May be combined with:

Marked Crosswalk (and Advanced Stop Line)
Warning Signs
Parking Restrictions
Curb Bulb
Crossing Island
RRFB Crossing Beacon
PHB Crossing Beacon
Mini Circles

How much does it cost?

\$ Stop sign or stop sign + stop line

How long does it take?

< 1 year Stop sign or stop sign + stop line

SETBACK PARKING AT CROSSWALKS



When cars are parked too close to the crosswalk, they can make it difficult for pedestrians and drivers to see each other. Keeping parked cars back a short distance from the crosswalk helps increase visibility.



Parking restriction sign.



Improved visibility created by bike racks.



Parking restrictions with vertical obstacles get better compliance.



Parking restrictions allow space for a crossing island.

Examples in Portland

N Willis Blvd and N Courtenay Ave
NE 37th Ave and NE Holman St
SE 33rd Ave and SE Belmont St



What challenges does it address?

- When cars park close to a crosswalk they can block drivers from seeing crossing pedestrians and vice versa. Sight lines to see children and people in wheelchairs are especially likely to be blocked by parked cars.

What is its purpose?

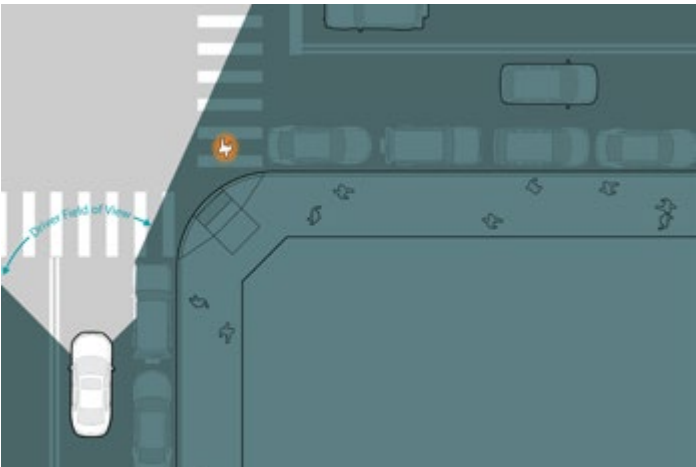
- Allows drivers and people crossing to see each other better, especially at crosswalks without stop signs or traffic signals.

How do we decide where to use it?

- Setback parking is strongly considered at **crosswalks** near schools.
- Setback parking can be an alternative to painting a **marked crosswalk**, generally on neighborhood streets that aren't near schools.

Other considerations

- Parking setbacks can be more effective when there are physical barriers installed, such as curb extensions, bike parking, or vertical posts.
- Freed-up space can be used for features like bike parking, bike share stations, plantings, or stormwater swales.
- It is important to communicate with the neighborhood about changes in parking availability.



Parked cars block people driving and people crossing the street from seeing each other.



Restricting parking near the crosswalk improves visibility.

Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
✓	✓	✓

May be combined with:

Marked Crosswalk (and Advanced Stop Line)
Warning Signs
Stop Sign
Curb Bulb
Crossing Island
RRFB Crossing Beacon
PHB Crossing Beacon
Improve Signalized Intersections
Speed Bumps (may be used in advance to slow cars)
Mini Circles

How much does it cost?

\$	Using signs and paint
\$\$	Adding bike racks, planters, furnishings

How long does it take?

< 1 year	Using signs and paint
1 - 2 years	Adding bike racks, planters, furnishings

CURB BULBS



Curb bulbs—also called curb extensions or bulb outs—extend a section of sidewalk into the parking lane or edge of a wide travel lane. They shorten the distance for people crossing the street and improve visibility. Narrowing the roadway may help slow down drivers.



Curb bulbs shorten the crossing for pedestrians.



Mid-block curb bulb with crossing island in a main street setting.



Curb bulb used for bike racks and other furnishings.



Curb bulb with stormwater swale.

Examples in Portland

NE Cully Blvd and NE 62nd Ave
SE Woodstock Blvd and SE 45th Ave
NW Raleigh St at NW 21st Ave



What challenges do they address?

- Pedestrians spend a longer time in the street when crossings are wider.
- Drivers sometimes have difficulty seeing pedestrians waiting to cross the street.
- Cars tend to make faster turns at intersections with tight curb corners.

What is their purpose?

- Shorten street crossing distance for pedestrians.
- Make crosswalks more noticeable to drivers.
- Narrowing street causes drivers to slowdown, while tightening the street corners reduces turning speeds for cars.
- Improve visibility for pedestrians and drivers to see each other; prevent cars from parking too close to a crosswalk where they can obstruct sight lines.
- Bulbs widen the sidewalk, allowing more space for ADA-compliant curb ramps.

How do we decide where to use them?

- At crossings where sight lines need improvement, such as school crosswalks.
- Where adequate space is available. Curb bulbs can be installed at most crosswalk locations where:
 - A street has all-day on-street parking,
 - A bulb won't extend into a car or bike lane, or prevent a planned future bike lane,
 - A crossing is marked or unmarked,
 - A crossing is mid-block.
- Is stormwater drainage affected? Curb bulbs often require changing street drainage.

Other considerations

- Widening the sidewalk can provide space for seating, public art, bike racks, stormwater swales, or other public amenities.

The more you dough...

Fun fact: In England, curb bulbs are called "Elephant Ears!"



Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
✓	✓	✓

May be combined with:

Marked Crosswalk (and Advanced Stop Line)
Warning Signs
Stop Sign
Parking restrictions (this is one of the functions of a curb bulb)
Crossing Island
RRFB Crossing Beacon
PHB Crossing Beacon
Improve Signalized Intersections
Speed Bumps (may be used in advance to slow cars)

How much does it cost?

\$\$\$ Curb bulb with storm drain adjustments

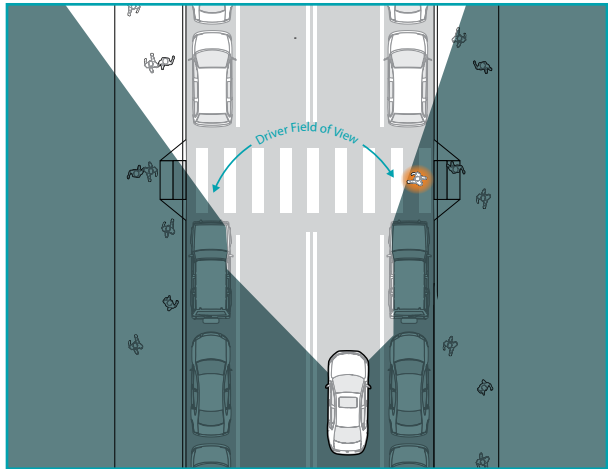
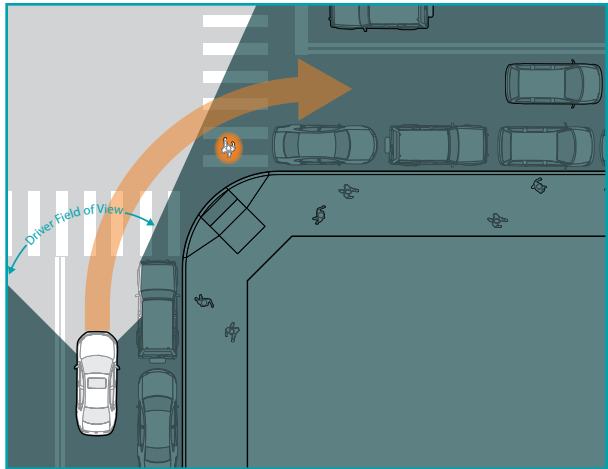
How long does it take?

1 - 2 years Curb bulb with storm drain adjustments

CORNER CURB BULB

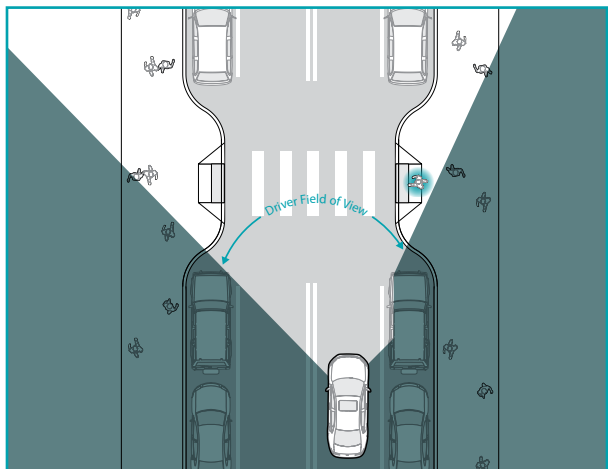
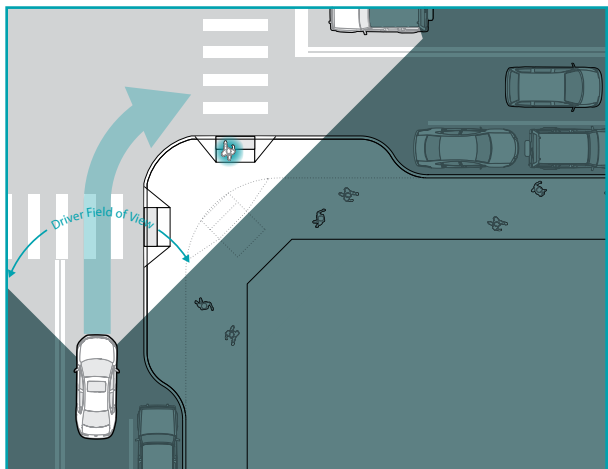
MID-BLOCK CURB BULB

NORMAL
CONDITIONS



It can be difficult for turning drivers to see crossing pedestrians at corners and mid-block crosswalks, especially when there are cars parked up to the crosswalk. At intersections, cars can turn relatively fast around a large corner.

WITH
CURB BULB



A curb bulb brings crossing pedestrians into view of the turning driver, shortens the crossing for pedestrians, and keeps parked cars from blocking the view. At intersections, the tighter corner also slows cars down.

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CROSSING ISLANDS



Crossing islands (also called pedestrian refuges, median islands, or center islands) are small raised islands located in the roadway. Center islands turn one longer crossing into two shorter ones, giving pedestrians and bicyclists a safe place to pause and wait for an opportunity to complete the crossing.



Crossing island in a two-lane road with a center turn lane.



Crossing islands can fit on two-lane roads without center turn lanes by restricting parking.



Mid-block island at school crossing, on two-lane road.



Crossing islands can also be located along the edges of larger roadways.

Examples in Portland

- NE Burnside St and NE 16th Ave
- SE Holgate Blvd and SE 78th St
- SE Steele St and SE 49th Ave



What challenges does it address?

- Busier roads make it challenging for pedestrians to find gaps in all lanes and directions of traffic at once before crossing the street.
- Wide streets have long distances for pedestrians to cross, exposing them to car traffic for long periods, and without providing a safe place to wait if they have misjudged traffic.

What is its purpose?

- A person crossing the street can focus on one direction of car traffic at a time, making it quicker and easier to find gaps in traffic; they also have a safer place to wait in the middle.
- Improves street crossing for kids, older adults, people with disabilities, and others who may need more time to cross.
- Makes crossings more noticeable to people driving; car traffic tends to slow down as the island makes the road feel narrower.

How do we decide where to use it?

- We assess the number of lanes a person has to cross, how heavy traffic is, and how fast it's moving.
- Is there enough space in the middle of the road to install them?
 - Generally, streets with a two-way center turn lane work well. (In this situation we try to avoid locations where a lot of drivers turn left.)
 - In some cases, space can be created on streets with extra-wide car lanes by narrowing the lanes on either side, leaving a space in the middle.
 - Using parking setbacks: car travel lanes will edge into the parking lane as they curve around the island (see photo on facing page).
- Can be located at intersections or mid-block.

Other considerations

- Crossing islands are typically used with a [marked crosswalk](#) and [warning signs](#). We also consider adding other safety improvements, like [RRFB crossing beacons](#) or [curb bulbs](#).
- At crossings used by a lot of people on bikes, we may install a second cutout in the crossing island reserved for bikes.

Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
✓	✓	✓

May be combined with:

Marked Crosswalk (required) and Advanced Stop Line
Warning Signs (required)
Stop Sign
Parking restrictions
Curb Bulb
RRFB Crossing Beacon
PHB Crossing Beacon
Improve Signalized Intersections
Speed bumps (may be used in advance to slow cars)

How much does it cost?

\$ - \$\$\$

How long does it take?

1 - 2 years

RRFB CROSSING BEACONS



RRFB crossing beacons (or rectangular rapid flash beacons), are button-activated flashing lights that make a crosswalk more visible to people driving, alerting them to the presence of a person crossing the street.



The RRFB always includes warning signs.



RRFB crossing beacon at a two-lane school crossing.



Pedestrians activate RRFBs with a button.



RRFB on busy five-lane street, with crossing island, curb bulbs, and advanced stop line.

Examples in Portland

NE Glisan St at NE 117th Ave
SE Powell Blvd and SE 116th Ave
SW Beaverton-Hillsdale Hwy and SW 43rd Ave



What challenges does it address?

- On faster roads, drivers often fail to notice or stop for pedestrians at [crosswalks](#) on the straightaways between signals.
- Pedestrians crossing busy streets can wait a long time to find sufficient gaps in traffic to safely cross the street.

What is its purpose?

- Alerts drivers to people crossing with bright, attention-getting, flashing lights. The lights only flash after a person pushes a button, making them really stand out. (RRFBs always include [warning signs](#) and [marked crosswalks](#) to make the crossing very visible).
- Research shows that drivers are more likely to stop for people trying to cross the street when an [RRFB crossing beacon](#) is flashing.
- Gives pedestrians a way to cross the street safely, while disrupting traffic flow as little as possible.

How do we decide where to use it?

- We look at the number of traffic lanes a pedestrian has to cross, how heavy traffic is, and how fast it's moving.
- RRFBs are typically installed on both sides of the crosswalk, with signs and flashers facing both directions. They can also be placed on [crossing islands](#).
- Other safety features should be added along with the RRFB when beacons are used at crossings of more than two traffic lanes, because of the [Multiple Threat](#) situation (see [marked crosswalks](#) for more information).
- A series of RRFB beacons can create numerous places for pedestrians to safely cross a busy street, at locations that wouldn't be suitable for full traffic signals.

You have the power!

RRFB crossing beacons can come with their own solar panel, making them independent of the power grid. This adds a lot of flexibility on where they can be placed.



They are a relatively lower-cost option compared to [PHB crossing beacons](#) or full traffic signals, and have less of an effect on car traffic.

Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
----------------------	----------------------------	--------------------------------



May be combined with:

Marked Crosswalk (required) and Advanced Stop Line (recommended with Multiple Threat)
Warning Signs (required - included as part of the installation)
Parking restrictions (required)
Curb Bulb
Crossing Island
Speed bumps (may be used in advance to slow cars)

How much does it cost?

- \$\$\$ Beacon + pole for each side of street
- \$\$\$\$ Beacons + new [marked crosswalk](#) with ADA curb ramps

How long does it take?

1 - 2 years

PHB CROSSING BEACONS

PHB crossing beacons (or pedestrian hybrid beacons) are a set of lights that help pedestrians safely cross major streets. They remain dark until a pedestrian presses a button, then cycle through yellow and red phases to stop cars and let pedestrians safely cross.

NORMAL OPERATIONS		AFTER PEDESTRIAN PUSHES BUTTON				
	DRIVE NORMALLY	KEEP DRIVING <small>Stay aware of changing conditions</small>	SLOW DOWN <small>Prepare to stop (Treat like any yellow light)</small>	STOP! <small>Pedestrians crossing! (Treat like any red light)</small>	STOP! <small>If crosswalk is clear, proceed with caution (Treat like a stop sign)</small>	DRIVE NORMALLY
	DON'T WALK	DON'T WALK	DON'T WALK	DON'T WALK	DON'T WALK	DON'T WALK

Phases of the PHB crossing beacon for drivers and pedestrians, after the pedestrian pushes the button.

Examples in Portland
SE Tacoma St and SE 19th Ave
NE Sandy Blvd and NE 18th Ave
SE 122nd Ave and SE Bush St

- What challenges does it address?
- On faster roads, drivers often fail to notice or stop for pedestrians at crosswalks on the straightaways between signals.
 - Pedestrians crossing busy streets can wait a long time to find sufficient gaps in traffic to safely cross the street.
 - At these locations we want to give pedestrians a way to cross the street safely, while disrupting traffic flow as little as possible.

- What is its purpose?
- PHB crossing beacons work a lot like traffic signals, stopping drivers to let pedestrians cross.
 - They disrupt drivers less than traffic signals; they only turn on after pedestrians press a push button.

- How do we decide where to use it?
- We look at the number of traffic lanes a pedestrian has to cross, how heavy traffic is and how fast it's moving, the history of collisions, and the local traffic conditions.
 - PHB beacons are typically located at least 300 feet (about a block) from existing traffic lights.



PHB crossing beacon on two-lane street. Pedestrians must push the button to activate the beacon.



PHB on a busy four-lane street.

Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
----------------------	----------------------------	--------------------------------

May be combined with:

Marked Crosswalk (required) and Advanced Stop Line (strongly recommended)
Warning Signs
Parking restrictions (required)
Curb Bulb
Crossing Island

How much does it cost?

\$\$\$\$

How long does it take?

1 - 5 years

SIGNALIZED INTERSECTION IMPROVEMENTS



When signalized intersections have been shown to have high crash rates, there are a variety of improvements available to make them safer. Many of these safety features are designed specifically to help pedestrians.



Signalized intersections are often complex, car-dominated spaces, and may need special attention.



A leading pedestrian interval gives people crossing a head start for a few seconds while the signal remains red for cars.

Examples in Portland

- NW Glisan St and 15th Ave
- N Williams Ave and N Killingsworth St
- SE César Chávez Blvd and SE Main St



What challenges does it address?

- The City of Portland has identified a [High Crash Network \(HCN\)](#), a set of streets and intersections on which the majority of traffic crashes occur.
- When [Primary Investment Routes](#) cross the High Crash Network at a signalized intersection, safety improvements are often needed to provide extra protection for school kids. Children cross the street more slowly than the average person, and are often less visible to drivers.

What is its purpose?

- At intersections on Primary Investment Routes with demonstrated traffic safety challenges, to make changes based on intersection evaluation that will prioritize the safety of school kids.
- The specific safety improvements will vary from intersection to intersection, depending on conditions and crash history. Different safety improvements have different purposes and effects, but all are geared towards improving safety for people walking.

How do we decide where to use it?

- We will always evaluate and add safety improvements where a Primary Investment Route includes the intersection of two streets on the High Crash Network.
- Where a Primary Investment Route crosses a street on the High Crash Network we will consider safety improvements on a case-by-case basis, using current conditions at the intersection, and the crash history.
- Many other crossing treatments described in this guide may also be appropriate for signalized intersection improvements, including [crossing islands](#), [curb bulbs](#), and [parking restrictions](#).

Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
✓	✓	✓

At crossings with busy streets

May be combined with:

Marked Crosswalk (required) and Advanced Stop Line
Warning Signs
Parking Restrictions
Curb Bulb
Crossing Island

How much does it cost?

Low-cost improvements: \$

- Leading Pedestrian Intervals (LPI's) and timing adjustments to an existing signal.
- No Right Turn on Red signs.
- Short-term slip lane changes, using paint and bollards.
- Adding pedestrian signal heads (costs can be higher if changes to the traffic signal are needed as well).

Higher-cost improvements: \$\$

- LPIs and timing adjustments where new signal equipment or major re-wiring is needed.
- Adding a protected left turn phase for drivers.
- Major slip lane safety improvements such as raised crosswalks (see [marked crosswalk](#)) or [truck aprons](#).

Highest-cost improvements: \$\$\$

- Closing slip lanes by rebuilding street corners, [sidewalks](#), and roads.



See pages 34-36 for details about each type of treatment.

How much does it cost?

\$ - \$\$\$ See box above

How long does it take?

6 months - 3 years Varies by project; more expensive projects will typically take longer

Protecting pedestrians from turning cars

One of the biggest safety risks to pedestrians at signalized intersections comes when drivers are turning right or left across a crosswalk at the same time people are crossing the street. The following safety improvements help to separate pedestrians from turning cars.



Leading pedestrian interval (LPI)

Lets pedestrians begin crossing the street (by giving them a WALK sign) a few seconds before drivers are given the green light in the same direction. When pedestrians are given a head start, turning drivers are much more likely to see and yield to them. LPIs are generally three to five seconds long, though they may vary depending on the size and conditions of the intersection. They work best in combination with No Right Turn on Red signs.



LPI gives pedestrians a head start, letting them start to cross an intersection before the light turns green.

No right on red for drivers

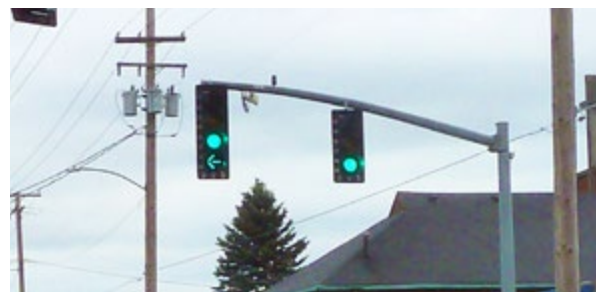
When drivers turn right at a red light they are often looking left for oncoming traffic and don't always look right for crossing pedestrians. No Right Turn on Red signs are simple and cost-effective, and reduce conflicts between right-turning cars and crossing pedestrians. Signs can designate No Right on Red at all hours, during certain times, or only when the sign is lit up.



This sign prohibits right turns when lit.

Protected left turn for drivers

Gives left-turning drivers their own green-arrow signal phase, during which pedestrians can't cross. This completely separates left-turning cars from pedestrians, creating more comfortable conditions for everyone. Protected left turns require space for a dedicated left turn lane and updated signal equipment. ****Protected left turns can increase signal cycle times, increasing the amount of time pedestrians must wait to cross the street.****



Protected left turns keep cars turning left completely separate from people crossing the street.

Creating crossings that work for people first, not cars first

Most signalized intersections are designed first and foremost for cars. This can lead to intersections that are frustrating for pedestrians, due to long wait times to cross the street, too short of a time given to cross the street, or unclear information on where and when to cross. When an intersection doesn't work well for people walking, pedestrians are more likely to cross against the light.

Signal length and timing

In general, pedestrians prefer shorter signal lengths and shorter wait times. The longer they have to wait, the more likely they are to cross against the light. However, this must be balanced against the longer times that children and elderly people may need to cross the street, and the increased time added for safety measures such as protected left turns.

Finding the right signal lengths for pedestrians is an art. In order to better serve [Primary Investment Routes](#), signal times may need to be lengthened to give children more time to cross the street, and at other times signal cycle lengths may need to be shortened to reduce pedestrian wait times.

Push buttons

In urban areas and locations where there are high pedestrian volumes, pedestrians should be given a WALK signal without having to press a button. Buttons are inconvenient and may cause pedestrians to wait longer to cross.

Where automatic WALK signals aren't practical, such as locations with low pedestrian volumes, accessible push buttons should be located near the crosswalk and in reach of children and people in mobility devices. Accessible push buttons use sounds and speech in order to aid people with visual impairments.

Adding & updating pedestrian signal heads

Signalized intersections should always have pedestrian signal heads, which give pedestrians WALK and DON'T WALK signs. New pedestrian signal heads will have countdown timers to let people know how much time they have left to safely cross the street. Older signal heads may need updating.

Marking all crosswalks at the intersection

Signalized intersections should always have [marked crosswalks](#) on every leg of the intersection. Some Portland intersections have only two or three of the four legs marked. In these cases we will examine why the crosswalk wasn't marked and mark it (unless there is a strong reason not to, possibly related to conditions on neighboring properties, or traffic safety concerns).



Children can take longer to cross the street.



Accessible push button.



Countdown timer on pedestrian signal.



This intersection is missing a marked crosswalk.

Slip lanes

Slip lanes are uncontrolled right turn lanes allowing continual turning movements, which reduce delay from turn queues and allow space for trucks to turn (see photo below). However, they encourage faster speeds as cars turn right, and their geometry can make it harder for drivers to see people crossing. They also lengthen the distance pedestrians must cross.

Potential solutions

- Close slip lanes entirely, moving cars to the intersection where they will turn right without cutting the corner, and giving pedestrians a shorter distance to cross. Short term, slip lanes can be closed using low-cost materials like paint and bollards. Long term, the entire corner can be rebuilt.
- Improve the slip lane by adding raised crosswalks (see [marked crosswalks](#)).
- Move the crosswalk so it falls at a safer location, where drivers are slowest and can see pedestrians best.
- Add a truck apron, which tightens up the corner for cars, while still allowing trucks to take the wider space they need to make the turn.



Slip lanes allow cars to maintain higher speeds on turns.



A reconstructed slip lane. Drivers can see crossing pedestrians better and the tighter turn slows driving speeds; the truck apron allows large vehicles to make the tighter turn by driving up onto the apron.

Truck apron examples in Portland



A truck apron in North Portland located along a frequent freight route.



A truck apron with additional pedestrian crossing treatments.

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SCHOOL ZONES



School zones are special speed zones located on the streets around a school. They have 20 mile per hour speed limits, special signs reminding drivers to watch for children, and use school crossing signs at marked crosswalks, to make street crossings safer for children walking and biking to school. Fines are also higher for speeding in school zones.



School zone flashing beacons. Two yellow beacon lights flash alternately during school arrival and departure times.



School crossing guard helping students cross the street safely.

Examples in Portland

SE Woodward St and SE 148th Ave
NE Killingsworth St and NE 19th Ave
SW Vermont St and SW 15th Ave



What challenges do they address?

- Children are more vulnerable than adults when walking and biking. They require special protection and driver alertness, so that drivers know to slow down and watch for kids.

What is their purpose?

- Provides safer and more comfortable conditions for families traveling to school.

How do we decide where to use them?

- School zones are designated on streets that are adjacent to school grounds and crosswalks near a school.
- As of 2018, 20 mph is the new speed limit for neighborhood streets throughout Portland. Speeding in a school zone still incurs a higher traffic fine.
- Other pedestrian improvements may be considered in school zones as well, including [sidewalks](#), [marked crosswalks](#), safety crossing guards, [curb bulbs](#) and [crossing islands](#), [crossing beacons](#), and pedestrian signals.
- [Marked crossings](#) in school zones are given school crossing [warning signs](#).

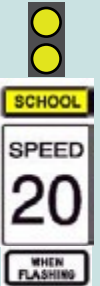
Types of school zone signs

In Portland, we use three different types of school zone signs:

WHEN FLASHING

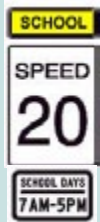
Beacons flash during designated hours.

The beacons are programmable for school schedules, late openings, and other timing changes. They are located at the beginning of school zones, generally on busier streets where speeds are normally faster than 20 mph.



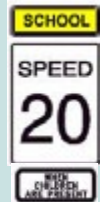
SCHOOL DAYS 7AM TO 5PM

Usually placed on lower volume streets adjacent to school grounds.

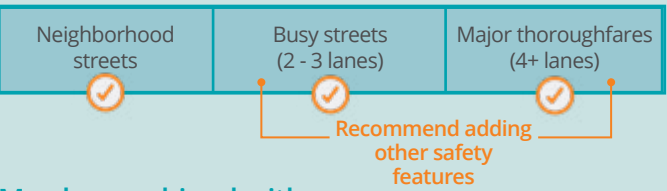


WHEN CHILDREN ARE PRESENT

Can be used at crosswalks anywhere within a school zone. They don't need to be adjacent to school property.



Suitable on these types of streets:



May be combined with:

All tools in the toolkit may be used in School Zones

How much do they cost?

\$\$\$\$ Sign + post only

\$\$\$ Signs + beacon

How long does it take?

6 months - 1 year

SPEED BUMPS & TABLES



Speed bumps are raised roadway sections extending across the road, encouraging drivers to slow down as they drive over them. ‘Fire-friendly’ speed bumps have wheel cut outs for large vehicles to use without slowing. Speed tables are longer and flatter, creating a smoother transition by raising up the whole car before dropping back down.



Speed bump, placed ahead of a crosswalk to slow drivers.



Speed tables are longer and are used on transit routes and busier streets.



Fire-friendly bumps have cut outs for emergency vehicles.



A raised crosswalk on a speed table.

Examples in Portland

- N Houghton St near N Haven Ave
- SE Thorburn St near SE Pine St
- NE 15th Ave between NE Mason and NE Shaver



What challenges do they address?

- On streets where drivers tend to speed on the long straightaways between traffic lights and stop signs, there are limited choices for slowing down drivers in the middle of the block. Speed bumps or tables are a good choice in many of these cases.

What is their purpose?

SPEED BUMPS

- Encourage drivers to slow down, making streets safer and more comfortable for people walking and biking.
- Designed to slow vehicles to posted speeds; typically used on neighborhood streets.

SPEED TABLES

- Longer and flatter than speed bumps, and much gentler for large vehicles such as emergency vehicles and buses.
- Designed to slow vehicles to posted speeds; typically used on busier streets or bus routes.

FIRE-FRIENDLY SPEED BUMPS (SPEED CUSHIONS)

- Have channels built into them spaced to let emergency vehicles pass through with less delay. Passenger vehicles and trucks, with smaller wheel spacing, must still pass over part of the bump.

How do we decide where to use them?

- We consider the number and speed of people driving on a street. If more than 15% of drivers are going more than 5 mph over the speed limit, we may install speed bumps, tables, or fire-friendly speed bumps depending on the type of street.
- Speed bumps are installed every 300 to 400 feet along a street.
- Speed bumps are often used along [Neighborhood Greenway](#) routes.
- When there is also a street crossing that we would like to make safer, we consider using a speed table to raise up the [crosswalk](#) and improve visibility while slowing drivers (see raised crosswalks in the [marked crosswalks](#) section).

Speed bumps and storm water

Speed bumps and tables taper down near the curb to allow storm water to pass by.



Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
✓	✓	Speed cushions & speed tables only

May be combined with:

Marked Crosswalk (raised crosswalk, or use speed bumps in advance to slow cars)
Warning Signs (required)
Stop Sign (use speed bumps in advance to slow cars)
Parking Restrictions
Curb Bulb (may combine curb bulb with raised crosswalk, or use speed bumps in advance to slow cars)
Crossing Island (use speed bumps in advance to slow cars)
Mini-Circles (use speed bumps in advance to slow cars)

How much do they cost?

- \$ Speed bumps and speed tables
- \$\$ Fire-friendly speed bumps (speed cushions)

How long does it take?

1 - 2 years

MINI CIRCLES



Mini circles (or neighborhood traffic circles) are usually used on neighborhood streets, and guide drivers through the intersection in one direction around a central island. Traffic circles are effective at slowing down drivers and reducing crashes. They are most effective when installed in a series at multiple intersections along a street corridor.



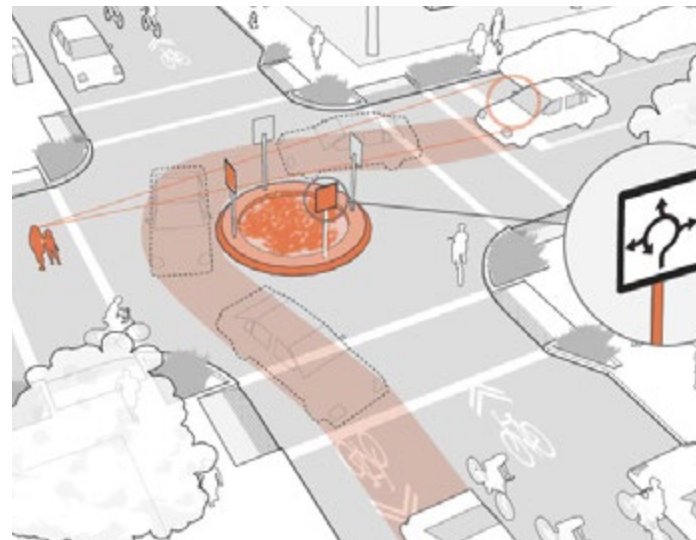
Cars slow down as they navigate a mini circle; circles increase pedestrian comfort and beautify the street.



Mini circles usually have parking restrictions.



Smaller mini circles help slow cars by narrowing the street, though larger circles have the greatest effect.



Drivers take left turns more slowly when navigating around a mini circle.

Examples in Portland

SE Salmon St and SE 13th Ave
NE Holman St and NE 37th Ave
NW 26th Ave and NW Raleigh St



What challenges do they address?

- On neighborhood streets, drivers often have long straightaways without any stop signs, or uninterrupted views for several blocks. This can encourage people to drive faster than the slow speeds that are safest on neighborhood streets.

What is their purpose?

- Slow down drivers, reduce collisions, and make neighborhood streets more comfortable for everyone.
- Slow speeds by creating a gentle obstacle vehicles must navigate, and by narrowing the street at the intersection.

How do we decide where to use them?

- We consider the number and speeds of cars on a street, and any history of traffic collisions at the location.
- Mini circles can be combined with [marked crosswalks](#) and [warning signage](#).

Street beautification

Mini circles provide an opportunity to beautify the street by adding trees, plants, and flowers.

Before installation, we sometimes identify neighbors to volunteer and maintain the plants in the center island.



Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
----------------------	----------------------------	--------------------------------



How much do they cost?

- \$\$\$ Simple installation - no curb or sidewalk changes
- \$\$\$\$\$ Complex installation - changes to curb, sidewalk, curb ramps, or drainage

May be combined with:

Marked Crosswalk (and Advanced Stop Line)
Warning Signs (required)
Stop Sign
Parking restrictions (required)
Speed Bumps (may be used in advance to slow cars)

How long does it take?

- 1 - 2 years** Priority intersections for mini circles are usually identified one year, with construction the following year.

STREET LIGHTING



Street lighting is a core component of designing safe streets for pedestrians. Well-lit streets and crossings help make people visible to drivers at night, and during dawn and twilight. Good street lighting also can also help people feel safer and more comfortable on the street at night.



It is essential to light street crossings well at night.



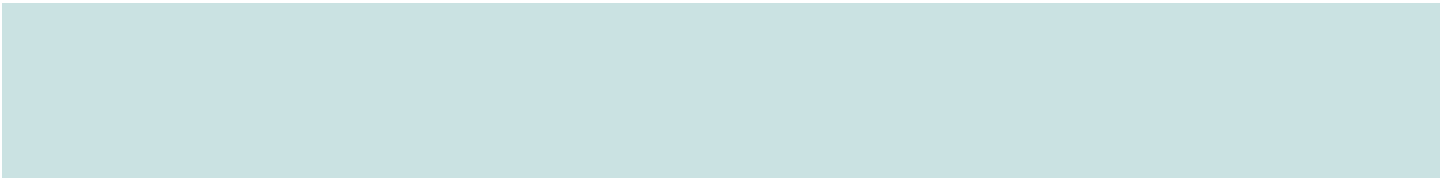
Well-lit stairs on a pedestrian path.



Pedestrian-scale street lighting.



Lighting is especially important on pedestrian underpasses.



- What challenges does it address?**
- Drivers can have difficulty seeing pedestrians, especially when they are crossing the street at night and during dawn and twilight.
 - School children travel to school in the morning while it's still dark out for many months of the year.
 - Without adequate lighting, streets can feel unwelcoming and dangerous to people walking or biking.

- What is its purpose?**
- Illuminates the sidewalk and streets for nighttime walking and biking. This is especially important during winter when daylight hours are shorter.
 - Improves a drivers' visibility to see people crossing, and can also be a signal to drivers that pedestrians may be present.
 - Well-lit streets and trails are much safer for pedestrians, especially at street crossings.
 - Can increase an individual's sense of personal security and discourage undesirable activities.

- How do we decide where to use it?**
- In areas with marked pedestrian crossings or pedestrian beacons, lighting is placed to provide contrast between a pedestrian and their surroundings.
 - We consider all other features of the sidewalk (trees, bike racks, utilities, benches, etc) and place lighting so as to minimize sidewalk clutter or crowding, comply with ADA-accessibility standards, and maximize the amount of light that reaches the sidewalk and street.
 - Where possible, lighting is placed to illuminate activity areas, such as transit stops, parks, and trails.
 - Lighting standards are consistent throughout most of the City, with exceptions for a few design districts in the Central City.

Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)
✓	✓	✓

How much does it cost?
\$ - \$\$ Varies depending on design

May be combined with:

Sidewalks
Alternative walkways
Paved Paths
Recommended in combination with all tools for Crossing the Street
School Zones

How long does it take?
< 1 year

CREATIVE STREET DESIGN



Creative street design projects use low-cost materials like paint, posts, and planter boxes, to quickly and inexpensively redesign the street. These projects typically take the excess space on extra-wide streets and intersections, and give the space to pedestrians and bikes in order to make streets safer and more comfortable.



Planter boxes and paint sharpen the corner to slow down drivers.



Painted curb bulb.



Creative street design can be simple and utilitarian like this painted median island.



Paint used to expand pedestrian space.

Examples in Portland

- N Overlook Blvd at N Failing St
- SW Ankeny Alley
- SE Lincoln Ave at SE 30th Ave



What challenges does it address?

- Many of the safety tools in this Toolkit take significant time and money to implement. Sometimes safety challenges require faster, more flexible, or less expensive changes to address immediate problem areas. Creative designs are also an opportunity to test ideas before permanent changes are made.

What is its purpose?

- Can dramatically change streets and intersections quickly and inexpensively.
- Projects are created with pedestrian safety and comfort in mind. The most common goals are to:
 - Shorten the distance for pedestrians to cross the street;
 - Help clarify where people should cross a large intersection;
 - Tighten corners at intersections, encouraging drivers to slow down.
- Paint, planter boxes, posts, and other materials can quickly create low-cost versions of pedestrian improvements, including:
 - [Marked crosswalks](#) and bike lanes;
 - Wider [sidewalks](#) or [alternative walkways](#);
 - [Curb bulbs/parking restrictions](#);
 - [Crossing islands](#);
 - [Mini circles](#);
 - Closing Slip Lanes (see [improving signalized intersections](#));
 - Small parks and pedestrian plazas.

How do we decide where to use it?

- Most often located at skewed, offset, or other large intersections that contain more road space than cars need to safely or comfortably drive.
- When a Primary Investment Route travels through an extra large or skewed intersection, PBOT will consider creative street designs on a case-by-case basis.

Bringing neighbors together

Creative street designs can add beauty and charm to the neighborhood, and provide opportunities for neighbors to come together to create public art and collective street paintings.



Suitable on these types of streets:

Neighborhood streets	Busy streets (2 - 3 lanes)	Major thoroughfares (4+ lanes)

May be combined with:

Sidewalk
Alternative walkways
Marked Crosswalks
Parking Restrictions
Curb Bulbs
Crossing Islands
Improving Signalized Intersections (may be used to close Slip Lanes)
Mini Circles

How much does it cost?

\$ - \$\$\$

How long does it take?

6 months - 2 years



The City Repair Project

Painting our intersections is nothing new in Portland. The City Repair Project is a local nonprofit that has been bringing neighbors together for more than 20 years to brighten their intersections by painting them with locally designed art.

These “repaired” intersections can be seen in neighborhoods throughout Portland. The City Repair Project has the potential to be an excellent partner for PBOT’s creative street design projects. Learn more at cityrepair.org.



City Repair Project intersection at SE 33rd Avenue and Belmont Street

Maintenance

Paint is subject to wear and tear over time, and flexible posts can get knocked down. Creative street design projects typically require ongoing maintenance to

stay in good shape and remain effective. If planters are used as part of a project, we will identify a party to maintain the plantings.



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COSTS & TIMELINES AT A GLANCE



These tables show the average cost and timeline for typical street improvement treatments. Each treatment is explained in further detail throughout the document.

Walking along the street

	Costs	Timeline
Sidewalk <ul style="list-style-type: none">On streets with a curb in placeFull sidewalk from scratch	<div>\$</div> <div>\$\$\$</div>	4+ years
Alternative walkways	<div>\$ - \$</div>	1 - 3 yrs
Paved path	<div>\$ - \$</div>	1 - 3 years

Slowing down traffic

	Costs	Timeline
School zone <ul style="list-style-type: none">Sign + post onlyWith Beacon	<div>\$ - \$</div> <div>\$</div>	6 months - 1yr 1 - 2 yrs
Speed bumps & tables <ul style="list-style-type: none">Speed bumps, tablesSpeed cushions	<div>\$</div> <div>\$</div>	1 - 2 years
Mini circles	<div>\$\$\$ - \$\$\$</div>	1 - 2 years

Other

	Costs	Timeline
Lighting	<div>\$</div>	< 1 year
Creative street design	<div>\$ - \$</div>	6 months -2 yrs

Costs Key

\$

 = \$200 to \$2,000

\$

 = \$2,000 to \$5,000

\$\$\$

 = \$5,000 to \$50,000

\$\$\$\$

 = \$50,000 to \$100,000

\$\$\$\$\$

 = \$100,000 to \$500,000

GLOSSARY

High Crash Network Over half of Portland traffic crashes happen on eight percent of its streets and intersections. These streets and intersections are called the High Crash Network.

Multiple Threat A dangerous situation where a pedestrian has to cross the street at a location with two or more lanes of traffic in the same direction, and no traffic signal or stop sign. (See [marked crosswalk](#) section.)

Neighborhood Greenway Quiet neighborhood streets that are designed to be good travel routes for people biking and walking. These streets already have low traffic volumes and speeds, and use a variety of safety tools to make the streets safer and more comfortable for people biking and walking.

Crossing the street

	Costs	Timeline
Marked Crosswalk <ul style="list-style-type: none">Marking the crosswalk onlyMarked crosswalk with ADA curb rampsRaised crosswalk	<div>\$</div> <div>\$\$\$</div> <div>\$ - \$</div>	< 1 year 1 - 2 years 1 - 2 years
Warning Signs	<div>\$</div>	<1 year
Stop Signs	<div>\$</div>	<1 year
Parking Setbacks at Crosswalks	<div>\$ - \$</div>	6 months - 2 yrs
Curb Bulbs	<div>\$\$\$</div>	1 - 2 years
Crossing island	<div>\$ - \$\$\$</div>	1 - 2 years
RRFB Crossing Beacon <ul style="list-style-type: none">Beacon installation onlyBeacon installation with curb ramps and other safety features	<div>\$\$\$</div> <div>\$\$\$\$</div>	1 - 2 yrs
PHB Crossing Beacon	<div>\$\$\$\$</div>	1 - 2 years
Signalized intersections improvements <ul style="list-style-type: none">Leading pedestrian interval, adjusting signal timing, No Turn on Red signs, closing slip lanes with short-term materials, adding pedestrian countdown signalsLeading pedestrian interval with major equipment or rewiring, protected left turn phase for drivers, crossing and safety improvements at slip lanesClosing a slip lane by reconstructing the sidewalk	<div>\$</div> <div>\$</div> <div>\$\$\$</div>	6 months - 1 yr 1 - 2 years 2 - 3 years

Primary Investment Routes Together with schools and families, Safe Routes to School has identified walking and biking routes for every public Portland K-8 school. These routes are designed to be convenient, safe, and comfortable for children walking to school, and aim to serve as many children as possible.

RESOURCES & REFERENCES



General Resources:

AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities, 2015
FHWA Proven Safety Countermeasures
NACTO Urban Bikeway Design Guide
NACTO Urban Street Design Guide
Pedestrian and Bicycle Information Center
Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE)
Portland Bureau of Transportation (PBOT)
Traffic Safety Resource: <https://www.portlandoregon.gov/transportation/68872>
Safe Routes to School Guide: Engineering <http://guide.saferoutesinfo.org/engineering/>

Sidewalks and Alternative Walkways

Sidewalk Repair: Frequently Asked Questions <https://www.portlandoregon.gov/transportation/article/463378>
Mandatory Sidewalk Repair <https://www.portlandoregon.gov/transportation/article/301362>

Paved Paths

NACTO Urban Bikeway Design Guide

Marked Crosswalks

Pedestrian Safety Guide and Countermeasure Selection System: Marked Crosswalks and Enhancements
Pedestrian Safety Guide and Countermeasure Selection System: Raised Pedestrian Crossings
Crosswalk Guide for Portland <https://www.portlandoregon.gov/transportation/article/594882>

Warning Signs

Manual for Uniform Traffic Control Devices

Stop Signs

Manual for Uniform Traffic Control Devices
AASHTO Guide for the Development of Bicycle Facilities

Parking Setbacks at Crosswalks

Office of Safety, Federal Highway Administration. Remove/Restrict Parking. <https://safety.fhwa.dot.gov/saferjourney1/library/countermeasures/56.htm>
Institute of Traffic Engineers UnSignalized Intersection Improvement Guide, 2015. <http://www.ite.org/uiig/>

Curb Bulbs

Pedestrian Safety Guide and Countermeasure Selection System: Curb Extensions
NACTO Urban Street Design Guide: Curb Extensions
AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities, 2015

Crossing Islands

Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE): Crossing Islands
NACTO Urban Bikeway Design Guide: Median Refuge Island
FHWA Proven Safety Countermeasures: Medians and Pedestrian Crossing Islands

RRFB Crossing Beacons

Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE): RRFB
FHWA Intersection Safety Technologies

PHB Crossing Beacons

Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE): PHB
FHWA Intersection Safety Technologies

Signalized Intersection improvements

Safe Routes to School Guide: Traffic Signals http://guide.saferoutesinfo.org/engineering/traffic_Signals.cfm
Pedestrian and Bicycle Information Center: Improved Right Turn Slip-Lane Design http://www.pedbikeinfo.org/planning/facilities_Crossings_sliplane.cfm

School Zones

Portland Bureau of Transportation: School Flashing Beacons <https://www.portlandoregon.gov/transportation/article/193010>

Speed Bumps & Tables

Safe Routes to School Guide: Speed Humps http://guide.saferoutesinfo.org/engineering/speed_humps.cfm
On SE Clinton, PBOT finishes permanent diverter and readies new 'bike-friendly' speed bumps. Bike Portland. <https://bikeportland.org/2017/01/26/on-se-clinton-pbot-finishes-permanent-diverter-and-readies-new-bike-friendly-speed-bumps-214976>
Pedestrian and Bicycle Information Center: Speed Humps/Tables. http://www.pedbikeinfo.org/planning/facilities_calming_speedhumps.cfm

Mini Circles

NACTO Urban Street Design Guide: Mini Roundabout
Safe Routes to School Guide: Neighborhood Traffic Circles. http://guide.saferoutesinfo.org/engineering/neighborhood_traffic_Circles.cfm

Lighting

PBOT Signals and Streetlights <https://www.portlandoregon.gov/transportation/58965>
Active Transportation Alliance
NACTO Urban Street Design Guide
Project For Public Spaces

Creative Street Design

NACTO Urban Street Design Guide: Interim Public Plazas



SAFE ROUTES to School



PBOT
PORTLAND BUREAU OF TRANSPORTATION

SafeRoutesPortland.org