STREET DESIGN GUIDELINES

INTRODUCTION

The White Salmon Transportation System Plan is focused on improving walkability, bikability, and access in White Salmon. These Street Design Guidelines describe a system of street classification, known as a typology, and include a design toolbox with elements that support connectivity and a low-stress experience for people traveling in White Salmon.

STREET TYPOLOGY

The Federal Highway Administration (FHWA) uses functional classification to define streets based on the level of mobility and access they provide people traveling in automobiles. The State of Washington Department of Transportation (WSDOT) applies functional classifications to public roads statewide. The TSP street typology adds another layer beyond functional classifications for streets in White Salmon. This typology considers land use and the experience of people using all modes, including walking and bicycling. The street types described here are meant to capture the unique characteristics of streets in White Salmon.

The TSP street typology is the basis for street design guidelines. These guidelines set standards while still allowing flexibility in how each individual street is designed. Each street type includes a cross-section with recommended dimensions and design elements such as sidewalks, bike facilities, and green infrastructure. The typology and design guidelines can be applied to existing streets when they are redesigned and to new streets as they develop.

Main Street

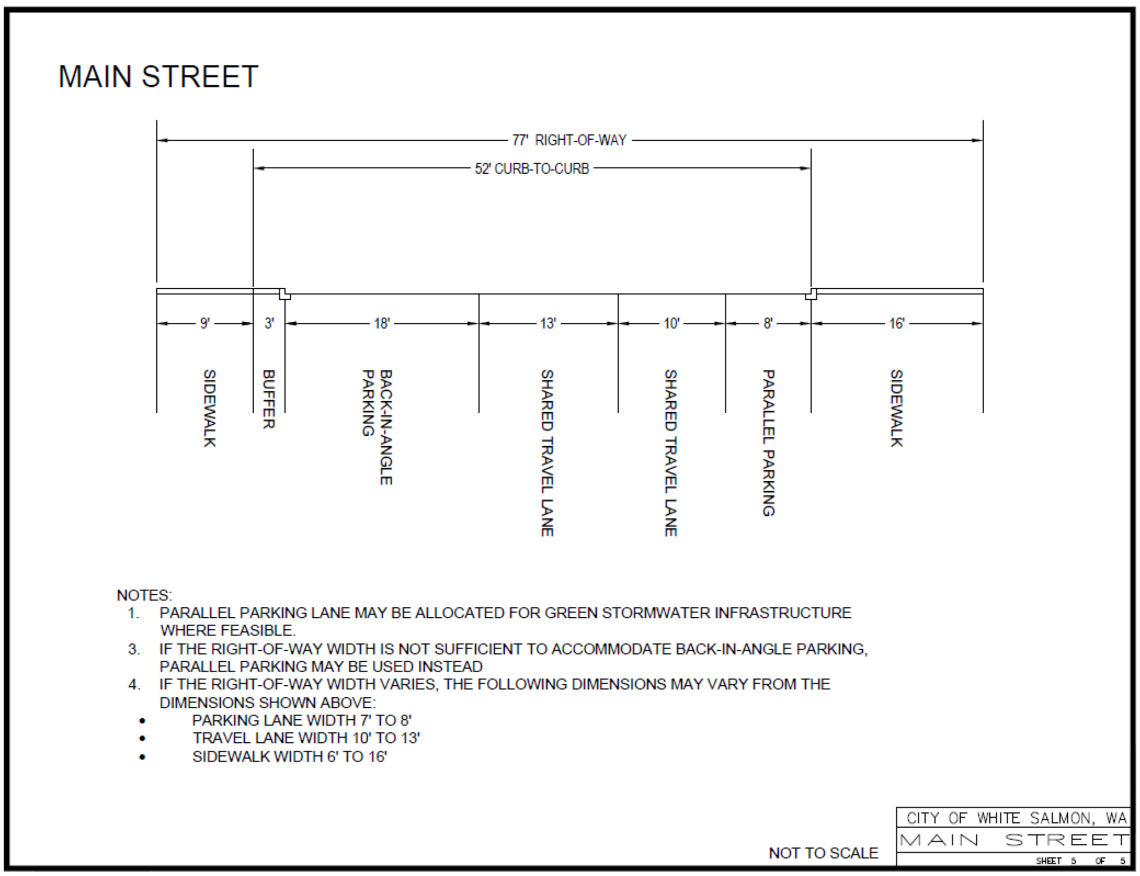
Design Objectives

- The main activity spine of the city
- Wide sidewalks for pedestrian access and lingering
- Distinct, activated streetscapes with furnishings and plantings
- On-street parking for business access

Example Locations

- Jewett Blvd in downtown White Salmon

Figure 1 Typical Cross-Section for Main Street



Regional Thoroughfare

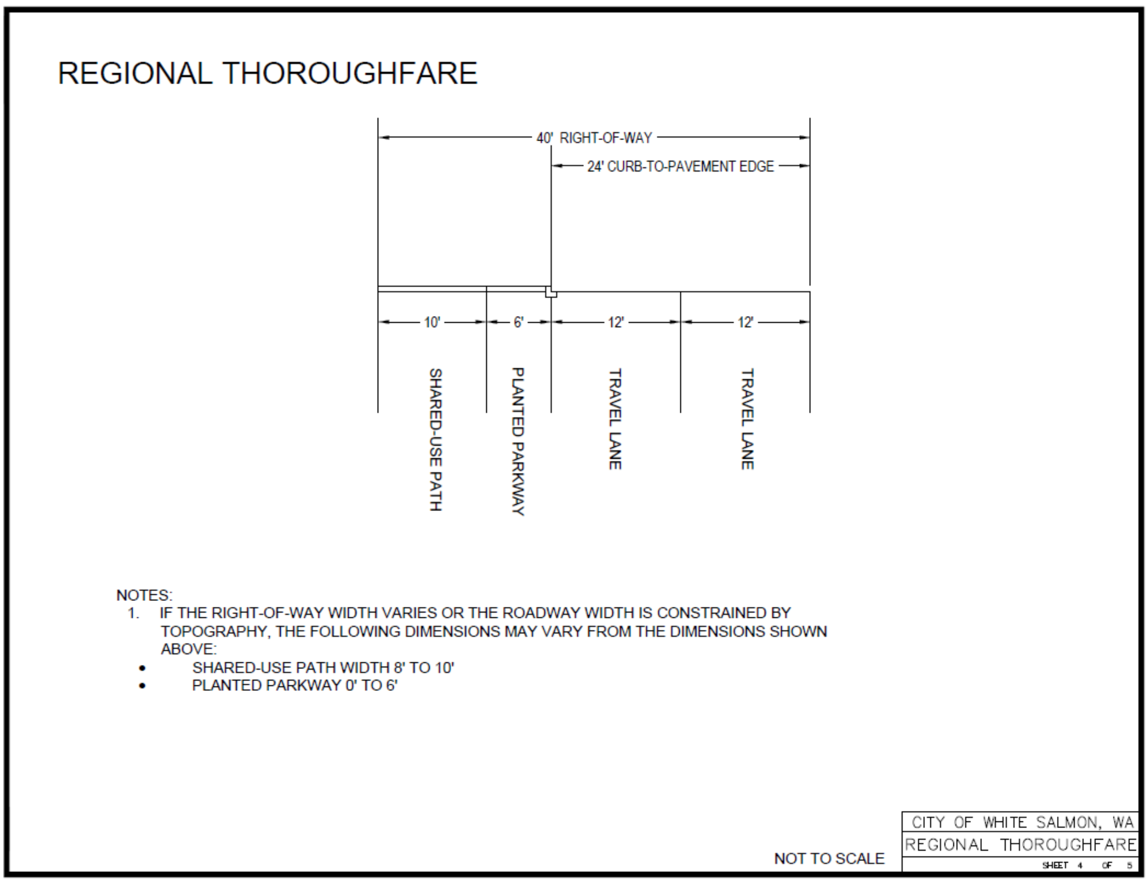
Design Objectives

- Provides regional access
- Moves people using all modes
- Biking and walking facilities are separated from automobiles

Example Locations

- Jewett/SR-141 outside of downtown
- Loop Road

Figure 2 Typical Cross-Section for Regional Thoroughfare



Connector Street

Design Objectives

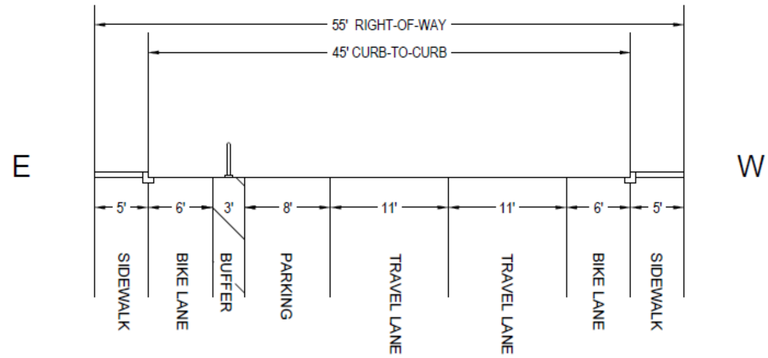
- Provides access across the city for all travel modes
- Slow vehicular travel speeds through design
- Bike infrastructure could include protected facility, shared use path, or bike lanes
- Safe pedestrian crossings at convenient intervals
- Integrate green stormwater infrastructure

Example Locations

- Main Ave
- Estes Ave

Figure 3 Typical Cross-Section for Connector Street on the Bicycle Network

CONNECTOR STREET - BICYCLE

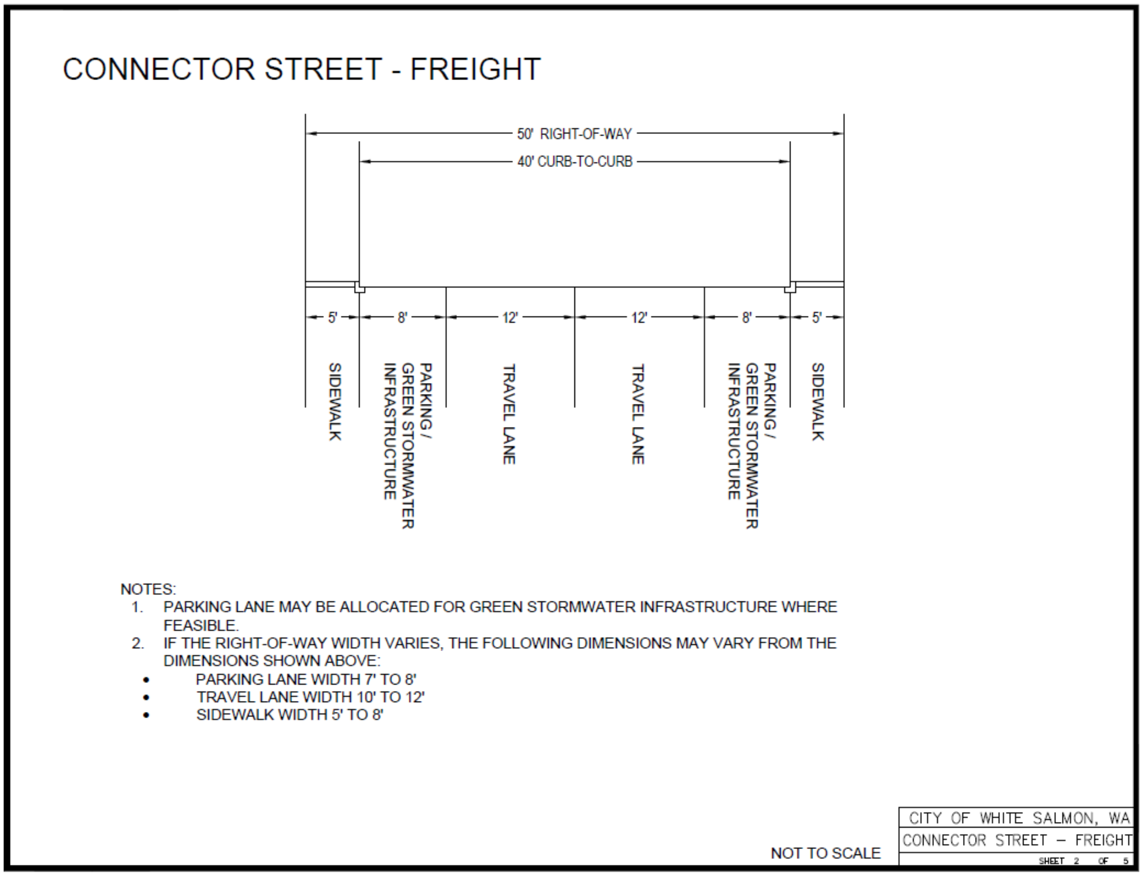


NOTES:
1. PARKING LANE MAY BE ALLOCATED FOR GREEN STORMWATER INFRASTRUCTURE WHERE FEASIBLE.
2. IF THE RIGHT-OF-WAY WIDTH VARIES, THE FOLLOWING DIMENSIONS MAY VARY FROM THE DIMENSIONS SHOWN ABOVE:
   - PARKING LANE WIDTH 7' TO 8'
   - TRAVEL LANE WIDTH 10' TO 12'
   - SIDEWALK WIDTH 5' TO 10'

NOT TO SCALE

CITY OF WHITE SALMON, WA
CONNECTOR STREET – BICYCLE
SHEET 3 OF 5

Figure 4 Typical Cross-Section for Connector Street on the Freight Network



Neighborhood Street

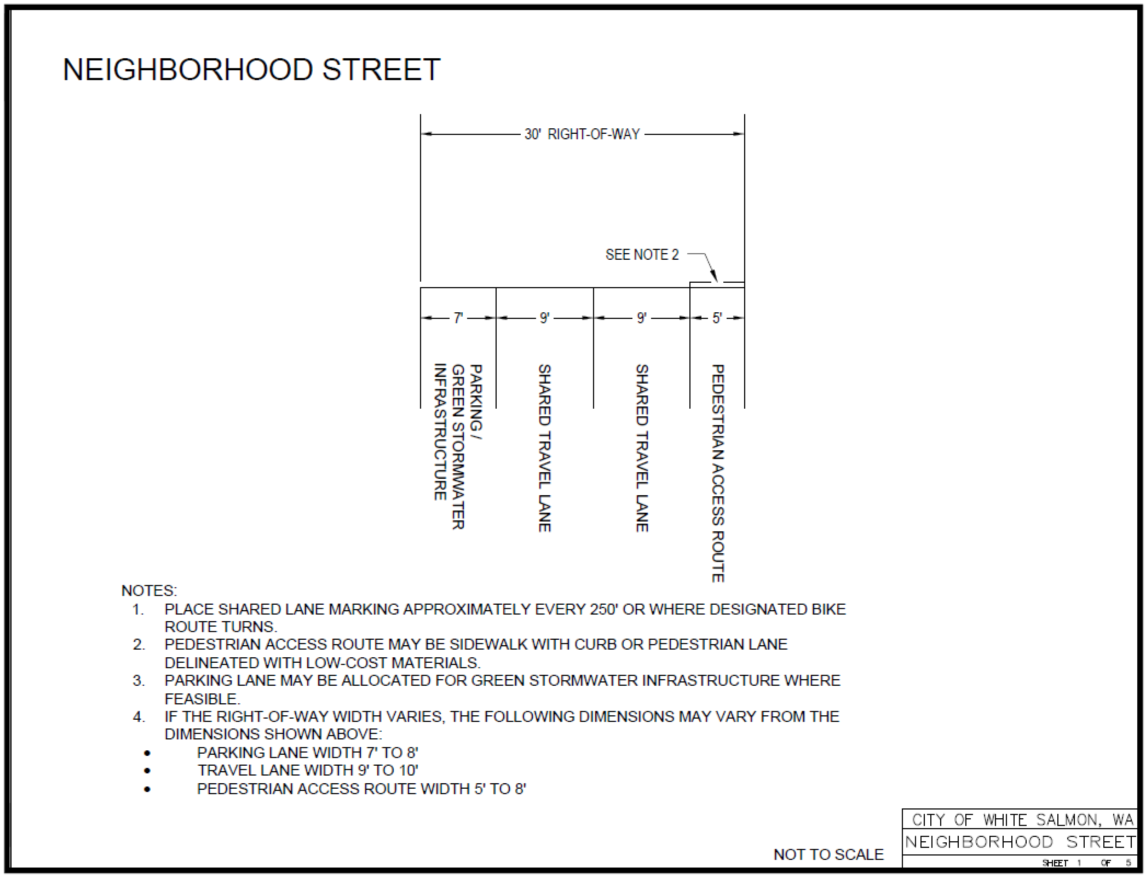
Design Objectives

- Provide access to homes and community destinations
- Low vehicular volumes
- Slow vehicular travel speeds through traffic calming
- Safe pedestrian crossings
- Bicycles can be accommodated in the travel way intermixed with slow moving traffic

Example Locations

- Lincoln St
- Hood St

Figure 5 Typical Cross-Section for Neighborhood Street



Street Typology and Functional Classifications

White Salmon Street Type	Federal Functional Classification
Main Street	Arterial/Highway
Regional Thoroughfare	Arterial/Highway or Major Collector
Connector Street	Major Collector
Neighborhood Street	Minor Collector or Local Access Street

DESIGN TOOLBOX

All photos are from Nelson\Nygaard unless otherwise noted.

The Design Toolbox describes improvements that the City of White Salmon could make to streets and sidewalks to complement the basic elements that are shown in the cross-section for each street type in the previous section. Many of these elements are referenced in the TSP project list.

Streets

Pedestrian Lane

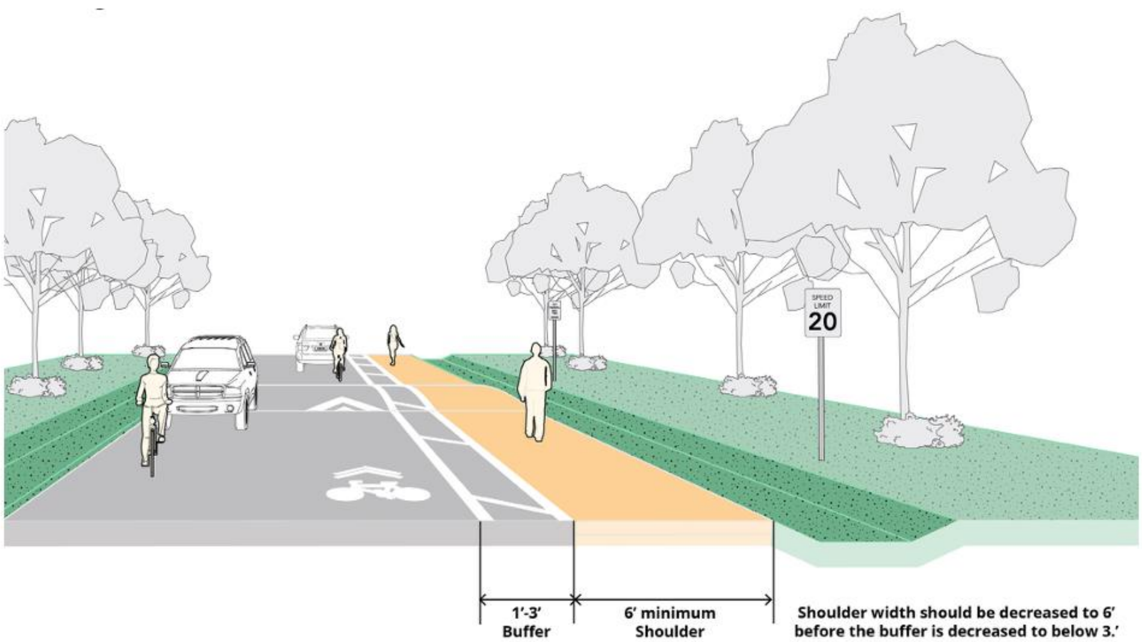


Figure 6 Portland PDG, pg. 45. Slow Safer Shoulder

Description

Pedestrian lanes are an interim or temporary type of walkway that can be applied to fill gaps in the walking network where a sidewalk is not feasible in the near-term. There are two main types: a Slow Safer Shoulder, which is a paved roadway shoulder with lane striping to protect pedestrians from traffic, and a Protected Safer Shoulder, which is a paved roadway shoulder that separates pedestrians from traffic with a physical barrier. Seattle is an example of a city that allows this treatment under certain circumstances, including topographic conditions and/or mature vegetation that does not allow for traditional sidewalks.

Design considerations

Slow Safe Shoulders should be installed on streets with traffic speeds at 20 mph or lower and vehicle volume of 3,000 ADT or fewer. The minimum walkway width should be 6 feet of clear space, with narrower spaces only to be used on a case-by-case basis. The shoulder must be delineated with a broken lane line with 3 feet line segments and 6 feet gaps and can include an additional solid white line for clearer separation. However, the roadway should not be marked. No street parking is allowed. Tactile warning surface indicators should indicate cross areas and side street crossings should be marked.

Protected Safer Shoulder considerations are like those of Slow Safe Shoulder, but Protected Safer Shoulders can be applied on larger streets with traffic speeds up to 35 mph and no ADT limit. They must have a vertical delineator, which likely would be a bollard but could be a wheel stop or extruded curb. Optional elements include on-street parking or a directional tactical edge away from roadway using rumble strips, thickened MMA/thermoplastic, or roadside bioretention to enhance safety conditions.

Street type it can be applied to

- Neighborhood Street
- Connector Street

Design guidance references

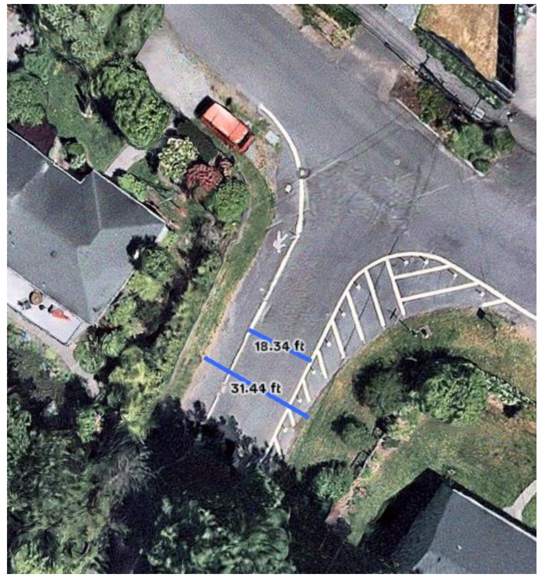
- Seattle Right-Of-Way Improvements Manual
- PBOT Pedestrian Design Guide
- FHWA Small Town and Rural Multimodal Networks

Relative cost

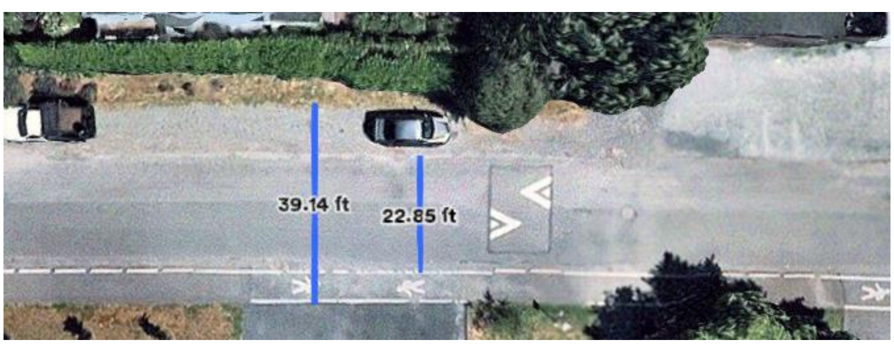
$

Examples

19th Ave NE between NE 130th Pl and NE Brockman Pl, Seattle, WA



NE 113th St between 34th Ave NE and 35th Ave NE, Seattle, WA



Bike Boulevard

Description

Bike boulevards are a type of bike facility where people bicycling share the travel lane with automobiles. A low-stress environment for people bicycling is accomplished through signs, pavement markings, and traffic calming elements to manage automobile speeds and volumes. Bike boulevards are appropriate for streets with maximum traffic volumes of about 3,500 daily vehicles and speeds of no more than 25 mph, according to the Washington State Department of Transportation (WSDOT). The desired condition for a bike boulevard is 1,500 or fewer daily vehicles and speeds of 20 mph.

Design considerations

Bike boulevards should be designed so that local streets can be enhanced to create safe options for people riding bikes. There are eight types of design treatments that can be used as safety enhancements.

1. Route planning and wayfinding
2. Signs and pavement markings
3. Speed management
4. Volume management
5. Minor street crossings
6. Major street crossings
7. Offset crossings
8. Green infrastructure

Street type it can be applied to

- Neighborhood Street

Design guidance references

- WSDOT Design Manual m22-01, Chapter 1520 Bicycle Facilities
- NACTO Urban Bikeway Design Guide
- FHWA Small Town and Rural Multimodal Networks

Relative cost

$ (pavement markings) - $$$$ (green infrastructure)

Bike Lane

Description

Bike lanes are spaces reserved for people biking through striping, pavement markings and signage. Bike lanes are used to protect people biking from vehicle traffic and people walking from people biking. Bike lanes allow for an increase in bicycle traffic. According to WSDOT, conventional bike lanes should be installed when daily traffic volumes are less than 7,500 vehicles and speeds are between 25 and 30 mph. The ideal conditions for a conventional bike lane are when daily traffic volume is between 1,500 and 3,000 vehicles and speeds are less than 25 mph. The addition of a striped buffer at least 18 inches wide is recommended for bike lanes on streets with traffic volumes between 3,000 and 6,000 daily vehicles.

Design considerations

Bike lanes are usually installed between the travel lane and curb, road edge, or parking lane. Parking lane width should always be minimized to favor the bike lane. A desirable bike lane width is 6 feet. A bike lane next to a parking lane must be at least 5 feet. A bike lane next to a guardrail or other physical boundary must increase by 2 feet. There must be a 6-to-8-inch solid white lane marking to indicate the separation between the travel lane and bike lane.

Street type it can be applied to

- Main Street
- Connector Street
- Neighborhood Street

Design guidance references

- WSDOT Design Manual m22-01, Chapter 1520 Bicycle Facilities
- NACTO Urban Bikeway Design Guide

Relative cost

$-$$

Protected Bike Lane

Description

Protected bike lanes have the skeletal structure of conventional bike lanes with added physical protection from vehicle traffic provided by a vertical buffer. Protected bike lanes offer dedicated and protected space, eliminated risk from collisions with vehicles, and prevention from double-parking. Protected bike lanes should be installed on streets with traffic volumes above 8,000 daily vehicles and speeds of 35 to 50 mph, according to WSDOT. NACTO guidance recommends protected bike lanes when daily traffic volume is greater than 6,000 vehicles and speeds consistently exceed 25 mph.

Design considerations

The bike lane itself must be at least 5 to 7 feet wide and the physical barrier between the bike lane and parking or vehicle traffic must be at least 3 feet wide. Existing pavement and drainage as well as parking lanes can be used as the physical barrier. Bike only markings or legends must be marked along the bike lane. Special attention must be given to transit stops along the bike lane to ensure safety for pedestrians and bicyclists.

Street type it can be applied to

- Regional Thoroughfare
- Main Street
- Connector Street

Design guidance references

- WSDOT Design Manual m22-01, Chapter 1520 Bicycle Facilities
- NACTO Urban Bikeway Design Guide
- FHWA Small Town and Rural Multimodal Networks

Relative cost

$-$$$

Advisory Bike Lane

Description

Advisory bike lanes are wide bike lanes used on streets that are too narrow for dedicated bike lanes, have low vehicle traffic (5,000 or fewer ADT) and 30 mph or lower speeds. Vehicles can use advisory bike lanes to pass other vehicles safely and then return to the center lane.

Design considerations

Streets with advisory bike lanes should be at least 16 feet wide; however, there are case studies with narrower roads. This width includes one vehicle travel lane and one bike lane on either side. They should be accompanied by signage indicating two-way traffic warning sign or yielding behavior: both between vehicles and bikes and vehicles with each other when they are trying to pass each other. There should not be a marked center line, unless for a short period of time to demarcate opposing traffic flows at specific locations. Advisory Bike Lanes are best implemented when there is a clear sight distance. When there are obstacles, such as at-grade crossings, around curves, over hills, and at bridges, the road should be widened enough to make space for conventional bike lanes. Advisory Bike Lanes must use bike lane pavement markings that should be continued through the crossings of minor intersections but stopped 50 feet before intersections controlled by stop signs or traffic signals.

FHWA has approved advisory bike lanes as an experimental treatment and several jurisdictions currently have them in place. However, FHWA is not considering new requests for advisory bike lanes as of this writing.

Street type it can be applied to

- Main Street
- Neighborhood Street

Design guidance references

- PBOT Advisory Bike Lanes
- NACTO Edge Lane Roads
- FHWA MUTCD FAQ Traffic Control for Bicycle Facilities
- Alta Planning + Design: Lessons Learned, Advisory Bike Lanes in North America

Relative cost

$

Guardrail

Photo from FHWA.

Description

Guardrails are used to protect drivers after they leave the roadway. They are best used when installed in places where there are embankments, side slopes, tree linings, bridge piers, retaining walls, or utility poles that lead to more severe outcomes when a car leaves the roadway.

Design considerations

Guardrails should be installed where high speeds occur and the conditions noted above make roadway departure crashes more severe; however, the guardrail can also encourage vehicles to drive at speeds over the speed limit. The guardrail has two main components: the guardrail face and the end terminal. The guardrail face is used to redirect the vehicle and the end terminal is used to the absorb the impact of a vehicle hitting the guardrail. To do so, the end terminal must be treated, most commonly with an energy-absorbing end treatment. This will allow the impact slide down the guardrail face.

Street type it can be applied to

- Regional Thoroughfare
- Connector Street

Design guidance references

FHWA Roadway Departure

Relative cost

$

Public Art and Streetscape

Photo from City Repair Portland. 8th and Holman.

Description

Public art and streetscaping enliven the experience of a neighborhood, provide an opportunity for cultural expression, and encourage people to connect with each other and use public space in new ways. Many communities have created "livable streets" or "open streets" programs to rethink the use of public right-of-way and create safe, welcoming active spaces in neighborhoods. Livable or open street programs usually include:

- Murals and other public art, including street paintings
- Street furniture and amenities such as temporary or permanent seating, planters, and pedestrian-scale lighting

Design considerations

Streetscaping can include elements like light poles, benches, trash receptacles, and planters. Street furniture should be placed on streets with high pedestrian numbers, popular gathering spaces, and a recreational role. Street furniture must be placed outside of the pedestrian through zone, which must be at least 5-feet wide.

Public art should be located to be pedestrian amenity and enhance the park, plaza, or walkway where it is located. Art needs to ensure it does not inhibit accessibility and detectable warning strips may be necessary. Street and original art murals cannot use moving structural elements, light elements of any kind, and design that would make the art appear to have moved or changed. Some cities have programs that allow community members to design and paint murals directly on the pavement of neighborhood streets, typically. In Portland, PBOT's Block Party Program allows for street closure to create street paintings after permit is submitted.

Street type it can be applied to

- Main Street
- Neighborhood Streets
- Shared Streets

Design guidance references

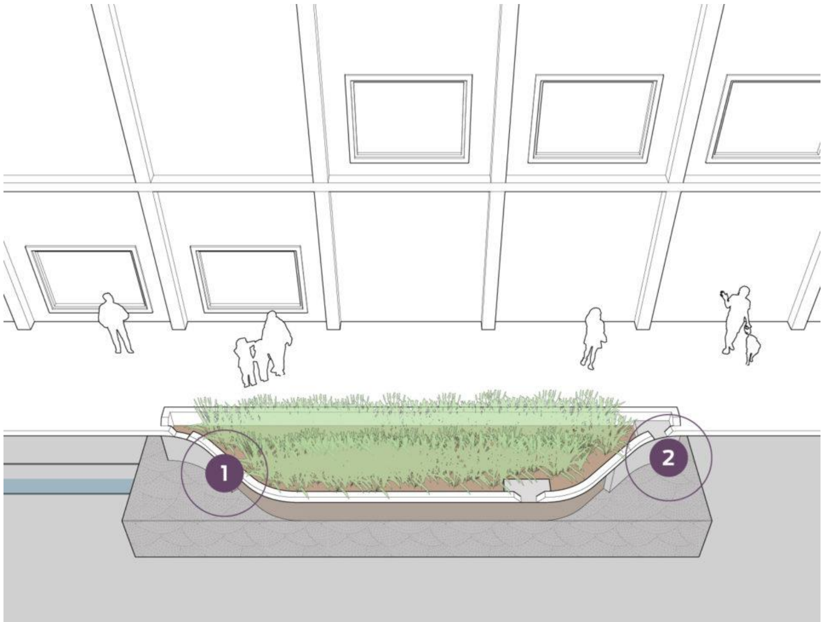
- City Repair
- SF Better Streets, Public Art
- SF Better Streets, Street Furniture
- PBOT Healthy Block Permit
- PBOT News Release
- Portland Public Street Plazas
- Portland City Code

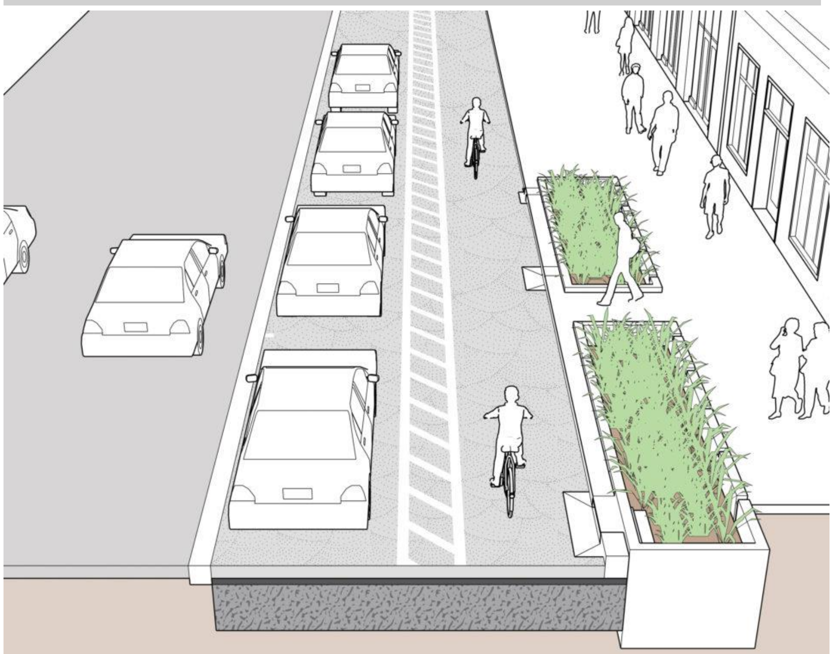
Relative cost

Infrastructure	Description	Median	Average	Min. Low	Max. High	Cost Unit	# of Sources (Observations)
Street Furniture	Street Trees	$460	$430	$54	$940	Each	7(7)
Street Furniture	Bench	$1,660	$1,550	$220	$5,750	Each	15(17)
Street Furniture	Bus Shelter	$11,490	$11,560	$5,230	$41,850	Each	4(4)
Street Furniture	Trash/Recycling Receptacle	$1,330	$1,420	$310	$3,220	Each	12(13)

Figure 7 Street furniture estimated costs, pedbikesafe.org

Green Infrastructure





Both photos from NACTO.

Description

Green infrastructure is a term for elements that capture, filter, and infiltrate stormwater. Green infrastructure that can be installed in streets and public right-of-way includes pervious pavement, which allows water to flow through an otherwise impermeable surface, and bioretention planters, which capture water runoff from impermeable surfaces. Green infrastructure also helps enhance multi-modal safety and accessibility when it is used as a buffer between automobile, bicycle, and/or pedestrian travelways, achieving both environmental and mobility goals.

Design considerations

Many different green infrastructure elements may be used in combination. It is important to consider context-specific ecological needs and the placement of underground utilities when locating and designing green infrastructure. Maintaining these facilities may require specialized expertise and equipment.

Pervious pavement design must consider the ability to both support traffic and store water long-term. Pervious concrete must have a depth between 4-5 feet for sidewalks or pathways, 5-6 inches for residential driveways and light duty parking lots, and 8-10 inches for heavier truck areas. Colder climate areas that use pervious pavement must account for biodegradable, non-corrosive de-icing agents and moderation of salt application.

When designing bioretention elements, considerations include: sizing the bioretention element to fit the available space and meet water absorption needs; maintaining a minimum of 3 vertical feet between the bottom of the infiltration method and water table or bedrock layer; choosing soil and plantings that support drainage and filtration needs; siting the stormwater infiltration system at least 100 feet from any sensitive public water supply.

Street type it can be applied to

- Main Street
- Connector Street
- Neighborhood Street

Design guidance references

- NACTO Pervious Pavement
- NACTO Urban Street Stormwater Guide
- Washington Pervious Concrete
- NACTO Case Study, Street Edge Alternatives Street Pilot

- City of Seattle, Broadview Green Grid Brochure

Relative cost

$-$$$

Crossings

Curb extension

Description

A curb extension is a section of sidewalk or landscaped area extending into the roadway at an intersection or mid-block crossing that physically narrows the roadway. They are used to create safer, shorter crossings for pedestrians; slow traffic speeds around corners; and/or increase pedestrian zone space for street furniture, benches, plantings, and street trees. These are also referred to as curb bulb-outs or bump-outs. Curb extensions on streets that accommodate transit vehicles will need to carefully consider the turning radii of those vehicles. Regardless of street type, curb extensions may only be used where a curb lane is present and used for parking, parklets, or loading, not bicycle or motor vehicle travel. Curb extensions are particularly beneficial in commercial frontage contexts where pedestrian volumes are high, where traffic calming is desired, and on very wide streets.

Design considerations

Curb extensions should not narrow any bike or general traffic lanes to an unsafe width. Extensions should preserve one to two feet of shy distance between the curb face and the first travel lane or bicycle lane. When applied to streets with on-street parking, they are typically six to seven feet wide; alternatively, extensions can shadow the length of the parking stall if parking is on the diagonal. Corner or mid-block extensions with crosswalks should be at least as wide as the crosswalk, and ideally extend to the stop bar. The curve of the extension must fit outside of any crosswalks. Extensions are intended to narrow pedestrian crossing distance and slow traffic speeds. To accomplish this, maintain tight turning radii no greater than 20 feet. The effective turning radius may be wider.

Street type it can be applied to

- Regional Thoroughfare
- Main Street
- Neighborhood Street

Design guidance references

- NACTO: Urban Street Design Guide, 2013
- FHWA: Small Town and Rural Multimodal Networks, 2016, Chapter 2, Page 14
- AASHTO: Guide for the Planning, Design, and Operation of Pedestrian Facilities, 2004

Relative cost

$

Ped refuge island

Description

Median refuge islands are raised or physically separated areas within the roadway. They provide a safe landing zone for people walking and bicycling to use while crossing a street with multiple travel lanes. Median pedestrian and bicycle refuge islands make roadway crossings easier and safer by 1) limiting exposure to through moving vehicles; 2) enabling crossings to commence when there are gaps in traffic from one direction at a time; and 3) providing a safe stopping place in the middle of the roadway for pedestrians who are not able to make the complete street crossing during a pedestrian signal phase. They may be used at signalized and unsignalized intersections or mid-block crossings.

Design considerations

Pedestrian refuge islands are most often used on multi-lane roadways where a pedestrian must cross 44 feet or more of continuous roadway or where they are necessary to provide a safe crossing. Pedestrian refuge islands may also be used as a traffic calming or traffic channelization device, often in concert with mini roundabouts or acute angle right turns. Pedestrian refuge islands should be a minimum of eight feet deep, and preferably 10, to comfortably accommodate single pedestrians, pedestrians with strollers or assisted mobility devices, or people with bicycles.

Street type it can be applied to

- Regional Thoroughfare
- Connector Street

Design guidance references

- NACTO: Urban Street Design Guide, 2013
- AASHTO: Guide for the Planning, Design, and Operation of Pedestrian Facilities, 2004
- Federal Highway Administration: Small Town and Rural Multimodal Networks, Chapter 2: Mixed Traffic Facilities

Relative cost

$$

Pedestrian Crossing Signage

Description

Pedestrian Crossing Signage includes Yield Here to Pedestrian and In-Street Pedestrian Crossing signs. Yield Here to Pedestrian signs are used in advance of an unsignalized marked midblock crosswalk. In-Street Pedestrian Crossing signs are used to remind drivers of the right of pedestrians to cross at an unmarked crosswalk. They should not be used at signalized intersections. Signs should have a black legend, barring the red Stop or yellow

Yield sign symbols. They should be installed in addition to other safety crossing enhancements to prevent pedestrian crashes.

Design considerations

Yield Here to Pedestrians signs should be placed 20 to 50 feet before the nearest crosswalk line. In-Street Pedestrians signs can be used temporarily on a seasonal basis to prevent damage due to plowing operations.

Street type it can be applied to

- Main Street
- Connector Street
- Neighborhood Street

Design guidance references

- MUTCD FHWA Chapter 2B. Regulatory Signs
- FHWA Course on Bicycle and Pedestrian Transportation, Lesson 14
- PedBikeSafe: Pedestrian Safety Guide and Countermeasure Selection System

Relative cost

$

Rectangular rapid flashing beacon

Description

Rectangular Rapid Flashing Beacons (RRFBs) are devices using LED flashing beacons in combination with pedestrian and bicycle warning signs to provide a high-visibility strobe-like warning to drivers when pedestrians and bicyclists use a crosswalk. RRFBs can be used when a signal is not warranted at an unsignalized crossing. They are not appropriate at intersections with signals or "STOP" signs.

Design considerations

RRFBs should be used in conjunction with advance yield pavement lines and high-visibility crosswalks. They should be placed curbside on both sides of the road below the pedestrian crossing sign and above the arrow indication pointing at the crossing. If there is a pedestrian refuge or other type of median, an additional beacon should be installed in the median. A push button is used to activate the beacon, or another activation method used by the person to signal the intent to cross. The push button and other components of the crosswalk must meet all other accessibility requirements. RRFBs should be limited to locations with critical safety concerns and high-volume pedestrian crossings but may also be considered for priority bicycle route crossings and at locations with high volume pedestrian destinations on either side of a street without a nearby controlled crossing.

Street type it can be applied to

- Regional Thoroughfare
- Connector Street

Design guidance references

- NACTO: Urban Street Design Guide, 2013: Intersection Design Elements: Traffic Signals
- AASHTO: Guide for the Planning, Design, and Operation of Pedestrian Facilities, 2004: Section 4.1: Pedestrian Signals

Relative cost

$$

Traffic Calming

Chicanes


Both photos from NACTO.

Description

A chicane is a series of alternating curves or lane shifts that can force a motorist to steer back and forth out of a straight travel path. The curvilinear path is intended to reduce the speed at which a motorist is comfortable travelling through the feature. The lower speed could in turn result in a traffic volume reduction. The offset curb extensions allow for an increase of public space, space for amenities, and landscaping space.

Design considerations

When designing a chicane, it may be helpful to increase the number of signs and add striping to alert drivers to this change in lane pattern. If drainage is an issue, chicanes can be designed as bioswales or installed 1-2 feet away from curb, also called edge islands. Chicanes can be achieved through either a return angle of 45 degrees or a gradual taper, both to create an S-shaped roadway. These require a vertical reflector or something else that draw attention to them since they form the lateral shift. Chicanes can also be achieved with alternating on-street parking if there is parking demand high enough to always be occupied. It is preferred to install chicanes at a midblock location near a streetlight.

Street type it can be applied to

- Neighborhood Street

Design guidance references

- [NACTO: Urban Street Design Guide, 2013]

- FHWA Traffic Calming ePrimer

Relative cost

$$-$$$

Speed humps

Description

Speed humps are parabolic vertical traffic calming devices intended to slow traffic speeds on low volume, low speed roads. Speed humps are three to four inches high and 12–14 feet wide, with a ramp length of three to six feet, depending on target speed. Speed humps reduce speeds to 15–20 mph and are often referred to as “bumps” on signage and by the general public. They will be most common on lower order streets (local and residential). They may also be used on streets where traffic volumes are higher than desired or those that are used by cut-through traffic on a regular basis. Speed cushions achieve the same goals as speed humps but are installed on routes classified as key emergency response corridors. Speed cushions have cut-outs to allow for the wheels of the emergency vehicles to travel through and are flatter than speed humps.

Design considerations

Vertical speed control elements should be applied on streets with speeds limits less than 30 mph, and where there is higher than desired operating speeds. Vertical speed control elements should be accompanied by a sign warning driver of the upcoming device. Speed humps should not be placed in front of driveways or other significant access areas. They should be located where there is sufficient visibility and available lighting. Spacing for vertical speed controls should be determined based on the target speed of the roadway. Speed humps should be spaced no more than a maximum of 500 feet apart to achieve an 85th percentile speed of 25–35 mph. To achieve greater speed reductions, space speed humps close together.

Street type it can be applied to

- Main Street
- Neighborhood Street

Design guidance references

- NACTO: Urban Street Design Guide, 2013
- AASHTO: Guide for the Planning, Design, and Operation of Pedestrian Facilities, 2004
- AASHTO: Guide for the Development of Bicycle Facilities, 2012
- PBOT North Portland Traffic Calming Project

Relative cost

$

Diverters


Description

Diverters are physical or regulatory barriers that restrict motor vehicle access and movement. They may prevent turning or through movements or restrict access to local traffic only, while allowing passage of bicycle and pedestrian traffic. On bike boulevards, they are designed so people biking can continue on the road, but larger vehicles need to turn. This decreases traffic volumes. Diverters and medians can create opportunities for landscaping and street trees.

Design considerations

Sometimes called a "half street closure," semi-diverters prevent vehicles from crossing an intersection in one direction of a street while permitting traffic in the opposite direction to pass through. It is an alternative to one-way street operation for a block and it allows residents on the block limited two-way travel opportunity. A semi-diverter should be located at the end of a block to prevent vehicles from entering but allowing exits. A somewhat less common volume control measure, diagonal diverters are barriers installed across an intersection blocking through movement and are usually staggered to create circuitous routes through neighborhoods.

Street type it can be applied to

- Neighborhood street

Design guidance references

- AASHTO: Guide for the Planning, Design, and Operation of Pedestrian Facilities, 2004
- AASHTO: Guide for the Development of Bicycle Facilities, 2012
- FHWA: Small Town and Rural Multimodal Networks, Chapter 2: Mixed Traffic Facilities

Relative cost

$$

Mini Roundabouts


Description

Mini roundabouts are small traffic circles used at the intersection of local streets to slow the speed of traffic. They may or may not be used in conjunction with stop signs. Traffic circles provide advantages for all road users as they reduce the need for a full stop and enable continuous progression when conflicting traffic is not present. An ideal treatment for uncontrolled intersections, traffic circles can reduce vehicle speeds and crashes in low volume areas. They can be installed using simple markings or raised islands, but they also provide opportunities to include stormwater management facilities or pieces of art.

Design considerations

Regulatory and/or warning signage should be provided to remind traffic to proceed counterclockwise around the circle. Provide approximately 15 feet of clearance from the corner to the widest point on the circle. Landscaping medians reduce the impervious surface area in the roadway, allowing stormwater infiltration or retention in the exposed soil. Street trees or public art located in traffic circles should be placed and designed to avoid blocking sight lines. If plantings are incorporated, they should require minimal maintenance; access paths for maintenance crews should be incorporated into the overall design. A neighborhood partner may need to be identified for maintenance.

Street type it can be applied to

- Connector Street
- Neighborhood Street

Design guidance references

- NACTO: Urban Street Design Guide, 2013

- AASHTO: Guide for the Development of Bicycle Facilities, 2012
- ITE: Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010

Relative cost

$$

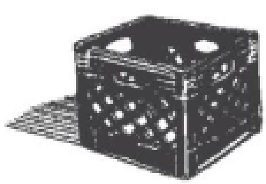
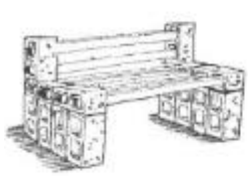
Temporary and Low-Cost Materials

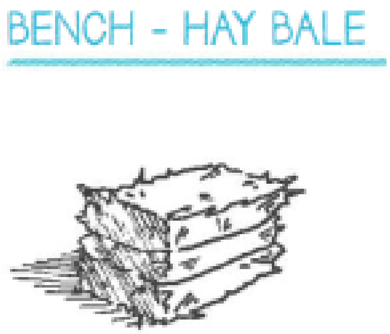
Lower budget and temporary design materials[1] allow safety improvements and street enhancements to be put in place quickly. They also have the advantage of allowing the city to easily make adjustments to the designs if needed.

	▪ Lowest cost option, can be donated ▪ For median islands: place 2-3 feet apart with a minimum of 6 feet for crosswalk and pedestrian access ▪ For curb extensions and plazas: place every 8 to 10 feet ▪ For mini roundabouts: use to demarcate perimeter, along with signs
	▪ Medium cost, approximately $40 per planter ▪ For bikeways: place 8 to 20 feet apart to create buffer, 1.5 feet minimum installation width needed ▪ For median islands: place 2-3 feet apart with a minimum of 6 feet for crosswalk and pedestrian access ▪ For curb extensions: place every 6 to 8 feet ▪ For plazas: place every 8 to 10 feet ▪ For mini roundabouts: use to demarcate perimeter, along with signs

[1] https://issuu.com/streetplanscollaborative/docs/tu-guide_to_materials_and_design_v1

GALVANIZED STEEL PLANTERS 	▪ High cost, approximately $90 per 4 feet or $150 per 6 feet ▪ For bikeways: place 8 to 20 feet apart to create buffer, 3 feet minimum installation width needed ▪ For curb extensions and plazas: place every 8 to 10 feet ▪ For plazas: place every 8 to 10 feet ▪ For mini roundabouts: use to demarcate perimeter, along with signs
LARGE POLYMER PLASTIC PLANTERS 	▪ Highest cost, approximately $441 for 34 inches by 27 inches or $785 for 42 inches by 33 inches ▪ For bikeways: place 8 to 20 feet apart to create buffer, 4 feet minimum installation width needed ▪ For curb extensions and plazas: place every 8 to 10 feet ▪ For plazas: place every 8 to 10 feet ▪ For mini roundabouts: use to demarcate perimeter, along with signs

MILK CRATES 	▪ Lowest cost, $4.75 for a square crate or $8 for a rectangular crate ▪ Can be used like wooden planters for barriers ▪ Can be used as seats for curb extensions and plazas
BENCH - CINDER BLOCK + WOOD 	▪ Medium cost, $1.25 per block and $5 to $10 per board ▪ Can be used as bench seats for parklets and curb extensions ▪ Place blocks every 4 feet for stability

	▪ Higher cost, $10 to $40 per bale ▪ Can be used as barriers for bikeways, pedestrian crossings, curb extensions, and plazas ▪ Can be used to define mini roundabouts ▪ Temporary, only lasts 1 to 3 days

Hillside Connections

Public Stairs

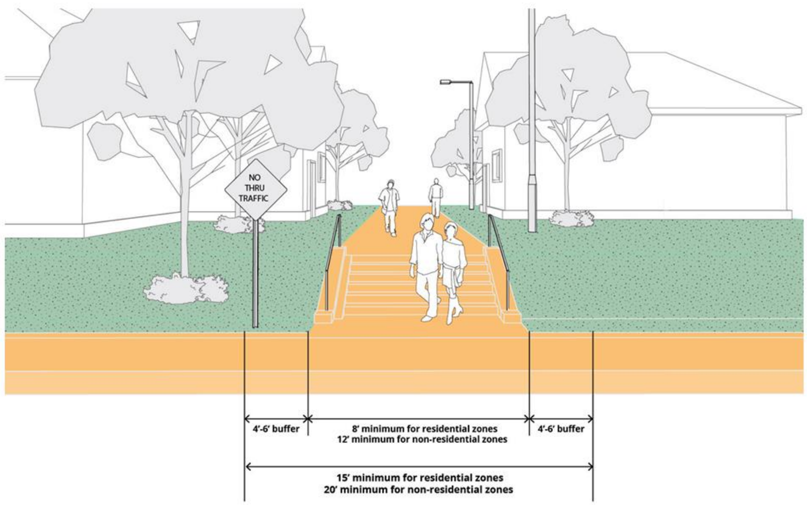


Figure B-34: Pedestrian/Bicycle Connection - stairway

Figure 8 Portland Pedestrian Design Guide, pg. 43

Description

Public stairs can be used as a pedestrian/bicycle connection where topography is too steep for a path. Stairs are typically short segments of walkway that are not adjacent to vehicular roadways, instead located midblock within rights-of-way. They could be used to meet pedestrian connectivity guidelines where direct alternative routes are not feasible. However, they are not accessible to people who use wheelchairs.

Design considerations

Stairs should be at least 8-feet wide for residential zones and at least 12-feet wide for non-residential zones. There should be a 4–6-foot buffer on each side of the bottom of the stairs, making the entire width including both buffer zones at least 15-feet wide for residential zones and at least 20-feet wide for non-residential zones.

Street type it can be applied to

Midblock within rights-of-way of any street type

Design guidance references

- Portland Pedestrian Design Guide, B.5.4.2 Pedestrian/Bicycle Connection
- Portland City Code, Chapter 17.88 Street Access

Relative cost

$$-$$$

Funicular/Aerial Tram

Description

Aerial trams and cable-operated funicular railways are a form of public transportation used to connect destinations that are separated by steep topography. They are an alternative to building out streets that would decrease safety and increase harm to the environment. Both aerial trams and railways are often associated with tourism, and most funiculars in the U.S and Europe are historic.

Design Considerations

The unique infrastructure and maintenance needs of these relatively rare forms of transportation can be expensive and require specialized experience. Both aerial trams and funiculars rely on cables for their operations that may be difficult to replace.

Examples

Portland's Aerial Tram connects the South Waterfront to Marquam Hill. South Waterfront serves other forms of active transportation like buses, shuttles, a streetcar, a cycle track, dense bike parking, and a pedestrian bridge. Marquam Hill serves a residential neighborhood, natural trails, and major hospitals. The aerial tram travels 3,300 linear feet and rise 500 feet during the 4-minute ride.

Photo from Go By Tram.

Los Angeles' Angels Flight Railway travels between Hill Street (downtown) and Grand Avenue on Bunker Hill (fashionable residential district). It serves as an historic landmark for the city.

Photo from Wikipedia.

Sandia Tram in Albuquerque travels above the Cibola National Forest and takes passengers to an elevation of 10,378 feet.

Photo from NewMexico.org

Design guidance references

- Go By Tram
- Angels Flight
- Los Angeles Conservancy
- Visit Albuquerque