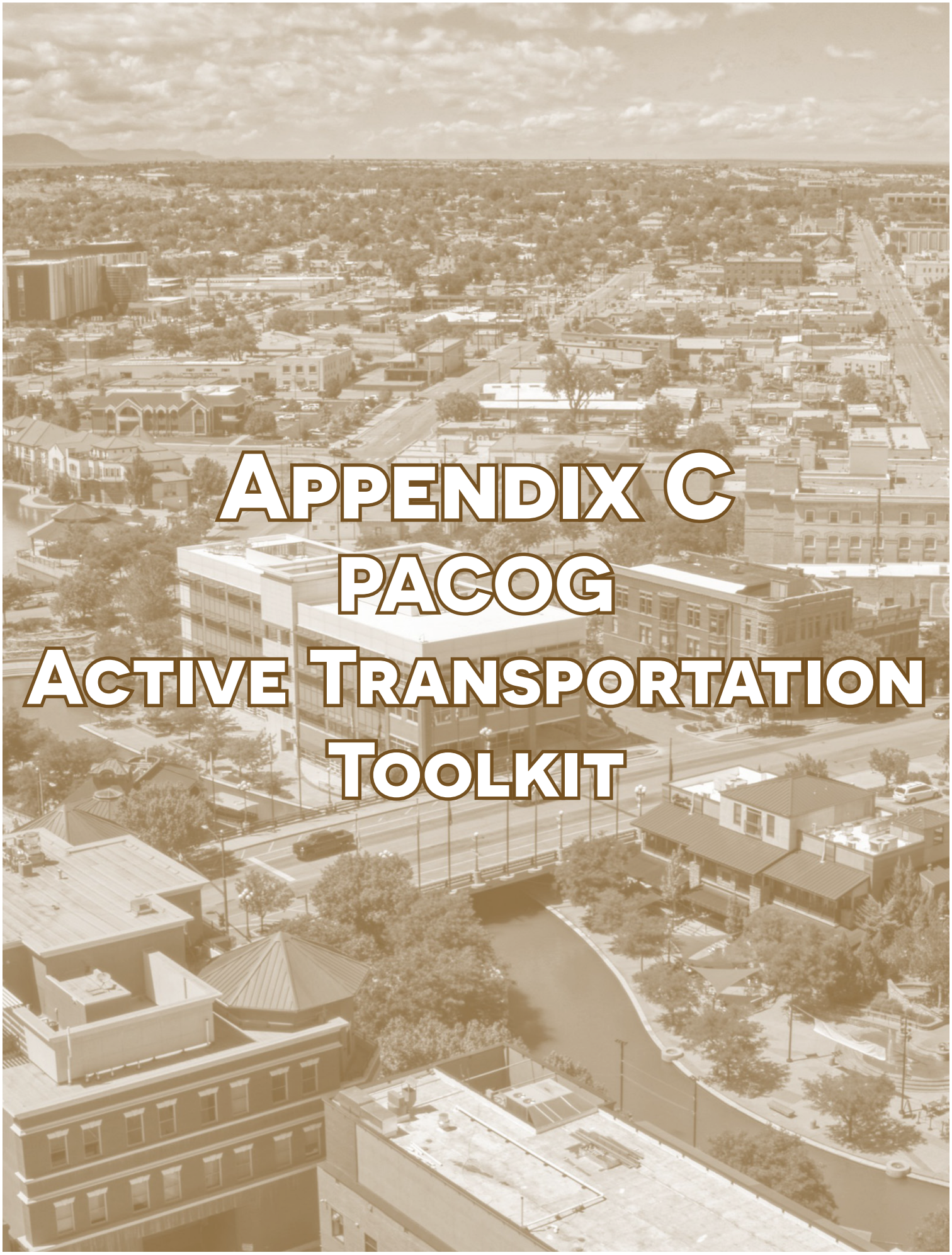


Appendix C
PACOG
Active Transportation Toolkit

Pueblo Area Active Transportation Toolkit

Introduction

The Pueblo Area Council of Governments (PACOG) Active Transportation Toolkit provides detailed information on the facilities and treatments recommended in the Bicycle and Pedestrian Master Plan. It includes the following sections:

- Bicycle facilities
- Pedestrian facilities
- Multi-use facilities
- Crossing and intersection treatments
- Active transportation amenities

This toolkit highlights best practices from state and national design guides. It is intended to be used for planning purposes and facility selection, and engineering-level design guidance should be referenced when designing and implementing active transportation facilities.

Design Resources

American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (5th Edition)

National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide (3rd Edition)

Federal Highways Administration (FHWA) Bikeway Selection Guide

FHWA Small Town and Rural Design Guide

FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

FHWA Pedestrian and Bicycle Safety Guide and Countermeasure Selection System

Bicycle Facilities

Selection Guidance

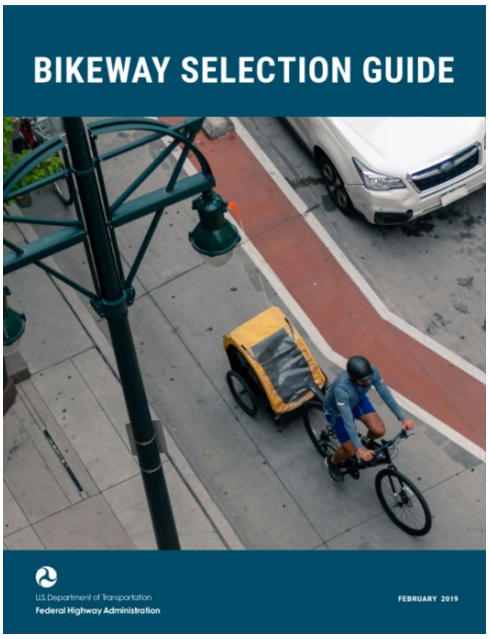
Selecting a bicycle facility type is context-dependent and determined by a variety of factors including motor vehicle speeds, traffic volumes, roadway width, and right-of-way constraints.

NACTO provides guidance on selecting between various bicycle facilities to provide an all ages and abilities network, with protected bicycle lanes serving higher volume, higher-speed roadways (Figure 1). FHWA also provides bicycle facility selection guidance, which specifies that bicycle lanes (preferably with a stiped buffer) are appropriate on some higher speed, higher-volume roadways (Figure 2).

FHWA Bikeway Selection Guide

The FHWA Bikeway Selection Guide provides additional information on choosing between various bicycle facilities in constrained situations. Examples include whether to build a narrow bicycle lane in constrained areas, choosing between one-way or two-way facilities, providing a shared-use path vs a separated bicycle lane, and when to downgrade a bicycle facility in favor of a parallel facility.

Agencies should implement NACTO guidance when feasible, as this guidance is geared towards all ages and abilities, ensuring that many different users will feel safe and comfortable on the facility. When implementing NACTO guidelines are not possible, FHWA's guidance can be used to implement bicycle facilities, although they may not be accessible for less confident bicyclists.



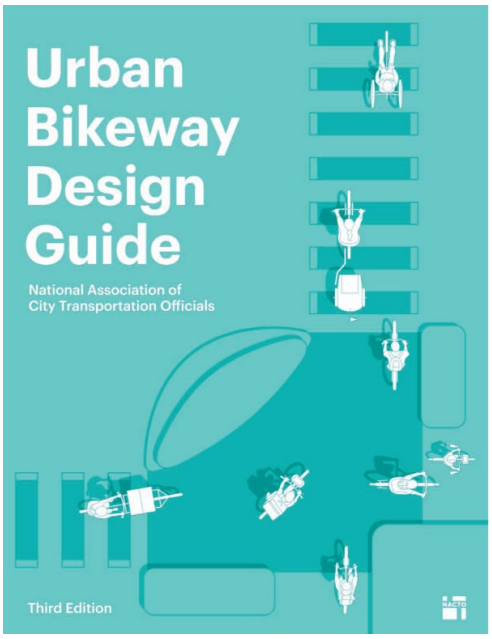


Figure 1: NACTO Guidance for Bikeways Selection

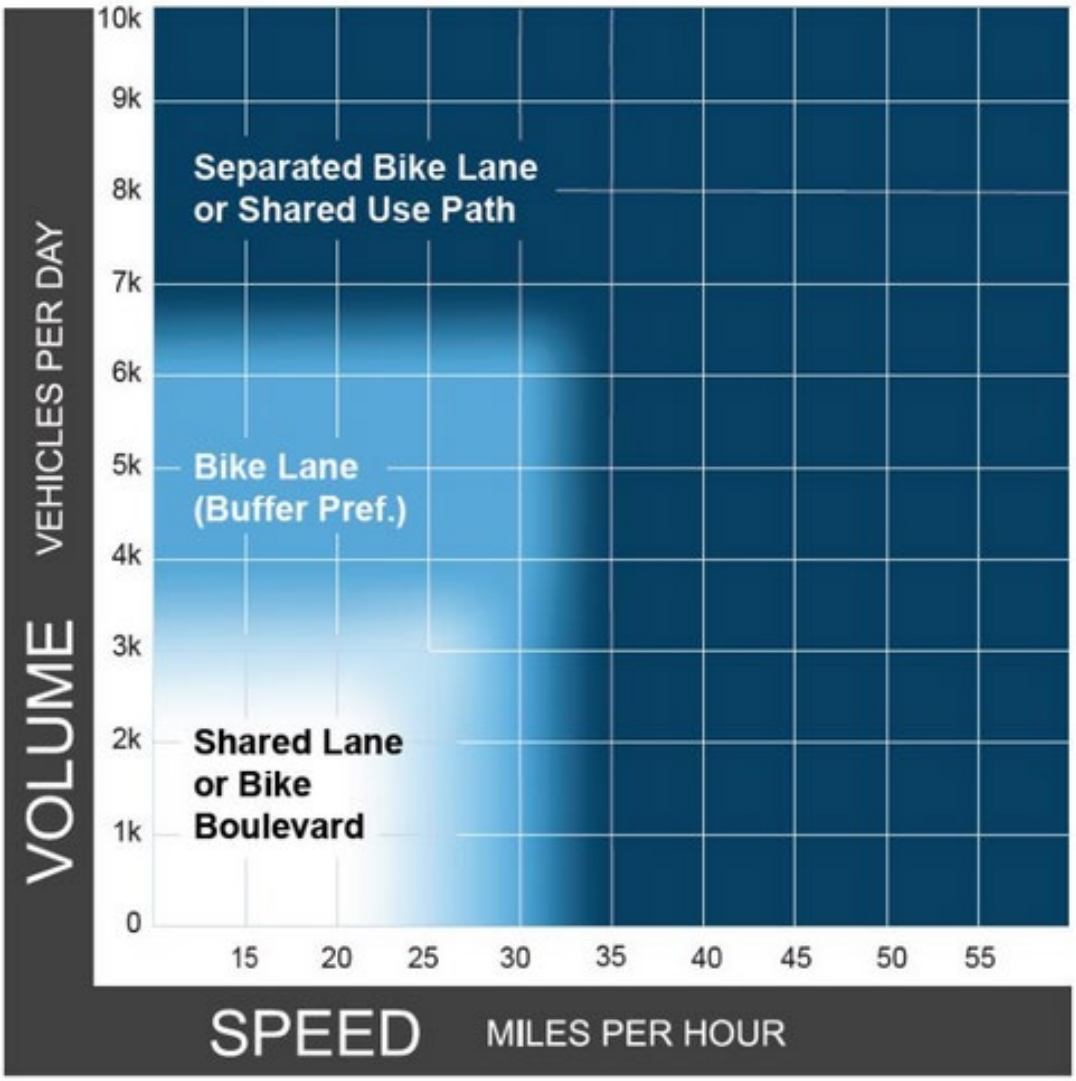
GUIDANCE FOR SELECTING ALL AGES & ABILITIES BIKEWAYS

Bikeway	Target Motor Vehicle Speed	Motor Vehicle Volume per day	Motor Vehicle Volume Peak Hour in Peak Direction
Protected Bike Lane	Any	Any	Any
Shared Spaces	≤10 mph ≤15 km/h	≤ 1,000	≤60
Bicycle Boulevard	≤ 20 mph ≤ 30 km/h	≤ 500 - 2,000	<50-150
Advisory Bike Lane	≤ 20 mph ≤ 30 km/h	≤ 500-2,000	<50-150
Constrained Bike Lanes	≤ 20 mph ≤ 30 km/h	≤ 1,500-3,000	≤ 300
Constrained Bike Lane *with Buffer*	≤ 25 mph ≤ 40 km/h	≤ 6,000	≤ 600

Source: NACTO Urban Bikeway Design Guide, 3rd Edition

Note: Not all infrastructure types listed in Figure 1 are currently found in the PACOG region.

Figure 2: FHWA Bikeways Selection Matrix for Urban, Urban Core, Suburban, and Rural Town Contexts

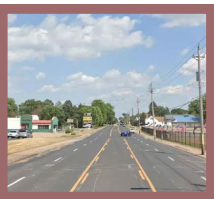
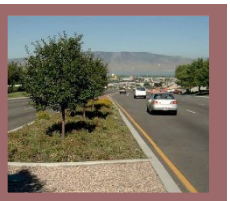


Source: FHWA Bikeway Selection Guide

Table 1 outlines the Level of Traffic Stress (LTS) for various bicycle facilities and roadway types. Agencies can reference this matrix during corridor design or restriping projects to select bicycle infrastructure aligned with the desired comfort level.

Wherever feasible, bicycle facilities should be LTS 1 and LTS 2, particularly along active transportation spines. LTS 3 facilities cater to a smaller subset of confident riders and should primarily be used where right-of-way constraints or feasibility issues prevent higher-comfort designs. LTS 4 facilities should be avoided, as high stress levels create unsafe conditions that deter the vast majority of cyclists.

Table 1: Bicycle Facility Selection Matrix by Level of Traffic Stress

Bike Facility Type	Local	Collector	 Minor Arterial	 Principal Arterial
Multiuse Path or Protected Bike Lane	1	1	1	1
Sidewalk Trail	2	2	2.5	3
Buffered Bike Lane	2	2	2.5	3

Bike Facility Type	Local	Collector	Minor Arterial	Principal Arterial
Bike Lane	2	2.5	3	4
Bicycle Boulevard	1.5	3	4	4
Bicycle Route	2.5	3	4	4
Shoulder Bikeways	2.5	3	4	4

Bicycle Lane

A bicycle lane is a designated portion of the roadway reserved for bicyclists. It is typically identified through pavement markings, striping, and signage. Bicycle lanes provide dedicated space for bicyclists, allowing them to travel more comfortably and predictably while reducing conflicts with motor vehicle traffic, and also help clarify expected movements and positioning for all roadway users, improving safety. Bike lanes should be a minimum of five feet wide, not including the width of the gutter pan.

Unlike a cycle track, a bicycle lane is not separated from motor vehicle traffic by a physical barrier (such as median, curb, or bollard). Therefore, cars may still encroach in the bicycle lane to make a turn or move over to a parking lane.

Conventional bicycle lanes run curbside when no parking is present, adjacent to parked cars on the right-hand side of the street, or on the left-hand side of the street in specific situations. While most bicycle lanes operate in the same direction as adjacent traffic, contra-flow bicycle lanes may be used on one-way streets or other corridors where they improve network connectivity and provide more direct bicycle travel routes.

Source: Allen Beauchamp

Bicycle Lane

Comfort Level

Low — High

Cost

$ — $$$

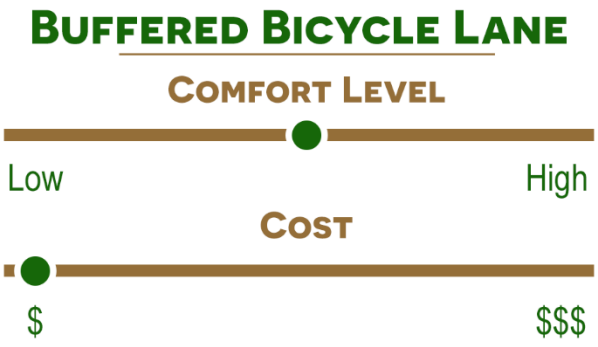
Context: The design and placement of bicycle lanes should consider existing traffic levels and behaviors and provide adequate safety buffers to protect bicyclists from parked and moving vehicles. While AASHTO does not establish strict speed or volume thresholds for bicycle lane installation, it emphasizes evaluating roadway speed, volume, width, truck presence, and crash history. NACTO provides guidance that conventional bicycle lanes are generally appropriate on streets where speed is 30mph or lower and traffic volumes are moderate, typically less than 6,000 vehicles per day.

It is also important to enforce unauthorized motorized vehicle encroachment and double-parking. Bicycle lanes may be enhanced using green paint, lane markings, signage, and intersection treatments.

Buffered Bicycle Lane

Buffered bicycle lanes are conventional bicycle lanes that include a designated striped buffer space separating bicyclists from adjacent motor vehicle travel lanes and/or parking lanes. Buffered bicycle lanes increase rider comfort and help reduce conflicts between bicyclists, moving vehicles, and parked cars. They appeal to a broader range of bicyclists including less experienced and more risk-averse riders, enhancing users' perception of comfort and safety within the bicycle network. Additional benefits and considerations include creating space for bicyclists to pass one another without encroaching into the adjacent travel lane. Buffers can be placed between parked cars and the bicycle lane to encourage bicyclists to ride outside of the range of an opening car door (the door zone).

Source: BHI



Context: Buffered bicycle lanes are appropriate wherever a conventional bicycle lane is being considered. AASHTO notes that buffers improve perceived and actual operating space for bicyclists but still considers them an intermediate treatment between conventional bicycle lanes and physically protected facilities.

AASHTO considers buffers particularly beneficial on streets with higher vehicle speeds, higher traffic volumes, and/or significant truck traffic, and where additional separation is desired but physical protection is not feasible. NACTO suggests that buffered bicycle lanes typically include at least 2 feet of buffer space and be used on roads with daily traffic volumes of up to 12,000.

Buffered bicycle lanes are well suited for corridors with excess pavement width, surplus travel lanes, or opportunities for roadway reallocation. Special consideration should be given at transit stops to safely manage interactions among bicyclists, pedestrians, and transit users.

Protected Bicycle Lane

Protected bicycle lanes are on-street bicycle facilities that are physically separated from motor vehicle traffic using barriers such as curbs, posts, planters, parked vehicles, or other vertical and horizontal separation treatments. By creating a dedicated space for bicyclists, protected bicycle lanes reduce conflicts with moving vehicles and remove cyclists from the door zone (where they can get hit by a parked car door opening or forced to swerve intro traffic to avoid one) while improving comfort and perceived safety.

Source: Maggie Ramirez

Protected bicycle lanes are designed to accommodate riders of all ages and abilities, including children, older adults, and less experienced bicyclists. Studies have shown that protected bicycle lanes can improve safety outcomes, increase bicycle ridership, and contribute to traffic calming. In addition, these facilities can enhance the streetscape and create a more inviting public realm by transforming streets into places where people can comfortably travel, interact, and spend time.

Protected Bicycle Lane

Comfort Level

Low — High

Cost

$ — $$$

Context: Protected bicycle lanes are especially effective along corridors with moderate to high vehicle traffic volumes, speeds where cyclists would benefit from physical separation from vehicles, and sufficient roadway width to accommodate the protection elements. Protected bicycle lanes can greatly improve access and mobility along corridors that connect key destinations.

Ways to create a protected bicycle lane:

- Delineator Posts
- Turtle Bumps (Raised pavement parkers)
- Large Bumps
- Oblong Low bumps
- Parking Stops (Pre cast concrete)
- Linear barriers
- Parked cars

Jersey barriers
- Planters
- Rigid Bollards
- Cast-in-place curb
- 12” precast curb
- Raised bikeway

Shoulder Bikeways

In the absence of other facilities, paved shoulders at the edge of roadways provide bicyclists with space outside the motor vehicle travel lane. Paved shoulders can be on rural roads where a bicycle lane may not be practical. Shoulders are shared space with motorists, who can use them to stop out of traffic in case of mechanical difficulty, a flat tire, or to escape potential crashes. They're often integrated for drainage and stormwater runoff from the motor vehicle travel lanes.

Context: NACTO does not consider shoulder bikeways a preferred urban bikeway type. In urban contexts, bicyclists should be provided a dedicated bikeway when possible. AASHTO recommends a minimum usable paved shoulder width of 4 feet for bicycle accommodation, with wider shoulders preferred on roads with higher speeds, higher volumes, or significant truck traffic. A shoulder width of 5 ft is recommended from the face of guardrail, curb, or other roadside barriers. If rumble strips are present on the shoulder, the ridable shoulder area should be separate from the rumble strip. Shoulder Bikeways should be maintained free of debris.

Roadway Shoulders

Comfort Level

Low — High

Cost

$ — $$$

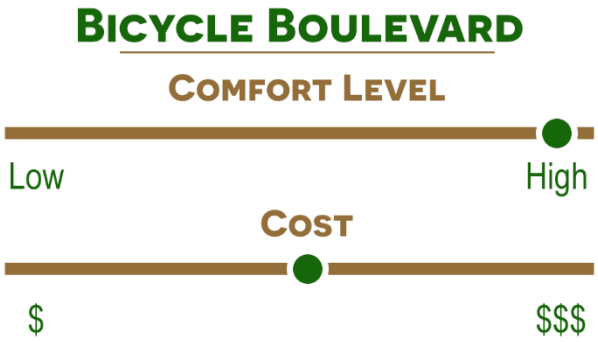
Bicycle Boulevard

Bike Boulevards are low-speed, low-volume local streets that are specifically designated and designed to prioritize bicycle travel while maintaining local vehicle access. They are typically located on residential streets where existing traffic conditions are already conducive to bicycling, making them attractive routes for people who want a comfortable, low-stress riding experience.

Bike boulevards are intended to serve a wide range of users, including children, families, older adults, and people who are interested in bicycling but may be concerned about riding in traffic. By creating a more comfortable and predictable riding environment, bike boulevards support "all ages and abilities" bicycling and can encourage more people to choose biking for everyday trips.

Context: Unlike conventional bicycle lanes, bike boulevards often rely on the existing street network rather than requiring dedicated bicycle facilities. Grid street patterns are particularly well-suited for bike boulevards because they provide multiple parallel routes and allow motor vehicle traffic to be diverted to higher-capacity arterial and collector streets while preserving direct bicycle connectivity.

Source: NACTO



Many local streets already possess the basic characteristics of a bike boulevard, including low traffic volumes and relatively slow vehicle speeds. However, designation as a bike boulevard typically involves additional treatments to reinforce bicycle priority, improve safety, and reduce conflicts with motor vehicles. Common design considerations include:

Key Design Elements

Route Planning: Bike Boulevard provides direct and continuous access to key destinations; minimizes out-of-direction travel and unnecessary detours; prioritizes bicycle movement through intersections.

Signs and Pavement Markings: uses wayfinding signs, bicycle route markers, and pavement symbols to clearly identify the route and reinforces the bicycle-priority character of the street.

Speed Management: maintains low motor vehicle speeds, typically through traffic calming measures. May include speed humps, speed cushions, mini-roundabouts, traffic circles, chicanes (offsetting lanes forcing vehicles to slow), curb extensions, or raised crossings.

Volume Management: discourages cut-through traffic; may use partial street closures, median diverters, forced-turn treatments, diagonal diverters, or other traffic management measures.

Minor Street Crossings: minimizes delay for bicyclists at intersections, can include mini traffic circles that slow vehicles while maintaining bicycle continuity.

Major Street Crossings: provides safe and convenient crossings of arterial and collector streets, may include enhanced crosswalks, median refuges, Pedestrian Hybrid Beacons, Rectangular Rapid Flashing Beacons (RRFBs), traffic signals, bicycle signals, or raised crossings.

Source: www.pedbikeimages.com / Adam

Offset Crossings: uses signage, pavement markings, and crossing treatments to guide users safely through transitions.

Green Infrastructure and Placemaking: incorporates landscaping, street trees, bioswales, rain gardens, planters, and other green infrastructure elements where feasible.

Source: www.pedbikeimages.com / Russ Roca

Bicycle Route

A bicycle route is a designated corridor, often identified through signs and wayfinding elements, that guides bicyclists along preferred streets and roadways between destinations. Signed bicycle routes are typically located on lower-volume residential streets, collectors, or secondary roadways that offer a comfortable and convenient alternative to higher-speed or more heavily traveled arterial routes. These routes are designated by the jurisdiction having authority over the roadway and may be identified by route names, route numbers, destination information, or directional signage.

Source: PACOG

Context: Unlike bicycle lanes or separated bikeways, a signed bicycle route does not necessarily require dedicated bicycle facilities or additional pavement width. Instead, the route is selected because of its favorable operating conditions, including lower traffic volumes (fewer than 3,000 vehicles per day preferred), lower vehicle speeds (25mph or less preferred), good connectivity, and fewer conflicts with motor vehicles. Selecting roads with minimal traffic hazards and comfortable riding conditions is an important part of developing an effective bicycle route.

Bicycle Route

Comfort Level

Low — High

Cost

$ — $$$

A bicycle route serves as a recommended path to a specific destination or series of destinations. Routes may connect schools, parks, employment centers, commercial districts, transit stops, neighborhoods, trails, and other community destinations. While a bicycle route may include segments of bicycle lanes, shared-use paths, bicycle boulevards, or protected bikeways, the route itself is primarily a wayfinding and network designation rather than a specific facility type.

Planning for a bicycle route begins by identifying the purpose of the corridor and establishing clear origins and destinations. A bicycle route should be part of a comprehensive bicycle transportation network that provides continuous and logical connections throughout the community. According to AASHTO and NACTO guidance, successful bicycle routes emphasize directness, connectivity, comfort, and ease of navigation while minimizing exposure to high-speed and high-volume traffic. Designating a bicycle route is often one of the most cost-effective methods for improving bicycle mobility.

Pedestrian Facilities

Selection Guidance

Choosing a pedestrian facility is often simpler than choosing a bicycle facility, as options for pedestrian facilities are more limited.

- Multi-Use Trails: Can be implemented if bicycle facilities also need to be accommodated, if there is ample right-of-way on one side of the street, or if the facility is not aligned with a roadway (for example, a trail following a river or canal).
- Sidewalk: Sidewalks should be built along roadways whenever pedestrians may be present.. Additionally, landscaped buffers between the sidewalk and street should be provided to protect pedestrians from motor vehicles, especially along high-speed roadways.
- Pedestrian lanes: Although pedestrian lanes do not provide as much separation from motor vehicles as sidewalks and paths, and are not as accessible for people with disabilities, they can provide dedicated space for pedestrians along low-volume, low-speed roadways. It can serve as a temporary treatment while funding for sidewalks is being procured.

Sidewalks

A sidewalk consists of a pedestrian travel zone located adjacent to a roadway but separated from vehicular traffic by a curb, planting strip, furnishing zone, or other buffer. Sidewalks provide safe and convenient access to homes, businesses, schools, parks, transit stops, and other destinations while reducing conflicts between pedestrians and motor vehicles. Well-designed sidewalks support community health, mobility, economic activity, and overall quality of life. In the City of Pueblo, bicyclists are also legally allowed to use the sidewalk except on Union Avenue between Abriendo Avenue and City Center Drive.

Context: AASHTO and NACTO emphasize that sidewalks should provide a continuous, accessible, and unobstructed path of travel. Sidewalk width should be based on pedestrian demand, adjacent land uses, and expected activity levels. Wider sidewalks are generally recommended in commercial districts, near schools, transit corridors, and other areas with higher pedestrian activity.

Sidewalks

Comfort Level

Low — High

Cost

$ — $$$

Buffered or detached sidewalks include a separation area between the pedestrian walkway and adjacent motor vehicle travel lanes. Buffers may consist of landscaping, street trees, planter strips, parking lanes, furnishing zones, stormwater features, bicycle facilities, or other physical elements. Both AASHTO and NACTO recognize that increasing the distance between pedestrians and moving traffic improves pedestrian comfort and perceived safety, particularly along higher-speed and higher-volume roadways.

Benefits of buffered sidewalks include:

- Improved pedestrian comfort and perceived safety.
- Space for street trees, lighting, utilities, benches, and other amenities.
- Opportunities for green infrastructure such as bioswales and rain gardens.
- Reduced exposure to vehicle spray, noise, and roadway debris.
- Enhanced accessibility and comfort for vulnerable users.

Key sidewalk design considerations include accessibility, including curb ramps and detectable warnings; continuity to minimize gaps and barriers; adequate width; buffering where feasible; and safe and convenient crossings at intersections and mid-block when warranted. Streetscape elements like trees, lighting, and seating can enhance the pedestrian experience.

Pedestrian Lanes

Pedestrian lanes are designated portions of a roadway, plaza, or other public space reserved primarily for pedestrian movement. Unlike sidewalks, which are typically separated from the roadway by curbs or buffers, pedestrian lanes are often created through pavement markings, vertical delineation, street design treatments, or other controls that clearly define pedestrian space.

Source: FHWA Small Town and Rural Design Guide

Context: NACTO guidance commonly refers to pedestrian lanes within shared streets, pedestrian-priority corridors, transit access areas, and temporary street reallocation projects. Pedestrian lanes can also be used where right-of-way constraints prevent construction of a conventional sidewalk or where pedestrian activity exceeds the capacity of existing facilities.

Pedestrian Lanes

Comfort Level

Low — High

Cost

$ — $$$

Pedestrian lanes provide a clearly defined space for walking and help organize movement within complex public environments. They can improve safety by increasing pedestrian visibility, reducing conflicts between users, and clarifying expected paths of travel for different roadway users. Pedestrian lanes are particularly useful in downtown areas, entertainment districts, special event corridors, transit stations, school zones, and other locations with high pedestrian activity.

Pedestrian lanes may be established through a variety of design treatments, including pavement markings and striping, colored pavement, posts, planters, street furniture, temporary barriers, curb extensions, and other features that clearly define and prioritize pedestrian space.

Multi-Use Facilities

Paved Multi-Use Path

Paved multi-use paths offer comfortable, low-stress environment separated from motor vehicle traffic. Multi-use trails may be located within roadway corridors, utility corridors, greenbelts, parks, drainage corridors, or other public rights-of-way. Because they are physically separated from motor vehicles, they are often suitable for users of all ages and abilities, including children, families, older adults, and individuals who may not feel comfortable riding a bicycle on streets.

Context: AASHTO recommends that shared-use paths provide adequate width, clear sight distance, and safe crossings where trails intersect roadways. NACTO emphasizes the importance of directness, network connectivity, and minimizing conflicts between different trail users. At planning and design levels, agencies should consider expected user volumes, maintenance requirements, accessibility, lighting, personal security, and connections to the on-street bicycle and pedestrian network.

Source: PACOG

Paved Multi-Use Path

Comfort Level

Low — High

Cost

$ — $$$

Multi-use trails are particularly appropriate along the corridor of higher-speed roadways, in areas lacking comfortable bicycle accommodations, or where opportunities exist to create regional connections. While they offer a high level of comfort and safety from motor vehicle traffic, special attention should be given to roadway crossings and locations where trail users must interact with vehicles. When properly designed and connected, multi-use trails can significantly expand active transportation opportunities and provide a safe, attractive, and accessible travel option for a wide range of users.

Sidewalk Trail

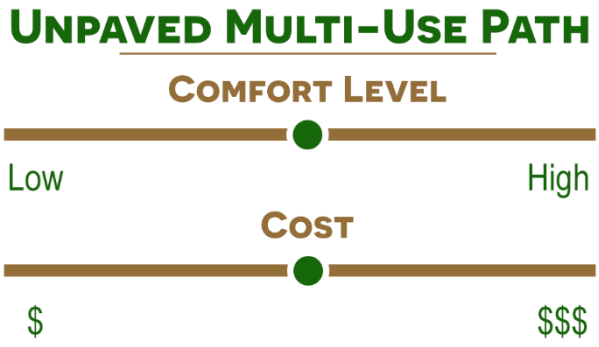
A sidewalk trail is a wide, paved facility located alongside a roadway that accommodates pedestrians, bicyclists, runners, and other non-motorized users. Unlike a standard sidewalk, a sidewalk trail is designed to support two-way travel and a broader range of users. It is typically separated from vehicle traffic by a curb, landscaped buffer, drainage area, or other physical space. Sidewalk trails are commonly used along arterial and collector streets, near schools and parks, and in areas where an off-street connection is needed but a separate multi-use path may not be feasible. They can serve both recreational and transportation purposes by connecting neighborhoods with community destinations, transit stops, employment areas, and the broader bicycle and pedestrian network.

Source: PACOG

Unpaved Multi-Use Path

An **unpaved multi-use path** is a shared-use trail made of natural surface materials such as gravel, crusher fines, and compacted soil. Unpaved paths accommodate pedestrians, bicyclists, runners, equestrians, and other non-motorized users. Unlike paved shared-use paths, unpaved multi-use paths are typically found in parks, open spaces, greenbelts, natural areas, drainage corridors, and rural environments where preserving the natural character of the landscape is an important consideration. They can serve both recreational and transportation purposes. They are often a lower-cost alternative to paving a trail and may also reduce environmental impacts compared to asphalt construction.

Source: PACOG



Crossings and Intersection Treatments

Crossings and intersections are critical components of the active transportation network. Uncomfortable or unsafe crossings can deter people walking and biking from using a route, even if the rest of the route is highly comfortable and safe. Note that Colorado's Safety Stop Law allows cyclists 15 and older to treat stop signs as yields and red lights as stop signs, letting them roll through intersections without a full stop if it's safe to do so.

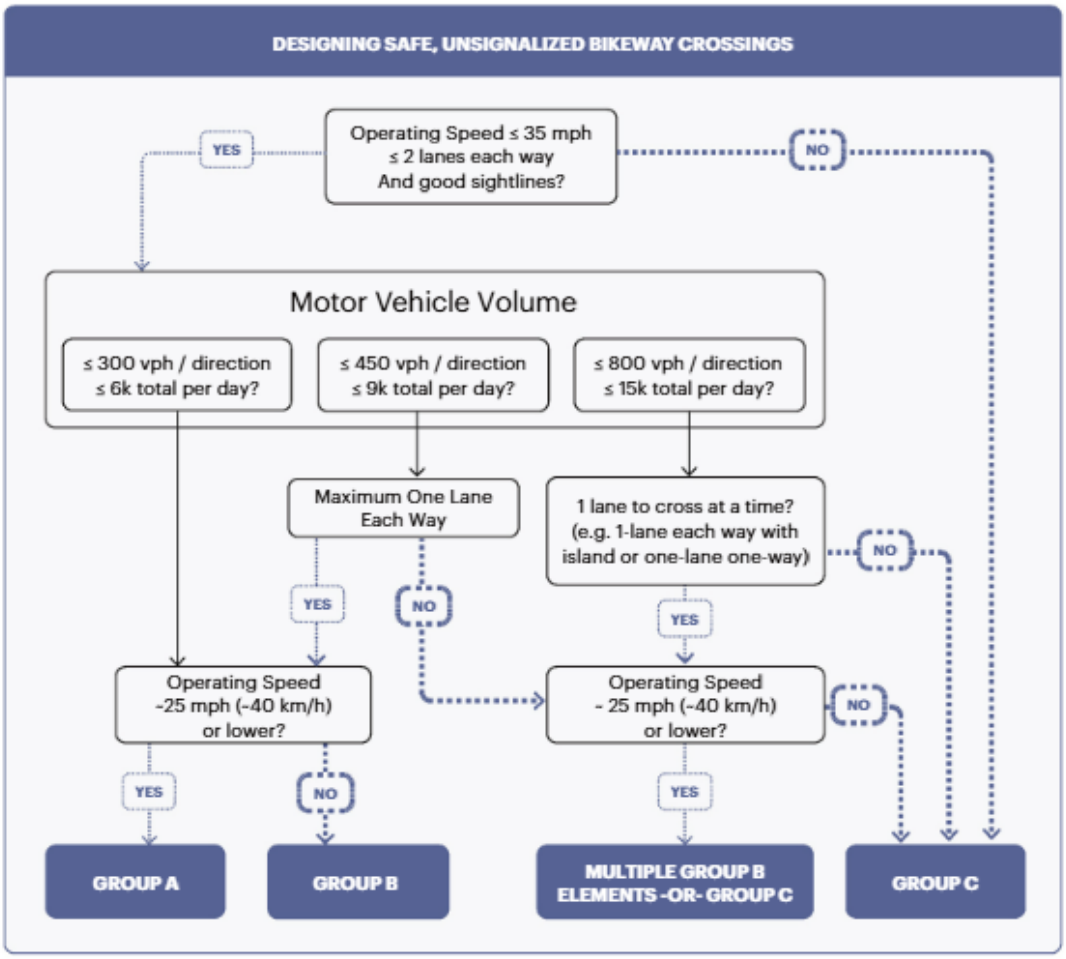
Unsignalized Crossings

Unsignalized Crossings Selection Guidance

Many of Pueblo's bike routes run along quieter side streets, which means cyclists often have to cross major, busy roads without the help of traffic lights. Similarly, pedestrians naturally take the shortest path to their destination, frequently crossing streets where there are no signals.

To address this, NACTO offers guidelines for making these unsignalized crossings safer. Generally, as roadways get wider, faster, and busier, they require more robust safety features to ensure people can cross comfortably and securely.

Figure 3: NACTO Urban Bikeway Design Guide Unsignalized Bikeway Crossing Selection



GROUP A	GROUP B	GROUP C
→ Neighborhood traffic circle → Crossbike → Gateway treatment → Diverter	→ Raised crosswalk → Raised intersection → Approach speed hump → Gateway treatment → Hardened centerline / Lane line → Rectangular Rapid Flashing Beacon (RRFB) → Mini-roundabout → Corner island → Curb extension → Sidewalk extension	→ Stop control → Hybrid beacon → Half-signal → Roundabout

Crosswalk Markings and Signage

Source: Carl Sundstrom

Crosswalk markings and signs identify designated pedestrian crossing locations and increase pedestrian visibility to motorists. They are appropriate at intersections and midblock crossings where bicyclists or pedestrians need a clearly defined crossing location and enhanced driver awareness.

Bump-Out

Source: PACOG

A bump-out extends the sidewalk into the roadway, reducing pedestrian and cyclist crossing distances, improving visibility between vulnerable users and approaching vehicles, and tighten turning movements to slow vehicles. Bump-outs are often used in school zones, at transit stops, at trail crossings, and in urban, downtown, and neighborhood commercial areas with on-street parking and significant pedestrian activity.

Median Islands

Source: PACOG

A median island is a raised refuge area located within the roadway that allows pedestrians, cyclists, and other vulnerable roadway users to cross one direction of traffic at a time. Median islands are beneficial on roads with high traffic volumes that have limited crossing opportunities or wide crossings. The island should be able to accommodate wheelchair users, bicycles with a child trailer, and people with strollers.

Raised Crosswalks/Intersections

Source: BHI

Raised crosswalks and intersections elevate the crossing area to sidewalk level, slowing down vehicles while improving vulnerable road user visibility and accessibility. They are most appropriate on low- to moderate-speed streets in downtowns, school zones, neighborhood centers, and other pedestrian-oriented environments, including on unsignalized collector streets and at alleys and busy driveways. They should be elevated 3 inches to 8 inches above the street level and may not be appropriate for streets with posted speeds over 30mph.

In-Street Pedestrian Crossing Signs

Source: visi-flash.com

In-street pedestrian crossing signs are flexible signs placed within the roadway at marked crosswalks to remind motorists to yield to pedestrians (reading YIELD HERE TO or STOP HERE FOR PEDESTRIANS). They are commonly used on low- to moderate-speed roadways to increase driver awareness and yielding compliance.

Lane Narrowing/Road Diets

Lane narrowing and road diets reduce the width or number of travel lanes to calm traffic, lower vehicle speeds, and create space for bicycle lanes, landscaping, wider sidewalks, or parking improvements. They are widely used to improve safety and enhance the multimodal environment.

Source: NACTO

Traffic Diverters

Traffic diverters are physical barriers or intersection treatments that restrict motor vehicle movements while maintaining pedestrian and bicycle access. A diagonal diverter, for example, can be installed at a four-way intersection to force motorists to turn right off a bicycle boulevard. Diverters are used on neighborhood streets to discourage cut-through traffic and improve conditions for walking and bicycling.

Source: NACTO

Neighborhood Traffic Circle

A neighborhood traffic circle is a small round island placed within a local street intersection that requires motorists to travel around the center feature, reducing vehicle speeds and improving intersection safety. They are commonly used as traffic calming elements on bicycle boulevards.

Source: BHI

Rectangular Rapid Flashing Beacon

With RRFBs, pedestrians push a button to activate yellow flashing lights when they're ready to cross an intersection. RRFBs are commonly installed at uncontrolled crossings on higher-volume or multilane roadways where additional driver awareness and yielding compliance are needed.

Source: BHI

Half Signals

A half signal is used where a major street intersects a smaller street. The major street operates with standard green, yellow, and red indications and normally remains green. The minor street is controlled by a stop sign or flashing red signal, with separate pedestrian and bicycle signals. When activated by a pedestrian or cyclist, the major street cycles through yellow and red phases, while the bicycle signal remains red during the crossing interval and pedestrian walk phases.

Source: City of Albuquerque

Pedestrian Hybrid Beacon (PHB)/HAWK Signal

Like an RRFB, a pedestrian hybrid beacon/HAWK signal remains dark until a pedestrian pushes a button. While RRFBs display flashing lights,

a PHB/HAWK signal features two red LED lenses, which become a steady red, making it a mandatory stop while pedestrians cross. It's best for multi-lane, higher speed roads.

Roundabout

A roundabout, like a neighborhood traffic circle, features a non-traversable center island and is a yield-controlled intersection. Roundabouts can be single lane or multilane. Roundabouts on busy streets that include a bike route should be designed, according to NACTO, with protected bicycle lanes that are separated from sidewalks and travel lanes.

Grade Separated Crossing

With a grade-separated crossing, pedestrians and bicyclists pass over or under a roadway, railroad, or other transportation facility using a bridge, underpass, or tunnel, so vulnerable users do not interact with motor vehicle traffic. They are typically used where traffic speeds, volumes, or roadway widths make at-grade crossings difficult or unsafe, such as across freeways, rail corridors, or major arterial roads.

Source: BHI

Table 2: Comfort and Cost Comparison, Unsignalized Crossing Treatments

Countermeasure	Comfort Level	Cost ($ - $$$)
Crosswalk Markings and Signage	Low	$
Bump-Out	Medium	$$
Median Islands	High	$$
Raised Crosswalk/Intersections	High	$$
In-Street Pedestrian Crossing Signs	Low	$
Lane Narrowing/Road Diets	Medium	$$
Traffic Diverters	Medium	$$
Neighborhood Traffic Circle	Medium	$$
Rectangular Rapid Flashing Beacon	Medium	$$
Half Signals	High	$$
PHB/HAWK Signal	High	$$$
Roundabout	High	$$$
Grade Separated Crossing	Very High	$$$

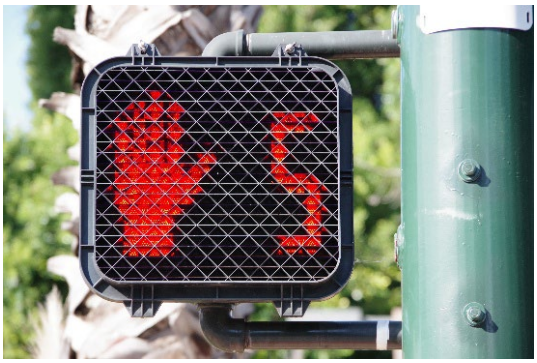
Traffic Signals

Safety treatments at signalized intersections can increase the visibility of people walking and biking and reduce conflict points with vehicles. Additionally, many of the unsignalized crossing treatments (such as bump-outs, median islands, raised crosswalks, and road diets) can be added to signalized intersections to slow vehicle speeds and reduce exposure to vehicles.

Source: City of Hopkins

Leading Pedestrian/Bicycle Interval

A leading interval is a signal timing treatment that gives pedestrians and bicyclists stopped at a red light a 3–7 second head start before parallel vehicle traffic receives a green light. This reduces conflicts with turning vehicles at signalized intersections and increases visibility of vulnerable road users in crosswalk.

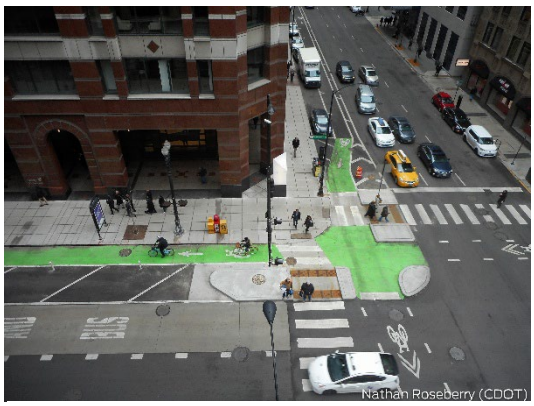


Exclusive Pedestrian Phase

During an exclusive pedestrian phase, all motor vehicles get a red light signal while pedestrians can cross in one or more directions (may include diagonal crossings across the intersection), eliminating vehicle-pedestrian conflicts. It is used in busy urban intersections.

Protected Intersections

A protected intersection is an intersection design that uses elements like corner refuge islands, setback crossings, and dedicated space for bicyclists and pedestrians to reduce vehicle speeds, improve visibility, and minimize conflict points. Protected intersections are often used where separated bicycle lanes cross major streets, helping reduce bicyclist exposure to motor vehicle traffic while creating safer and more predictable interactions among all road users.



Source: Nathan Roseberry (CDOT)

Shorter Signal Cycles

Shorter signal cycles reduce the amount of time pedestrians and cyclists traveling along side-streets must wait at an intersection. By providing more frequent crossing opportunities, shorter cycles can improve pedestrian/bicyclist compliance. In urban areas, cycle lengths of 60–90 seconds are generally recommended.

Protected Left Turn Phasing

Protected left-turn phasing gives left-turning motor vehicles a dedicated green arrow interval. This separates them from conflicting oncoming vehicle traffic as well as eliminates conflicts with crossing pedestrians or bicyclists. It is commonly used at intersections with a history of left-turn crashes, heavy conflicting traffic volumes, or locations where turning vehicles create safety concerns for people walking and biking.

Bicycle Signal Heads

A bicycle signal head is a traffic signal that uses bicycle symbols to provide traffic control specifically for people riding bikes. Bicycle signal heads are used at protected intersections, separated bicycle lane crossings, and other locations where separate signal timing can reduce conflicts and improve safety for bicyclists.

Source: www.pedbikeimages.com / TREC

Bike Box

A bike box is a designated area ahead of a traffic lane at a signalized intersection that provides cyclists with a visible and safe way to get ahead of traffic during red signal phase. Bike boxes have been shown to increase cyclist safety by increasing cyclist visibility, reducing signal delay for cyclists, and providing priority for cyclists at signalized bicycle facility crossings of major streets. Additionally, these treatments group cyclists together so that an intersection can be cleared quickly, minimizing impediment to other traffic.

Source: Long Beach Public Works

Table 3: Comfort and Cost Comparison, Signalized Crossing Treatments

Countermeasure	Comfort Level	Cost ($ - $$$)
Leading Pedestrian/Bicycle Interval	Medium	$
Exclusive Pedestrian Phase	Medium	$
Protected Intersections	High	$$$
Shorter Signal Cycles	Low	$
Protected Left Turn Phasing	Medium	$
Bicycle Signal Heads	Medium	$$
Bike Box	Medium	$

Active Transportation Amenities

Lighting

Lighting improves visibility, comfort and safety for pedestrians and cyclists by illuminating travel paths, crossings, and potential conflict areas, particularly at night.

Source: BHI

Signage and Wayfinding

Signage and wayfinding systems provide directional, destination, and regulatory information that helps pedestrians and cyclists to navigate networks safely and efficiently.

Source: PACOG

Street Furniture

Street furniture – such as benches, shade structures, drinking fountains, and trash cans – enhances the comfort, accessibility, and usability of active transportation corridors and public spaces. Street furniture can also be used to create a protective barrier between cars and vulnerable users.

Source: PACOG

Bike Parking

Bike racks and other dedicated bike parking infrastructure provide places to securely and conveniently store bicycles at destinations, which supports bicycling as a practical mode of transportation and encourages greater bicycle use. For more information on bike parking, see the bike parking guide in the appendix.

Source: PACOG