



Complete Streets Toolbox

East Jefferson Corridor

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Complete Streets

Streets play an omnipresent role in our daily lives. We use streets to get to work or school, to access healthcare and other critical destinations, and as spaces to interact with our neighbors and community. At their most basic level, streets need to be passable for everyone— meaning that no matter your physical ability or what neighborhood you live in, you should be able to travel along and across every street.

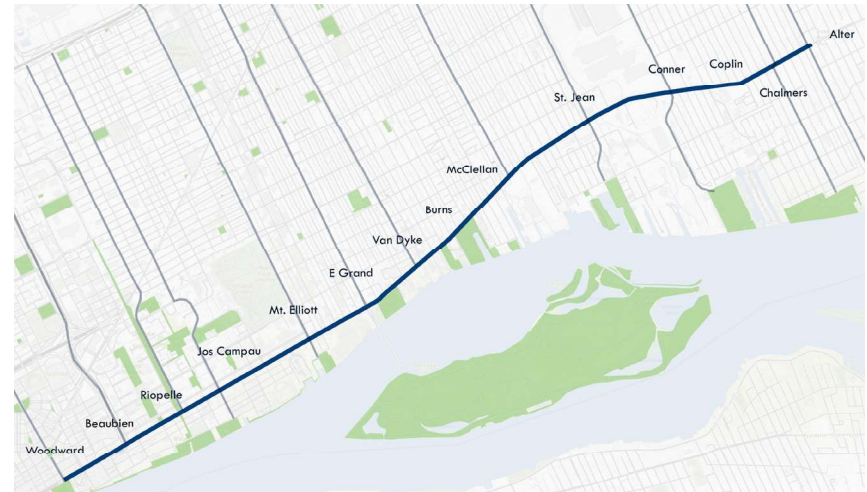
Complete streets go beyond the minimum standards for passable streets. Rather, complete streets aim to allow people of all ages and abilities to safely use all streets and to deliver convenient, comfortable journeys for people driving, walking, biking, and using public transit.

While all complete streets have similar goals, there are a multitude of approaches that may be used. According to the National Complete Streets Coalition, though, complete streets projects often include: wider and improved sidewalks, bike lanes, crosswalks and pedestrian refuge islands, landscaping and street trees, and upgraded transit shelters.

The Complete Streets Toolbox provides guidance on how to choose between the many street design tools that are available today. The Toolbox was developed for use within the East Jefferson Corridor but can be applied and used as a resource for the entire city of Detroit. Each tool includes an explanatory description, benefits, application guidance, and estimates of costs and time to completion. Time durations are estimated as short (less than one year), medium (about one year), or long (over one year) range processes.

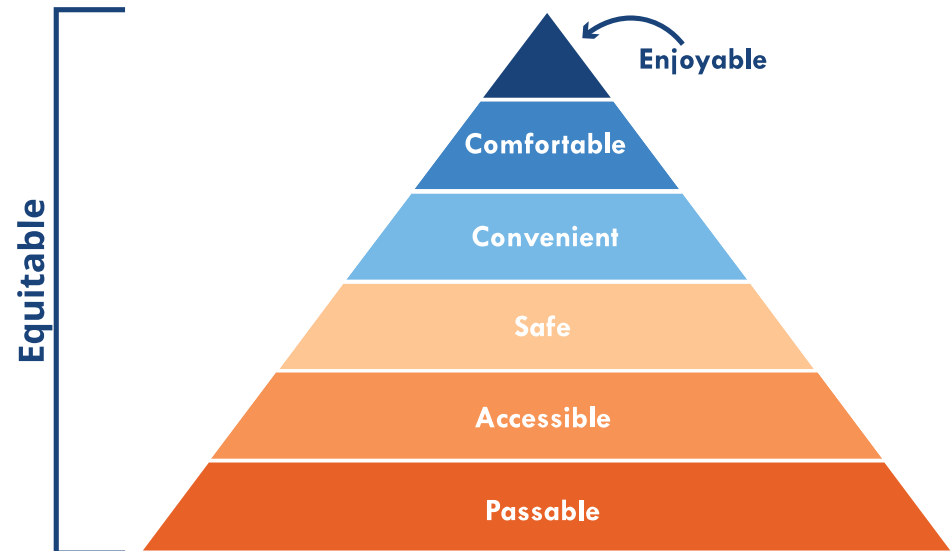
The Toolbox is divided into four sections detailing general street design tools and strategies, tools for pedestrians, tools for transit, and tools for bicyclists. It also includes several example street cross sections that illustrate how the individual tools can be combined to create a more complete street.

Map of the East Jefferson Corridor



The project area of E Jefferson Ave is bounded by Woodward Ave and Alter Rd

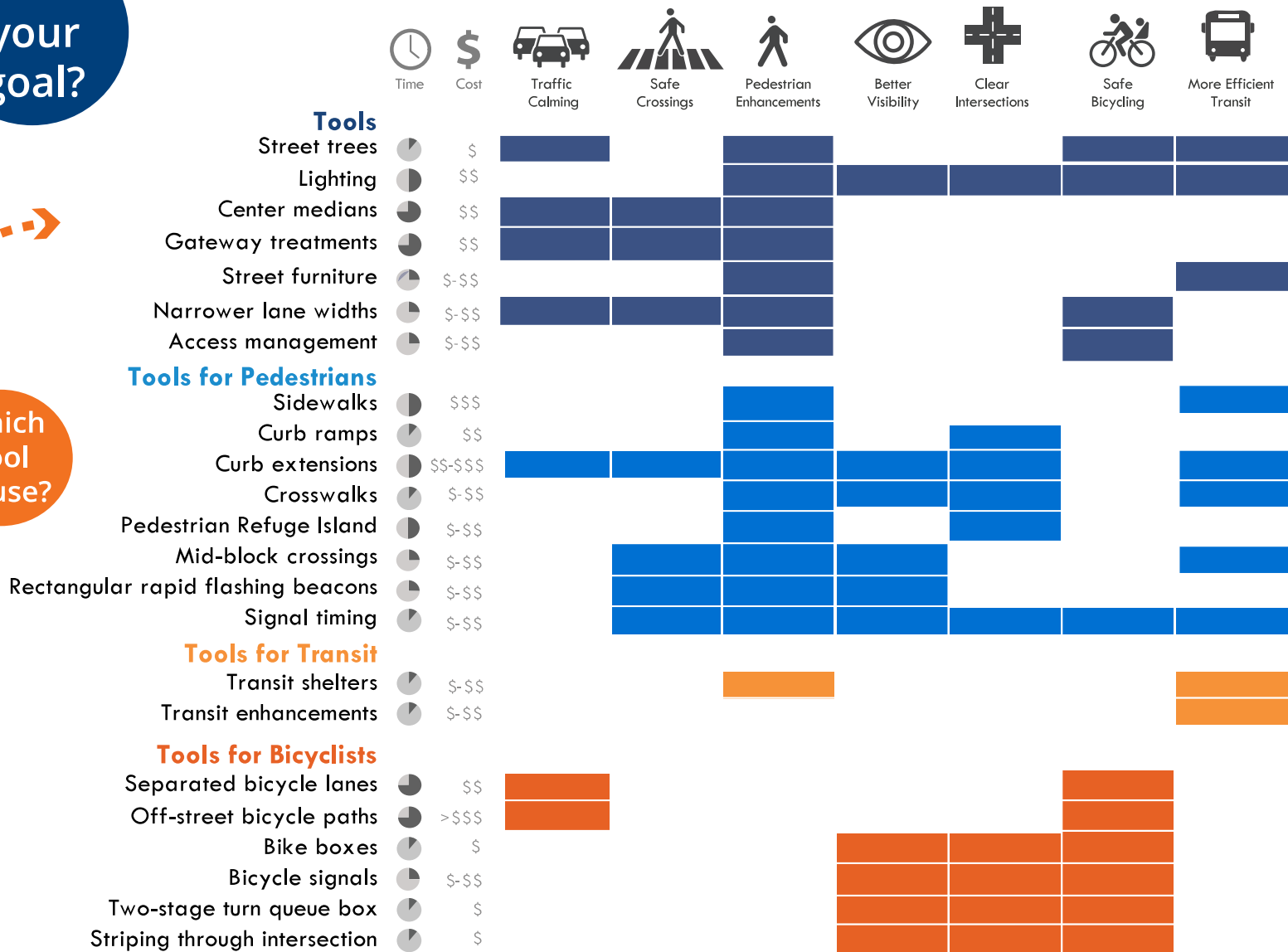
Hierarchy of Street Needs



Selecting the Right Tools

What's your goal?

Which tool to use?



General
Street Design
Tools + Strategies

Street Trees

Street trees located between the sidewalk and street are a cost-effective way to beautify the block and improve air quality while creating a more comfortable and safer corridor. Street trees buffer pedestrians from the vehicular traffic and calm traffic by visually narrowing the roadway.

Benefits

- Buffer and protect the sidewalk from the roadway traffic.
- Calm traffic by visually narrowing the roadway.
- In addition to the safety benefits, street trees offer many economic, social and environmental benefits by offering opportunities for urban wildlife habitats, cooling the urban environment, reducing storm water runoff and soil erosion, improve air quality and increasing pavement life by avoiding extreme heat.

Application

- Proper width between the curb and sidewalk is required for planting street trees or heaving or cracked sidewalks may result.
- Trees should be limbed properly and setback from intersections and crossings to maintain proper sight lines.
- Street tree species, form and aesthetic qualities should be determined based on characteristics of the road including cross section, usage, etc. and must meet all town guidelines.
- Planting of street trees requires the removal of portions of sidewalk, the digging and preparation of a tree pit and on-going watering and maintenance until the tree is established (generally 1- 2 years).

Time: Short

Cost: \$



Lighting

Lighting is a key element of the visual environment that allows pedestrians to move about safely and feel more secure after sundown. Well-lit sidewalks and roadways allow drivers to see pedestrians entering the roadway and allow pedestrians to avoid tripping hazards or other sidewalk elements.

Benefits

- Increases visibility of pedestrians.
- Reduces conflicts between bicycles/cars and pedestrians.
- Reduces tripping hazards.

Application

- There are two types of lighting that may be used to illuminate the roadways: Pedestrian-Scale Lighting (12 foot - 16 foot height); and Roadway Lighting (20 foot - 26 foot height).
- Proper light levels vary depending on road typology and usage. For example, areas with high pedestrian traffic, such as commercial corridors, may require pedestrian-scale lighting in addition to standard roadway lighting.
- Light levels of adjacent properties are a contributing factor, as light from these properties may supplement the sidewalk lighting.
- The means, methods, and level of difficulty involved with installing existing lighting varies greatly depending on existing site conditions, such as availability of electricity, existing poles and footings, light level requirements, etc.

Time: Medium

Cost: \$\$



Center Medians

Center medians are used to separate opposing lanes of traffic along wide roadways. Medians can be used to deter mid-block crossing or jaywalking and may also be used to calm traffic by visually reducing the road width, especially if they contain trees and/or landscaping.

Benefits

- Calm traffic along excessively wide roadways.
- If median is landscaped, can provide similar benefits to street trees, such as opportunities for urban wildlife habitats, cooling the urban environment, reducing storm water runoff, improve air quality and increasing pavement life by avoiding extreme heat.

Application

- Medians are constructed in the center of the roadway and consist of a curbed edge and either paved or landscaped center area. Additional elements that may be designed into the median include street lighting, landscape materials, raised planters or fencing.
- Unlike highway medians, medians installed within the town should be designed to visually narrow the roadway and calm traffic. If not properly designed, medians may inadvertently result in increased travel speeds.
- Medians may interfere with emergency vehicle access.
- Landscaped medians require long-term maintenance.

Time: Medium - Long

Cost: \$\$



Gateway Treatments

Gateway treatments are often used to calm traffic when drivers are transitioning from a higher-speed roadway into a more pedestrian-oriented residential neighborhood or center. They typically involve a decorative sign, landscaping and lighting.

Benefits

- Notifies drivers that they are entering a neighborhood and should expect pedestrians to be using the street.
- Calms traffic at neighborhood entry and transitional points.
- Defines transitions to low speed, shared streets and pedestrian-friendly areas.

Time: Medium - Long

Cost: \$\$

Application

- Gateways should be identified by the community and designed to express the character of the community.
- Gateway designs vary greatly and may incorporate curb extensions, center medians, vertical speed control elements and other tools identified in this manual.



Street Furniture

Street furniture such as benches, garbage and recycling cans, bicycle racks, and others can be located in the furniture zone between the sidewalk and street.

Benefits

- Improve walkability by providing comfortable places to sit and rest and add to the visual interest of the street.
- Helps create a more welcoming pedestrian environment for people of all ages and abilities.

Application

- Street furniture should generally be setback at least 2' from the curb while still providing a suitable clear portion of the sidewalk for pedestrians (minimum 4').
- Street furniture that is accessible, comfortable, well-maintained, and located in the right places is critical to successful placemaking.
- Maintenance of street furniture will help contribute to an attractive public realm.

Time: Short - Medium

Cost: \$ - \$\$



Narrower Lane

Travel lanes are striped to define the intended path of travel for vehicles along a street. Narrower lane widths (e.g., 10') reduce speeding and improve safety without impacting a street's capacity or traffic flow.

Benefits

- Reduce speeding and can, therefore, decrease the number and severity of traffic crashes.
- Reduce distance pedestrians must walk to cross the street, which reduces exposure to vehicles.
- Create more and higher-quality space for other uses, such as pedestrians, bicyclists, or transit facilities.

Application

- In most urban settings, 10' lanes can be implemented without impacting the flow of vehicle traffic.
- Narrower lane widths may not be suitable on streets that carry large numbers of trucks or buses or are primary routes for emergency vehicles responding to incidents.

Time: Short - Medium

Cost: \$ - \$\$



Driveway & Curb Management

Driveway and curb management policies should provide access to land development while striving to limit driveways and curb cuts on major streets and encourage shared access points and connections between adjacent parcels. By limiting the number of driveways, the number of potential conflicts between people driving, biking, or walking is reduced.

Benefits

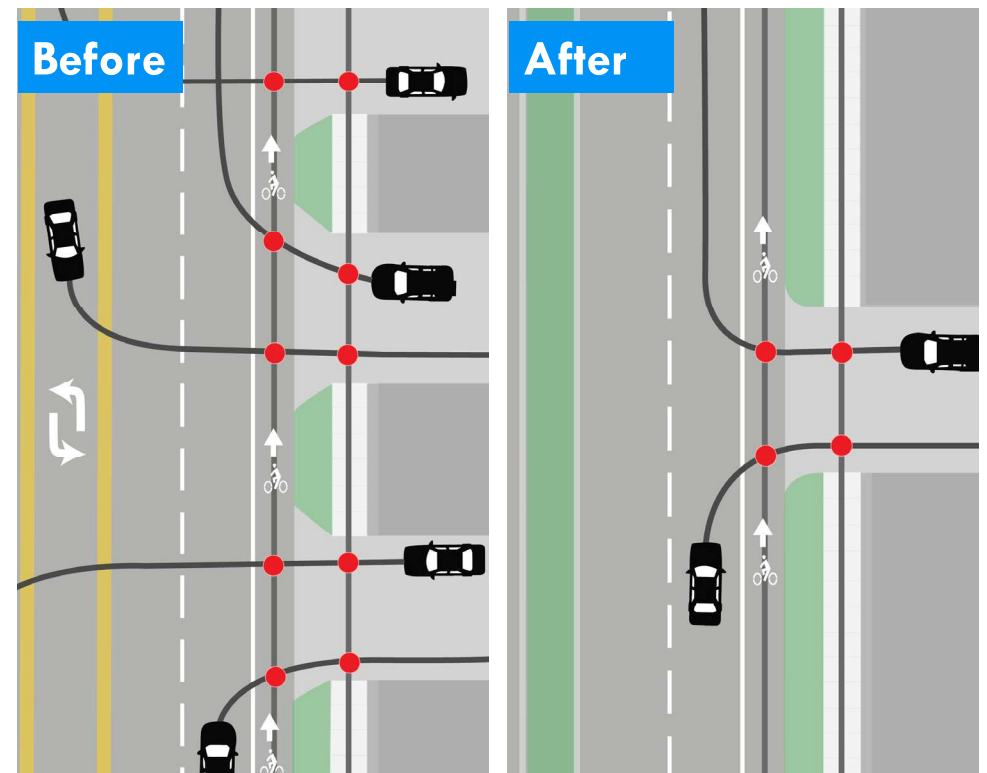
- Reducing the number of curb cuts along a street eliminates conflicts between vehicles and people walking.
- Reducing curb cuts is usually good for business as it increases the efficiency of parking, reduces crashes and conflict points, and reduces stress on customers and motorists.
- Access management policies maintain capacity on surrounding streets while ensuring safe and convenient access to parcels of land.

Time: Short - Medium

Cost: \$ - \$\$

Application

- Cities can require driveway permit applications and establish where new access should be allowed.
- Closing, consolidating, or improving existing driveways are all elements of access management.



Street Design
Tools for
Pedestrians

Sidewalks

Sidewalks provide safe and accessible pedestrian circulation throughout the town. Proper sidewalk widths vary depending on the roadway type, usage, location, and land use, among other factors. The Federal Highway Administration recommends at least 5 feet of unobstructed sidewalk width. If there is enough room, a planted buffer between pedestrians and vehicles can enhance safety and comfort.

Benefits

- Minimize conflicts between pedestrians and cars.
- Reduce traffic crashes involving pedestrians.
- Properly designed sidewalks offer a number of social, economic and environmental benefits by promoting walking and public transit as a transportation mode.
- Sidewalks can improve the shopping experience in retail corridors and enhance the sense of community by encouraging social interaction.

Application

- Throughway, buffer zones, and frontage widths will vary based on the road typology and surrounding land use.
- Compliance with the most current Americans with Disabilities Act Accessibility Guidelines (ADAAG) as well as the Public Rights-of-Way Accessibility Guidelines (PROWAG) is essential.
- Installing or widening sidewalks often requires relocating curbs and drainage as well as re-striping.

Time: Medium

Cost: \$\$\$



Curb Ramps

Curb ramps are the sloping element of the sidewalk that transitions pedestrians from the sidewalk elevation to the roadway elevation. This transition allows for safe crossing and ADA-compliant accessibility.

Benefits

- Provide accessible crossing for pedestrians of all ages and abilities.
- Minimize the need for pedestrians in wheel chairs or pushing strollers to walk in the street.

Time: Short

Cost: \$\$

Application

- All pedestrian crossing areas (corners and mid-block) should be equipped with curb ramps.
- All curb ramps must be installed in compliance with ADAAG and PROWAG standards.



Curb Extensions

A curb extension, or bump-out, is an area of sidewalk that is widened into the parking lane to reduce crossing distances, slow turning vehicles, and improve pedestrian visibility.

Benefits

- Reduce distance pedestrians must walk to cross the street, which reduces exposure to vehicles.
- Increase pedestrian visibility at intersections.
- Reduce turning speed, giving priority to pedestrian crossings.
- Newly created space can act as a gathering space, waiting zone, or landscaped area for green stormwater infrastructure.

Time: Medium

Cost: \$\$ - \$\$\$

Application

- Installation of curb extensions may reduce the number of on-street parking spaces.
- The site should be reviewed to determine any interference with fire hydrants, snow plows, street sweepers, deliveries, bus stops, etc.
- Depending on the slope of the sidewalk, roadway and road crown, curb extensions may impact roadway and sidewalk drainage. Particular care should be taken to avoid pooling.
- Curb extensions require the installation of new curbing, sidewalks and, in some cases, drainage infrastructure.
- Temporary curb extensions can be implemented using roadway paint and flexible delineators or cones.



Crosswalks

Crosswalks are used to clearly identify where pedestrians are encouraged to cross the road. Crosswalks are differentiated from other areas of the roadway by a change in the surface to designate the pedestrian right-of-way.

Benefits

- Alert drivers to the presence of pedestrians in the roadway.
- Notify pedestrians of the designated areas to cross the roadway.
- Reduce the incidence of traffic crashes involving pedestrians.

Time: Short

Cost: \$ - \$\$

Application

- Crosswalks should be located based on the desired walking paths of pedestrians. Crosswalks will typically be located at corners and intersections, but mid-block crosswalks should be provided at major pedestrian generators (e.g., bus stops, schools, commercial centers).
- Crosswalks should be aligned perpendicular to the roadway to provide the shortest possible crossing distance.



Pedestrian Refuge Islands

A pedestrian safety island is a segment of roadway median that is used as a refuge for pedestrians that are crossing the road. Pedestrian refuge islands can be used whenever people walking need to cross more than one lane of traffic going in a single direction, at transit stops, or on wide streets.

Benefits

- Reduce distance pedestrians must walk to cross the street, which reduces exposure to vehicles.
- Reduces the complexity of crossing multiple lanes of traffic by allowing pedestrians to cross one direction of traffic at a time if needed.
- Provides protection to pedestrian from turning cars.
- Reduces speed of on-coming as well as turning vehicles. zone, or landscaped area for green infrastructure.

Application

- Pedestrian refuge islands require the installation of a curbed island, flush sidewalk zone, tactile paver and bollards. Size and materials may vary greatly depending on location.
- Constructing pedestrian refuge islands may require decreasing the width or number of travel lanes and can impact emergency vehicle access.

Time: Medium

Cost: \$ - \$\$



Mid-Block Crossings

Mid-block crossings are often installed in areas with heavy pedestrian traffic to provide more frequent crossing opportunities. They may also be added near major pedestrian destinations, such as schools, where people might otherwise cross at unmarked locations.

Benefits

- Provide additional opportunities for pedestrians to cross the street.

Time: Short - Medium

Application

- Additional pedestrian safety measures such as advanced warning signs, raised crosswalks and curb extensions should be considered at mid-block crossings.
- Stop lines at mid-block crossings should be set back a minimum of 20 feet from the crossing.

Cost: \$ - \$\$



Rectangular Rapid Flashing Beacons

Rectangular rapid flashing beacons (RRFB) are yield-to-pedestrian-signals that can have sensors or be wirelessly synchronized to alert drivers when a pedestrian is entering the crosswalk. RRFBs are usually placed at mid-block crossings or on neighborhood main streets where an additional level of pedestrian safety is required.

Benefits

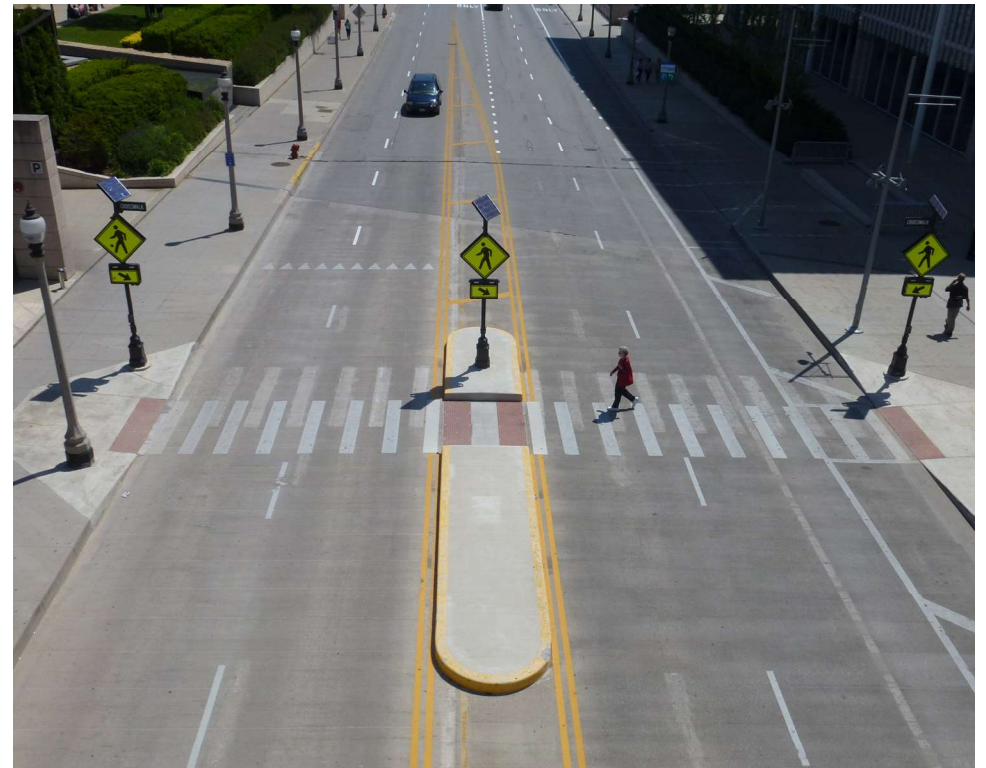
- Visually alerts drivers when pedestrians are entering the crosswalk.
- Extra nighttime and high-fog visibility.
- Ideal for uncontrolled crossings locations like midblock crossings.

Time: Short - Medium

Cost: \$ - \$\$

Application

- RRFBs have to be installed in pairs with one on each side of the roadway. If a median or Pedestrian Safety Island is used, then three RRFBs may be needed.



Signal Timing

Signal timing such as leading pedestrian intervals (LPI), lagging left turns, and protected turning phases are used to give pedestrians priority at intersections and temporarily separate pedestrian and vehicles at crossings. Crossing speeds of pedestrians should also be considered when retiming traffic signals.

Benefits

- Reduce overall pedestrian wait times and exposure at intersections.
- LPIs allow pedestrian to begin crossing 3-6 seconds before vehicles traveling in the same direction are given the green light.
- Decrease conflicts between pedestrians and vehicles by improving visibility.

Time: Short

Cost: \$ - \$\$

Application

- Short cycle lengths of 60 - 90 seconds are ideal for urban areas.
- Crossing time should be site specific. Longer crossing times should be considered in areas with higher populations of elderly residents and children.
- The Federal Highway Administration suggest that crossing time should be calculated based on a walking speed no more than 1.065 m/s (3.5 ft/s).





ONE WAY
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Seaf
Park

cta

Link

Link
Washington/
LaSalle

118	120	122	124	126	128	130	132
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Link Link Services

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Street Design
Tools for
Transit

Transit Shelters

Transit shelters are located in the streets' furniture zone and provide a protected place for people to sit and wait for the bus.

Benefits

- Provide seating and protection from the elements for people waiting for the bus.
- Space to provide information to riders on the transit system and schedule.
- Can generate revenue through advertising.

Time: Short

Cost: \$ - \$\$

Application

- Transit shelters should be provided at all stops with moderate to high boardings, as well as at transfer points, stops in weather-exposed locations, and stops with a prevalence of children and/or older adults.
- Ensure transit shelters are well-lit and people waiting are easily visible.
- Transit shelters should include street furniture (particularly garbage cans) and need to be cleaned and maintained.
- Transit shelters are typically oriented open towards the street but other configurations are possible.
- Transit shelters are typically 4' deep and must provide a minimum 2.5- by 4-foot clear space for wheelchair users located entirely within the shelter space.



Transit Enhancements: Bus-Only Lanes

Transit enhancements such as bus-only lanes can be used to improve transit service and customer experience.

Benefits

- Bus-only lanes can reduce travel times for buses and increase on-time performance.
- Bus-only lanes can also reduce conflicts between buses and vehicles and improve traffic flow for the street as a whole.

Application

- Transit enhancements such as bus-only lanes should be prioritized on corridors where transit is delayed by congestion and curbside activities.
- Deciding where to implement bus-only lanes should be based on existing and future transit volume and demand, and the potential to reduce total person delay for the corridor.
- The reliability of transit travel times can be a good indicator of the potential benefit of bus-only lanes.
- Markings, signage, and enforcement are necessary to ensure bus-only lanes at their highest level.

Time: Short

Cost: \$ - \$\$



Transit Enhancements: Queue Jumps

Transit enhancements such as queue jump signals and lanes can improve transit travel times by giving priority to transit and allowing transit to bypass traffic and enter the intersection.*

Benefits

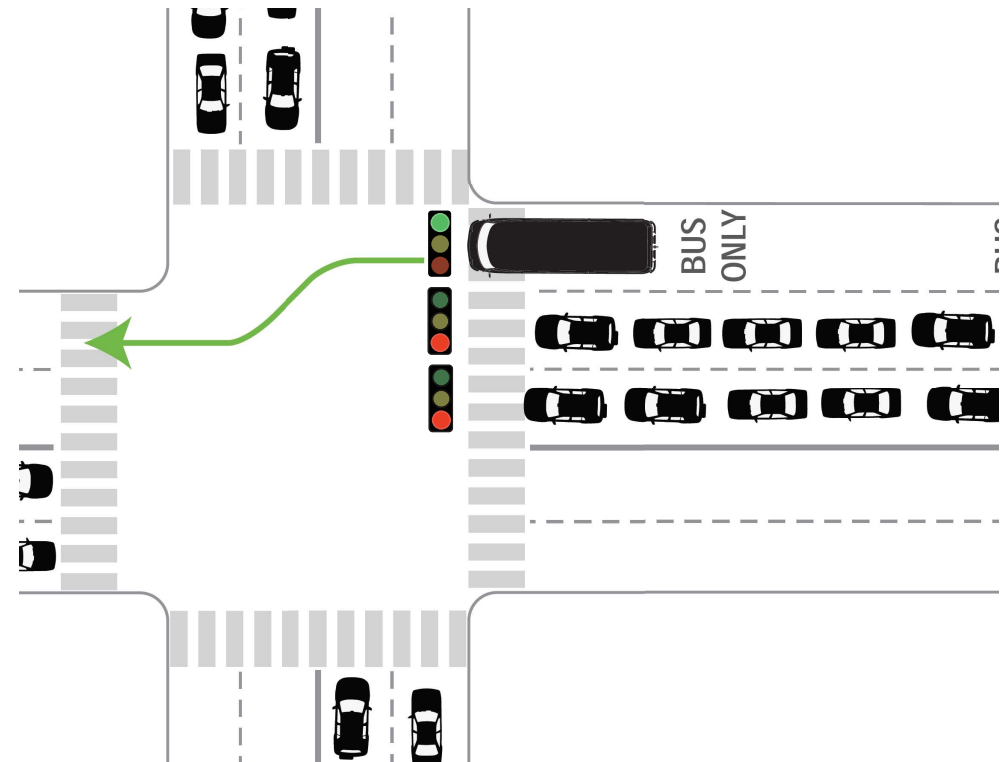
- Queue jumps can improve travel times for buses.
- Queue jump lanes allow buses to easily enter traffic flow in a priority position at signals.

Application

- Queue jumps should be prioritized on corridors where transit is delayed by congestion and curbside activities.
- Buses are allowed to use restricted lanes to bypass queued vehicles at signalized intersections, reducing travel time and providing improved service reliability.
- Bus enters into a short lane (could also be utilized as a right turn lane) located adjacent to the through lane and stops at the intersection's near side.
- Separate signal provides an early green light to the bus to move through the intersection and into the through travel lane prior to the general traffic.
- Common technique: many U.S. cities, including Portland, Denver, San Francisco, Las Vegas and Seattle, have implemented queue jumps into their transit systems.

Time: Short

Cost: \$\$



*Ministry of Transit Ontario. (2012). *Transit Priority Measures*. Retrieved from <http://www.mto.gov.on.ca/english/transit/pdfs/transit-supportive-guidelines.pdf>

Transit Enhancements: Transit Signal Priority

Transit enhancements such as Transit Signal Priority (TSP) serve to provide a more consistent and reliable level of transit service.

Benefits

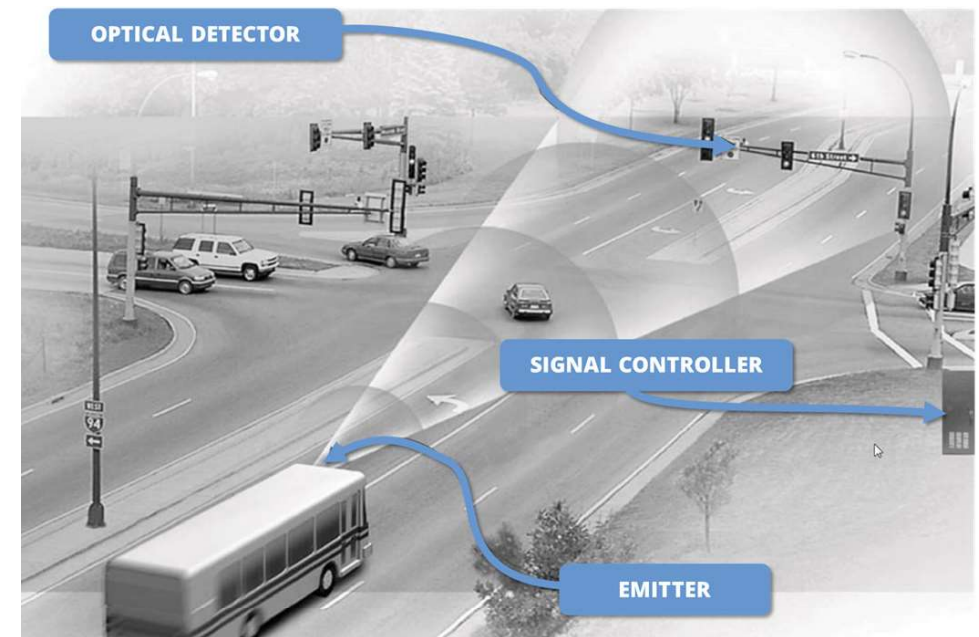
- TSP reduce delay for transit vehicles at traffic signals.
- TSP can improve transit reliability and travel time.

Application

- TSP is effective at intersections with routinely long vehicle queues, or on routes where transit routes are commonly delayed.
- TSP is most effective at intersections with far-side stops or no stops that allow buses to cross without waiting at a signal.
- Active TSP will require a high degree of coordination between the Detroit Department of Transportation (DDOT) and Department of Public Works (DPW), with regard to on-board technology as well as signal technology and communications systems, transit schedules, and system goals.*

Time: Short

Cost: \$\$\$



* National Association of City Transportation Officials. (n.d.). *Active Transit Signal Priority*. Retrieved from <https://nacto.org/publication/transit-street-design-guide/intersections/signals-operations/active-transit-signal-priority/>

Transit Enhancements: Bus Bulbs

Transit enhancements such as bus bulbs can expedite transit travel times by aligning the bus stop along the travel lane and eliminating the need to pull in and out of traffic to pick up and drop off passengers.

Benefits

- Bus bulbs are curb extensions that improve bus travel times by extending bus stops along travel lanes
- Bus bulbs eliminate the need for buses to pull in and out of traffic at bus stops

Application

- Bus bulbs should be combined with transit shelters.
- Bus bulbs are typically at least 6' deep, often the width of adjacent parking lanes. The length of the bus bulb depends of transit frequency and types of buses.
- Installation of bus bulbs may reduce the number of on-street parking spaces.

Time: Medium

Cost: \$\$ - \$\$\$

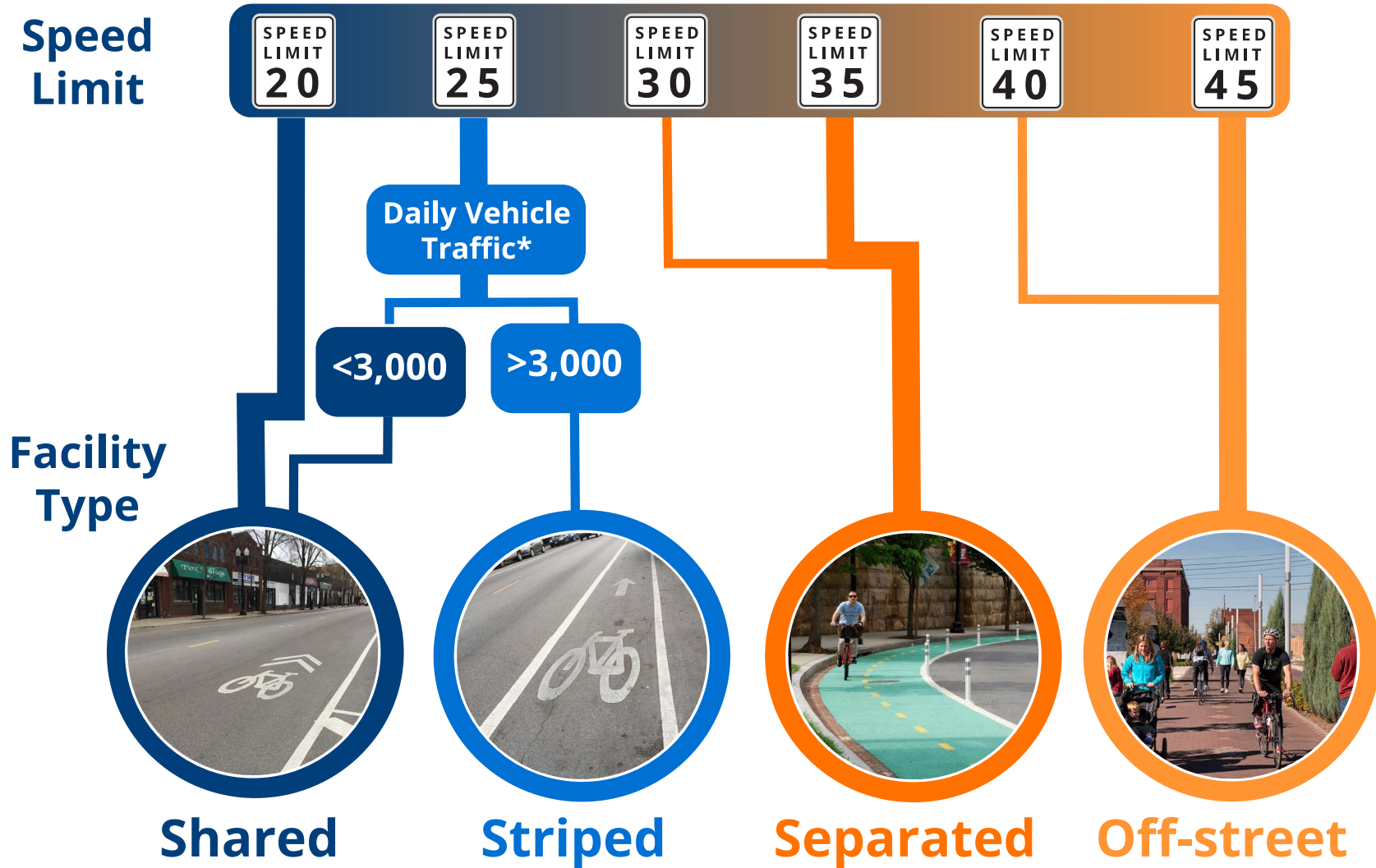




Silver Line Bus Rapid Transit in Grand Rapids, MI

Street Design
Tools for
Bicyclists

Bicycle Facility Guidance



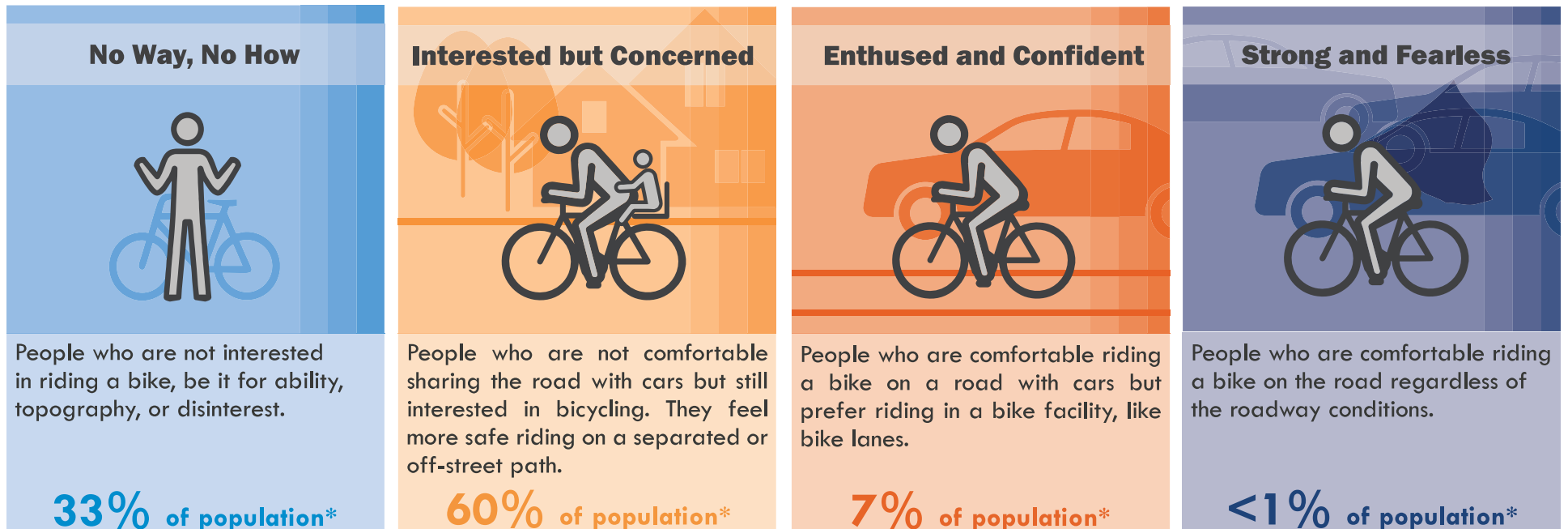
* Average annual daily traffic (AADT) is the total volume of vehicle traffic on a road for a year per day.

** Criteria are adapted from the National Association of City Transportation Officials' Contextual Guidance for All Ages and Abilities Bikeways.

Types of Bicycle Riders

In the attempt to understand people's relationship with bicycling as a form of active transportation, the Bicycle Coordinator at the Portland Office of Transportation categorized people into four groups: (1) no way, no how, (2) interested but concerned, (3) enthused and confident, and (4) strong and fearless.

Over half of the population (60%) falls into the category 'interested but concerned', suggesting they would ride if they felt safer on the road*. In order to address the needs of the many 'interested but concerned' riders, low-stress bike facilities, such as separated bicycle lanes and off-street paths are encouraged**.



* Geller, R. (2005). Four types of cyclists. Portland Office of Transportation. Retrieved from <https://www.portlandoregon.gov/transportation/article/264746>

** Dill, J., McNeil, N. (2013). Four types of cyclists? Examinations of typology for better understanding of bicycling behavior and potential. Transportation Research Board: Journal of the Transportation Research Board, 2387:129-138.

Separated Bicycle Lanes

A separated bicycle lane, or cycle track, is physically separated from motor traffic using a variety of treatments such as on-street parking, raised curbs or medians, bollards, landscaping, planters, concrete barriers and/or distinctive paving. A two-way cycle track is a type of separated bicycle lane that allows bicyclists to travel in both directions on one side of the road.

Benefits

- The dedicated, separated space for bicyclists increases perceived comfort and safety (and, depending on the particular location and design, actual safety), making the facility more attractive to bicyclists of a wide range of abilities and ages.
- Physical separation all but eliminates the risk and fear of a collision with vehicles mid-block and decreases the risk of dooring.
- Physical separation prevents or reduces parking in the bicycle lane.

Time: Medium

Cost: \$\$

Application

- Separated bicycle lanes provide a moderate to high level of comfort to a wide range of bicyclists, particularly when the separation is a physical barrier.
- While separated bicycle lanes have the potential to provide a superior facility for bicyclists, there are many more design challenges that must be addressed in their implementation. In particular, special consideration must be given to the design at intersections, driveways and transit stops to manage conflicts, improve visibility and maximize awareness for both bicyclists and motorists.
- A two-way cycle track may be applied when there is not enough space for separated bicycle lanes on either side of the street, or to allow bicyclists to travel in both directions on a one-way road.



Off-Street Bicycle Paths

Off-street bicycle paths, such as shared use paths used by pedestrians and bicyclists, are completely separated from vehicular traffic, aside from intersection crossings.

Benefits

- The dedicated space for bicyclists increases comfort and safety, making the facility more attractive to bicyclists of a wide range of levels and ages.
- Isolation from vehicular traffic allows for low stress riding and eliminates the risk and fear of being hit by a door or colliding with a vehicle (apart from any intersections).
- Off-street bicycle paths provide an ideal environment to learn to ride a bike in the city or to teach children how to ride.
- Off-street bicycle paths provide recreational and exercise opportunities.

Application

- The planning, design and construction of off-street bicycle facilities can require capital construction work and consequently take a long time, especially when the facility is not being built on an existing right-of-way.
- If implemented as part of a larger street construction project, then off-street bicycle paths need only add a marginal cost. Costs could be significantly higher for a standalone project that requires major site preparation and construction work.

Time: Medium - Long

Cost: \$\$\$ - \$\$\$\$



Bike Boxes

Bike boxes are designated spaces for bicyclists between the stop bar and pedestrian crosswalk at signalized intersections. They allow bicyclists to queue in front of motor vehicles at red lights, either to position themselves to make a left turn or to improve their visibility when proceeding on a green light.

Benefits

- Provides designated space to increase the visibility of queued bicyclists for motorists waiting at red lights.
- Offers bicyclists the ability to enter the intersection in front of motor vehicles when the signal turns green, which improves visibility and reduces bicycle-vehicle conflicts at intersections.
- Formalizes bicyclist behavior at intersections and encourage bicyclists to move up and in front of stopped motor vehicle traffic to increase their visibility when navigating the intersection during the next green phase.
- Provides bicyclists with the opportunity to position for a left turn during red phases. On multi-lane streets, bike boxes that extend across all lanes up to the left turn lane allow left-turning bicyclists to queue in front of left-turning vehicles behind them.

Time: Short

Cost: \$

Application

- Provides a moderate improvement to cyclist comfort by facilitating safer and more convenient maneuvers at intersections.
- Requires changes to street markings, including a potential shift in the location of an intersection's stop bar.



Bicycle Signals

Bicycle signals provide a dedicated indicator for bicyclists proceeding through an intersection. They are used in conjunction with separated bicycle lanes to separate through bicycle phases from the motor vehicle turning phase. For example, for a separated bike lane on the right side of a street, a bike signal would be used to separate the bicycle through phase from the motor vehicle right turn phase.

Benefits

- Decrease intersection conflicts between bicyclists proceeding straight through an intersection and vehicles making turns across the bike lane.
- Through the use of leading bicycle intervals, bike signals can be timed to provide a green signal for cyclists before motor vehicles receive a green light. This allows bicyclists to enter the intersection earlier and increase their visibility to motorists navigating the intersection.
- Provide more clarity for all road users and provide motorists with a better understanding of bicycle movements to anticipate at intersections.

Time: Short - Medium

Cost: \$ - \$\$

Application

- When used at appropriate locations, bike signals can provide a high level of comfort to bicyclists by providing clarity at intersections for riders of all skill levels. Novice bicyclists will see the most benefit from bike signals.
- Signal installation can be capital-intensive and may require the town to evaluate the effects of a new signal phase(s) on existing traffic volumes and flows.



Two-Stage Turn Queue

Two-stage turn queue boxes allow bicyclists to make left turns across high-volume or multi-lane intersections from a right-side aligned bike lane (or right turns from a left-side aligned bike lane). A bicyclist uses the queue box as a staging area to divide a difficult turn into two distinct phases with fewer vehicle conflicts.

Benefits

- Formalizes a “pedestrian style” bicyclist turning movement, in which the bicyclist typically crosses a street with through traffic and then waits in the queue box for a signal change to proceed across the intersection with cross street traffic. The refuge area provides bicyclists with a safe location to wait to make the second portion of the maneuver out of the way of other through bicycle and vehicle traffic.
- Bicyclists performing a two-stage turn avoid higher-speed conflicts with vehicles using the intersection.
- Positions bicyclists in front of stopped vehicles at red lights on the second leg of the turning movement, providing the safety benefits associated with bike boxes.
- Provides clear visual cues for bicyclists and reduces uncertainty when navigating an intersection.

Application

- Provides a high level of comfort to less experienced or more risk-averse bicyclists because “pedestrian style” two-stage turns generally require less skill than merging into moving traffic to perform “vehicle style” turns.
- Depending on the intersection configuration, convenience for motorists may be reduced, as a two-stage turn queue box is typically positioned in the path of vehicles seeking to make a right turn on red.

Time: Short

Cost: \$



Striping Through the Intersection

Striping through an intersection guides bicyclists through an intended path. White dashed markings are typically used but can be supplemented by green paint to increase visibility and draw attention to potential conflicts. Similar striping can be applied at driveways and other curb cuts.

Benefits

- Provides a direct path for bicyclists and reduces their uncertainty about how to navigate the intersection. Predictable cycling behavior through an intersection reduces the risks of conflicts with motorists.
- Markings such as dotted lines and green paint are also intended to give motorists an increased awareness of where bicyclists may be positioned. They provide a clear boundary between the paths of through bicyclists and either through or crossing motor vehicles in adjacent lanes, and in doing so alert motorists to the potential presence of bicyclists in the intersection or other traffic conflict areas.
- Striping, especially with colored paint, may increase the likelihood of turning motorists yielding to through bicyclists.

Time: Short

Cost: \$

Application

- Intersections with striping provide a moderate level of comfort to bicyclists, contributing to a more comfortable experience than intersections with no markings at all. However, since the markings offer no physical protection, less experienced cyclists who are uncomfortable riding in mixed traffic may still choose to avoid certain busy intersections, regardless of markings.



Nodes

NODES

