

BICYCLE & PEDESTRIAN TOOLBOX

AMARILLO
area







IN MOTION

FINAL JUNE 2021



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Prepared for the Amarillo MPO as a supplementary design document for the Amarillo Area in Motion regional multimodal mobility plan.





SIDEWALK

SAFETY ●●●●● COST ●●●○○ FEASIBILITY ●●●●●

DEFINITION

Sidewalks are the standard pedestrian facility that provide a designated space for people to walk or use wheelchairs to get from one place to another.

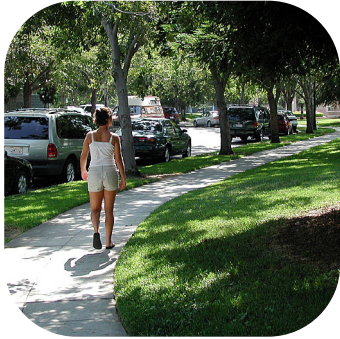


Photo Source: PBIC? (Left), Kimley-Horn (Right)



Photo Source: Kimley-Horn

DESIGN GUIDELINES

- Typically, sidewalks are paved facilities made from concrete, but they can also be constructed using materials such as asphalt or crushed stone based on the site-specific context and availability of funding.
- The recommended minimum sidewalk width is 5 feet.
- It is recommended that a buffer zone of 4-6 feet be incorporated to further separate pedestrians from the roadway. This buffer zone is often created by a landscaped or hardscaped strip next to the curb, but it can also be created by the presence of bike lanes or on-street parking to create a separated space between the sidewalk and the roadway. The separation is particularly important when the sidewalk is next to the curb. In cases where the sidewalk is immediately adjacent to the curb, the sidewalk is often widened an additional 2-3 feet.
- The Americans with Disabilities Act (ADA) requirements should be met for all new sidewalk facilities and any existing facilities should be retrofitted to meet ADA requirements where necessary.

BENEFITS

- Sidewalks improve both pedestrian safety and comfort by providing a defined travel space that is separate from automobile traffic.
- Sidewalks function as the backbone of the pedestrian network by connecting pedestrians to their homes and other important destinations such as schools, parks, commercial areas, employment, and community services.

CONSIDERATIONS

- It is recommended that sidewalks be installed along any new or reconstructed roadway.
- Efforts should be made to install sidewalks along roadways that do not currently have them, starting with areas of high pedestrian activity.
- Sidewalks should be installed along both sides of a roadway.
- Sidewalks should be designed to accommodate people of all ages and all abilities.



PEDESTRIAN-ONLY STREET

SAFETY ●●●●● COST ●○○○○ FEASIBILITY ●●○○○

DEFINITION

Pedestrian-only streets are sections of the roadway network where vehicle activity is either prohibited or restricted so that pedestrians may use the space for recreational or leisure activities, including but not limited to walking or running, shopping, sitting, and dining.



Photo Source: Arthur Bogacki (Left), NCSU (Right)



Photo Source: Jen Lobo

DESIGN GUIDELINES

- A physical barrier should be used to block pedestrian-only streets from the rest of the roadway network to prevent general vehicle traffic from accessing the facility.
- Pedestrian-only streets can be designed with flexibility to accommodate the needs of adjacent businesses. This can be done by restricting vehicular access to the facility to only allow emergency vehicles, essential services vehicles, and vehicles conducting business activities during specific windows of time.
- For a pedestrian-only street that allows restricted vehicle access for business-access only, signage should be posted to identify the types of vehicles allowed and the time frames during which access is allowed. In addition, the physical barriers should provide enough space for the specified vehicles to enter and exit the facility.
- It is recommended that pedestrian-only streets be relatively flat without changes in grade.
- These facilities can be paved with materials other than typical roadway paving treatments, such as brick or stone, to visually differentiate them from adjacent roadways. They can also be landscaped with plants, furniture, water features, and public areas to create a more welcoming environment.

BENEFITS

- Improves pedestrian safety by providing spaces free from the risk of interactions with automobiles.
- Creates a public space where pedestrians can gather and provide opportunities for commercial and leisure activities that contribute to the economic health of an area.

CONSIDERATIONS

- Should only be implemented where pedestrian activity and demand to spend time in or walk in the street are high enough to justify the facility.
- Appropriate levels of pedestrian activity and demand may occur along roadway segments in proximity to popular pedestrian destinations such as campus buildings, offices, shops, restaurants, and entertainment establishments.
- Emergency vehicles such as fire trucks and EMS should be able to obtain either direct or adjacent access to the facility. Vehicles conducting essential services should also be able to access the facility unless alleys provide alternative access.
- Can be temporary (i.e. weekends only).



MARKED CROSSWALK

SAFETY ●●●●● COST ●●●○○ FEASIBILITY ●●●○○

DEFINITION

Marked crosswalks are designated locations where pedestrians can cross a roadway. These facilities are generally installed at intersections. Motorized vehicles are expected to yield to pedestrians when they are using a crosswalk.



Photo Source: Dan Burden



Photo Source: Tony Hull (Left), TJW (Right)

DESIGN GUIDELINES

- Crosswalk width should reflect the width of the sidewalks that approach the intersection but should be no less than 6 ft wide and, in most cases, should be 8-10 ft wide.
- Connections between sidewalks and crosswalks at intersections frequently create changes in grade, which must be addressed using ADA-compliant curb ramps.
- Standard marked crosswalks should be delineated with high-visibility pavement paint using a white striped pattern. Continental markings or ladder pattern shown in the images are preferred over standard parallel or dashed markings, as they are more visible to all roadway users.
- Crosswalks at four-way intersections should include electronic signage that designates when pedestrians are permitted to cross the roadway.
- Crosswalks should be perpendicular to streets to minimize crossing distances and limit the time that pedestrians are exposed.

BENEFITS

- Increases pedestrian and automobile safety by designating the appropriate locations for pedestrians to cross a roadway and by alerting drivers to the potential presence of crossing pedestrians.
- Creates crucial linkages in the broader pedestrian network that provide connectivity.

CONSIDERATIONS

- Crossing distances should be minimized to the extent possible to improve the safety of users, and when necessary, should be broken up using crossing islands (p. 7).
- Marked crosswalks should be accompanied by other measures on uncontrolled roadways where the speed limits exceed 40 mph and average daily traffic exceeds 12,000 vehicles. Crossings in these contexts benefit by being converted to Pedestrian Hybrid Beacons (p. 9) or Rectangular Rapid Flashing Beacons (p. 10).
- Crosswalks can be enhanced by special materials or paint treatments to help increase the visibility of the facility.



MID-BLOCK CROSSING

SAFETY ●●●○○ COST ●●●○○ FEASIBILITY ●●○○○

DEFINITION

Midblock crosswalks are marked crosswalks that are installed at midblock locations between intersections to provide pedestrians with designated crossing opportunities along a given block.

See page 29 for *Mid-Block Crossing Decision Matrix*



Photo Source: Dan Burden (Left), Dan Burden (Right)



Photo Source: Dan Burden

DESIGN GUIDELINES

- A pedestrian study should be performed to determine the need and suitable location prior to installing any midblock crossing. Designers should consider existing pedestrian and vehicular traffic volumes and vehicle speeds while assessing the need for a midblock crossing.
- Midblock crosswalks should be provided at locations where pedestrians are expected to cross. The midblock crosswalk location should give maximum visibility to both pedestrians and drivers.
- Midblock crossings must be marked with signage and high visibility pavement to improve the visibility of crossing pedestrians to drivers, especially at night. Lighting considerations should be included in crossing design, as well (p. 12). Signage and pavement marking design should reference the Texas MUTCD.
- Connections between sidewalks and crosswalks at midblock locations frequently create changes in grade, which must be addressed using ADA-compliant curb ramps (p. 6).
- Like marked crosswalks, midblock crosswalks should be striped to alert drivers to the presence of the facility and show pedestrians the designated crossing location.
- Restricting parking near a mid-block crosswalk or adding curb extensions can help keep the area around the facility clear and visible for all users.

BENEFITS

- Increases pedestrian safety by providing designated crossing space in areas where pedestrians might otherwise be tempted to cross the street outside of a crossing space.
- Increases the directness of connections to destinations with high pedestrian demand, such as schools, parks, transit stops, and social/cultural destinations.

CONSIDERATIONS

- Midblock crosswalks are suitable in areas with long block lengths where pedestrians would otherwise be required to travel significantly out of their way to cross a roadway safely, or in locations where there is high pedestrian travel demand to destinations at midblock.
- Midblock crossings may be provided for bus stops located more than 20 feet from an intersection.
- Pedestrian crossing islands (p. 7) and flashing beacons (p. 10) complement midblock crosswalks by increasing pedestrian safety.



CURB RAMP

SAFETY ●●●●● COST ●○○○○ FEASIBILITY ●●●●●

DEFINITION

Curb ramps are sloped facilities that provide transitions between sidewalks and roadways, particularly at pedestrian crossing facilities. The designs of curb ramps are critical for all pedestrians, but particularly for people with disabilities.



Photo Source: Kimley-Horn (Left), Dan Burden (Right)



Photo Source: Shane Sawyer

DESIGN GUIDELINES

- The slope of a curb ramp must be no more than 1:12 (cannot exceed 1 inch per foot, or a maximum of 8.33%) for newly constructed ramps.
- The maximum slope allowed on any side flares of a curb ramp is 1:10.
- It is recommended that all curb ramps are designed with the lowest slope possible for each specific context.
- Tactile and detectable warnings should be provided at the edges of each curb ramp to alert pedestrians to both the presence of the facility and the roadway's edge.
- At intersections, separate curb ramps should be installed in the direction of each adjacent crosswalk rather than one curb ramp installed at the corners of the intersection.
- To meet ADA requirements:
 - Newly constructed or altered roadways must have curb ramps at all pedestrian crossings, whether at intersections or midblock locations, that have curbs or other barriers to entry.
 - Newly constructed or altered street-level pedestrian walkways must have curb ramps at all pedestrian crossings, whether at intersections or midblock locations, that have curbs or other barriers to entry.

BENEFITS

- Allows pedestrians using mobility devices or wheeled equipment to safely move between the sidewalk and the roadway without having to step up or down.
- Improves pedestrian experience for wheelchair users, people using walkers, canes, or crutches, and people pushing carts, strollers, or luggage. Bicyclists also benefit from these facilities.
- Improves orientation for visually impaired pedestrians by directing them toward the correct crosswalk.

CONSIDERATIONS

- Existing curb ramps that do not meet design requirements and recommendations should be upgraded wherever possible.
- Curb ramps should be installed/upgraded in all applicable locations, and facilities in locations with high pedestrian volumes should be prioritized. These locations can include, but are not limited to, near schools, commercial areas, residences, parks, transit stops, medical facilities, and employment hubs.



CROSSING ISLAND

SAFETY ●●●●○ COST ●●○○○ FEASIBILITY ●●●○○

DEFINITION

Crossing islands, also known as pedestrian refuge islands, are medians located mid-crosswalk; these medians provide a space for pedestrians to wait safely as they cross a multilane roadway or intersection in phases.



Photo Source: Kimley-Horn (Left), Kimley-Horn (Right)



Photo Source: Adobe Stock

DESIGN GUIDELINES

- Crossing islands should be a minimum of 6 feet wide but are recommended to be wider if possible (8-10 feet is preferred). This allows the facility to accommodate pedestrians with disabilities and/or several pedestrians waiting on the island at one time.
- The island's at-grade cut-through should be the same width as the adjoining crosswalk and must include detectable warnings if the facility is at least 6 feet wide.

BENEFITS

- Provides a safe space for pedestrians to take refuge from automobile traffic in locations where crossings are long or complicated, or when the signal phase changes while pedestrians are still crossing the roadway.
- Allows pedestrians to focus on one direction of automobile traffic at a time when crossing a roadway at a midblock location.

CONSIDERATIONS

- Crossing islands can be installed in both controlled locations (i.e. signalized crossings) and uncontrolled locations (i.e. no traffic control devices or pedestrian signals are present).
- Crossing islands are well-suited for midblock crosswalks on roads with four or more travel lanes, especially where speed limits are 35 mph or greater and/or where annual average daily traffic is 9,000 vehicles or more.
- These facilities are also suitable for uncontrolled pedestrian crossings on 3-lane or 2-lane roadways with high vehicle speeds and/or volumes.



SIGNALIZED INTERSECTION

SAFETY ●●●●● COST ●●○○○ FEASIBILITY ●●●●●

DEFINITION

The primary purpose of a signalized intersection is to move traffic. It can be difficult for pedestrians to navigate, but there are techniques to improve the pedestrian experience at signalized intersections such as pedestrian signals, leading pedestrian intervals, and improved turning lanes.



Photo Source: Dan Burden (Left), Kimley-Horn (Right)



Photo Source: Dan Burden

DESIGN GUIDELINES

- Pedestrian signal timing and countdown indicator:
 - Minimizes the time that pedestrians must wait with signal timing. Long wait times encourage pedestrians to cross against the signal.
 - Should use the MUTCD-recommended average pedestrian walking speed of 3.5 feet per second, benefitting children and persons with disabilities.
- Leading Pedestrian Interval and No Right-Turn on Red:
 - Provides enough time for pedestrians to cross at least one lane of traffic before the light turns green for vehicles.
 - Gives pedestrians a minimum lead time of 3-7 seconds, depending on the total crossing distance.
- Improved Turning Lanes:
 - Utilize slip lanes to allow traffic to turn right without entering the intersection.
 - Orient crosswalks at a 90-degree angle to the slip lane to optimize sight lines.
 - Position crosswalks at least one car length behind the intersecting roadway. This provides space for vehicles to wait for a gap in oncoming traffic after passing through the crosswalk.
 - Consider a raised crosswalk in addition to geometric improvements of slip lanes.

BENEFITS

- Countdown indicators inform pedestrians of the amount of time in seconds that is available to safely cross during the flashing DON'T WALK interval. Motorists also use the countdown indicators to manage their travel through an intersection.
- Leading pedestrian intervals enhance the visibility of the pedestrian in an intersection and reinforce the pedestrian right-of-way.
- Improved slip lanes allow motorists and pedestrians to easily see one another while navigating slip lanes, in part due to slower vehicle speeds.

CONSIDERATIONS

- Typically used at intersections with high volumes of pedestrians (especially those who walk slower) and conflicting turning vehicles, most commonly in downtown areas.



PEDESTRIAN HYBRID BEACON

SAFETY ●●●○○ COST ●●●●● FEASIBILITY ●●●○○

DEFINITION

Pedestrian Hybrid Beacons (PHB) are signalized pedestrian crossings that control automobile traffic during designated pedestrian crossing intervals. These facilities are installed either midblock or at intersections that do not have existing traffic signals, like some T-intersections. The beacon remains off and traffic can flow freely through the crossing space until a pedestrian activates it.



Photo Source: Wisconsin DOT



Photo Source: Mike Cynecki (Left), Mike Cynecki (Right)



DESIGN GUIDELINES

- Minimum volumes of 20 pedestrians or bicyclists per hour for major arterial crossings (volumes exceeding 12,000 vehicles/day) or any unsignalized designated crossings of roadways with six or more lanes.
- Vehicle signals comprised of two clusters of three beacons facing both directions of the approach to the facility. The three beacons on each cluster include one circular yellow beacon centered below two circular red beacons.
- An overhead sign (one facing each direction of the approach to the facility) that explains the stages of the beacons to approaching drivers.
- A standard pedestrian signal with accompanying signage on each end of the crossing that communicates when they are permitted to begin crossing, how much crossing time they have remaining, and when not to cross.

BENEFITS

- Improves pedestrian connectivity by providing safe and comfortable pedestrian crossings at key destinations or locations.
- Improves safety and motorist compliance at intersections with high traffic volumes and high frequencies of pedestrian crashes.
- PHBs give pedestrians a level of priority by initiating pedestrian crossing intervals promptly after being activated.

CONSIDERATIONS

- Consider installing these facilities when:
 - There is pedestrian demand to cross a roadway in a location that does not have other crossings nearby.
 - The roadway has three or more lanes, annual average daily traffic levels over 9,000 vehicles, and/or a speed limit of 40 mph or higher.
- The pedestrian detection used to activate the beacons can be manual (i.e. pushbuttons) or automated (i.e. video or infrared detection).



RRFB (Rectangular Rapid Flashing Beacon)

SAFETY ●●●●● COST ●●●○○ FEASIBILITY ●●●●●

DEFINITION

RRFBs are activated pedestrian crossings that alert automobile drivers to the presence of pedestrians crossing a roadway. These facilities are installed either midblock or at intersections that do not have existing traffic signals, like some T-intersections. The beacons remain off and traffic can flow freely through the crossing space until a pedestrian activates the beacons. RRFBs do not control automobile traffic, but instead provide a warning to approaching drivers that pedestrians may be crossing. These facilities include pedestrian crossing signage and rectangular beacons that flash more rapidly and at a brighter intensity than standard beacons.



Photo Source: Toole Design Group



Photo Source: Michael Frederick (Left), Dan Burden (Right)

DESIGN GUIDELINES

- RRFBs should be rectangular and flash at a bright intensity at a rapid rate.
- The beacons should accompany standard pedestrian crossing signage and should be affixed directly to the post that holds the signage, between the pedestrian crossing sign and an arrow sign that points to the crossing.
- The crossing space should be delineated with striped pavement markings.
- RRFBs should be placed on both sides of the crossing.
- The facility should include pedestrian activation/detection equipment, such as pushbuttons.
- Use on Collectors and Arterials with volumes exceeding 12,000 vehicles per day.
- Consider using on collectors with 5,000 - 12,000 vehicles per day and secondary arterials with up to 12,000 vehicles per day.

BENEFITS

- Increased yielding behavior of drivers at crosswalks when supplementing standard pedestrian crossing signs.
- Installed with minimal traffic disruption.
- Lower installation and operating costs compared to traffic signals and hybrid signals.

CONSIDERATIONS

- Though RRFBs do not control traffic, vehicles must yield to pedestrians using the facility.
- RRFBs are suited for installation at pedestrian crossings on multilane roadways where speed limits are below 40 mph.
- The pedestrian detection used to activate the beacons can be either manual (i.e. pushbuttons) or automated (i.e. video or infrared detection).



STREET FURNITURE & SHADE

SAFETY ●●●○○ COST ●●●○○ FEASIBILITY ●●●●○

DEFINITION

Street furniture refers to elements that are placed within the pedestrian realm, particularly on sidewalks, that provide enhanced safety and comfort for pedestrians as they pass through the space. This can include benches, trash receptacles, street trees, planters, water fountains, and even transit shelters.



Photo Source: Carl Sundstrom (Left), Dan Burden (Right)



Photo Source: Dan Burden

DESIGN GUIDELINES

- Street furniture should be placed so that the sidewalk is clear of any obstructions, typically between the sidewalk and the curb.
- Placement of street furniture should provide enough space so that all types of users can access them and should not obstruct a driver's or pedestrian's view of the roadway.

BENEFITS

- Enhances pedestrian comfort by providing space for users to rest, shade to protect from sun exposure, and visual stimulation to create a more friendly and enjoyable pedestrian environment.
- Improves both the real and perceived safety of pedestrians by creating a barrier between the street and the pedestrian realm.
- In warmer climates such as Amarillo, street furniture and trees can provide shade that creates an environment that encourages walking during higher temperatures.

CONSIDERATIONS

- Street furniture should be properly maintained for both usability and safety purposes. The furniture zone should be kept clear of debris and other tripping hazards. Landscaping should be managed so that vegetation does not become overgrown and create hazards for either pedestrians or roadway users.
- High-quality street furniture should be installed to the extent possible. These elements are more cost-effective long-term and show a sense of pride for public spaces.
- Plan for maintenance needs and costs from the outset of installation.



LIGHTING

SAFETY ●●●●● COST ●●●●○ FEASIBILITY ●●●●○

DEFINITION

Pedestrian and street lighting allow people to identify objects quickly and easily during times of low light, resulting in a safer environment. Pedestrian lighting is a crucial element in providing a safe and desirable multimodal environment.



Photo Source: Adobe Stock (Left), Adobe Stock (Right)



Photo Source: Adobe Stock

DESIGN GUIDELINES

- Streetlights should be placed on both sides and/or both ends of a pedestrian facility or roadway that intersects a pedestrian facility.
- 20 units of illuminance (lx) are necessary to allow automobile drivers to detect a pedestrian in a crosswalk. This level of illumination can be achieved by placing a light 10 feet from the crosswalk, in between the crosswalk and the approaching automobile, at midblock crosswalks and intersections.

BENEFITS

- Lighting increases the safety of pedestrians during dark conditions by improving their visibility and detectability, especially when pedestrian facilities intersect with the roadway network.
- Lighting enhances both the real and perceived comfort, safety, and security of pedestrians by illuminating their surroundings during dark conditions so that they can maneuver through a facility and identify any potential hazards.

CONSIDERATIONS

- The level and placement of lighting fixtures should be determined based on the context of the pedestrian facility or roadway.



CURB EXTENSION/BULB-OUT

SAFETY ●●●●● COST ●●●○○ FEASIBILITY ●●●○○

DEFINITION

Curb extensions, also known as bulb-outs, are facilities that extend the sidewalk or curb line further into the streetscape than standard curbs, thereby reducing the width of the roadway in locations where pedestrians are crossing.



Photo Source: Andy Hamilton (Left), Dan Burden (Right)



Photo Source: Dan Burden

DESIGN GUIDELINES

- Curb extensions cannot extend into travel lanes and should not extend across bicycle lanes. Therefore, the width of a curb extension in any given direction should be no wider than the adjacent on-street parking, bus bay, or turn bay so that it does not extend into the roadway or bicycle lane.
- Any grade-separation that exists between the sidewalk and the curb extension or between the curb extension and the roadway should include ADA-compliant ramps.

BENEFITS

- Curb extensions increase pedestrian safety by shortening the distance that they must traverse across a roadway.

CONSIDERATIONS

- Curb extensions are only viable in locations where there is on-street parking, where there are bus bays for buses to pull out when making stops, or where there are automobile turn bays.
- Curb extensions can be installed at both mid-block locations and intersections.
- Installation of curb extensions may reduce the possibility of changes to the streetscape in the future and can make turning movements more difficult for larger vehicles when installed at intersections.



SHARED LANE/BIKE ROUTE

SAFETY ●○○○○○ COST ●○○○○○ FEASIBILITY ●●●●●●

DEFINITION

Shared lanes are a type of bicycle facility that denote where a bicyclist may legally share the road with motorized vehicles. This type of facility is recommended for local streets only where pavement width is limited. Shared lanes have a low level of comfort rating for users because they do not provide any separation from motorists.



Photo Source: Heather Bowden



Photo Source: Kimley-Horn (Left), Dan Burden (Right)

DESIGN GUIDELINES

- Shared lanes are identified with both pavement markings and signage. The marking used for this facility, also known as a “sharrow”, is a bicycle with a double arrow above it to mark the direction of travel. Signage is useful when placed at the beginning of a shared lane to alert motorists.
- Sharrows should be placed immediately after an intersection and spaced at 250-foot intervals.
- Unlike other on-street bicycle facilities, shared lanes do not require additional pavement width.

BENEFITS

- Encourages bicyclists to position themselves safely in lanes too narrow for a motor vehicle and a bicycle to comfortably travel side by side within the same traffic lane.
- Alerts motor vehicle drivers to the potential presence of bicyclists and encourages safe passing by motorists.
- Alerts road users of the lateral position bicyclists are expected to occupy within the travel lane.
- Provides a wayfinding element along bike routes and reduces the likelihood of wrong-way bicycling.

CONSIDERATIONS

- While this type of facility is easiest to implement, it has a very low level of comfort for users and should only be implemented on streets with a speed limit of 30 mph or lower and average daily traffic volumes below 1,000 vehicles.
- Shared lanes are useful in short distances to connect other, more separated bicycle facilities and in potential conflict areas such as angled parking or intersections.



BIKE LANE

SAFETY ●●●○○ COST ●○○○○ FEASIBILITY ●●●●○

DEFINITION

Bike lanes are one-way facilities that typically carry bicycle traffic in the same direction as adjacent motor vehicle traffic. Bike lanes are provided for the exclusive or preferential use of bicyclists on a roadway and are identified through signage, striping, or other pavement markings.

When there is sufficient roadway width, a buffer should be striped between a bike lane and travel lane to provide additional comfort for users. This buffer increases the level of comfort for bicyclists.



Photo Source: Jennifer Campos



Photo Source: Brandon Whyte (Left), TJW (Right)

DESIGN GUIDELINES

- A minimum bike lane width of 5-feet is acceptable; however, 6 feet is desired when possible. If a striped buffer is present, 2 feet is the desired minimum for the buffer.
- Bike lanes are typically on the right side of the street, between the outside travel lane and curb.
- Bike lanes are compatible on streets with speed limits between 25-35 mph and average daily traffic volumes ranging from 3,000 to 10,000 vehicles.
- Buffered bike lanes are most beneficial on streets with higher travel speeds (> 35 mph), higher travel volumes (10,000+ ADT), and higher truck traffic.
- Buffer treatments can vary from striping to permanent concrete barriers (p. 20).

BENEFITS

- Creates a designated space for bicycle travel and increase separation from automobiles. Bicyclists can continue riding at a comfortable speed, even as vehicular traffic slows in the adjacent travel lanes.
- Encourages less skilled riders to cycle on streets with higher travel speeds and higher traffic volumes.
- Increases the perception of safety among bicyclists.

CONSIDERATIONS

- Bike lanes and buffered bike lanes should both utilize the presence of bicycle markings and signage.
- Standard bike lane symbols and arrows should be used to inform bicyclists and motorists of the restricted nature of the bike lane, and markings should be placed at periodic intervals to remind motorists of the presence of bicyclists.
- Interaction with existing drainage and grading should be considered when determining the facility width.



TWO-WAY CYCLE TRACK

SAFETY ●●●●● COST ●●●○○ FEASIBILITY ●●○○○

DEFINITION

A two-way cycle track is a type of on-street separated bicycle facility that is designed for two directions of travel. By separating cyclists from motor traffic, cycle tracks can offer a higher level of comfort than bike lanes and are more attractive to a wider spectrum of the public.



Photo Source: Toole Design Group (Left), Kristen Brookshire (Right)



Photo Source: Adam Coppola Photography

DESIGN GUIDELINES

- The desired width for a two-way cycle track is 12 feet plus an additional 3 feet of buffer space. In constrained areas, the track width may be reduced to 8 feet.
- A dashed yellow line should be painted in the middle to show the separation of the directions of travel. Bicycle lane markings can also be used with arrows to further communicate this message.
- At potential areas of conflict, such as driveways or intersections, signs and markings should indicate that drivers will yield to bicyclists.
- Buffer treatments can vary from striping to permanent concrete barriers (p. 20).

BENEFITS

- Dedicates and protects space for bicyclists by improving perceived comfort and safety. Eliminates risk and fear of collisions with over-taking vehicles.
- On one-way streets, reduces out of direction travel by providing contra-flow movement.
- Low implementation cost when making use of existing pavement and drainage and using parking lane or other barrier for protection from traffic.

CONSIDERATIONS

- Two-way cycle tracks may be a good alternative to buffered bike lanes when a street does not have enough room, because it only requires one buffer.
- Due to their high level of separation and comfort, two-way cycle tracks are compatible on roads with higher speeds and traffic volumes.
- This type of facility works best on streets with a low number of driveways, intersections, or other potential conflict areas.



BIKE LANE AT INTERSECTION

SAFETY ●●●●● COST ●●○○○ FEASIBILITY ●●○○○

DEFINITION

Designing intersections with bicycle facilities should reduce conflict between bicyclists (and other road users) and motorists by heightening the level of visibility, denoting a clear right-of-way, and facilitating awareness with competing modes. Intersection treatments can resolve both queuing and merging maneuvers for bicyclists and can be coordinated with timed or specialized signals.



Photo Source: Dylan Passmore



Photo Source: Toole Design Group (Left), Andrew Miller (Right)

DESIGN GUIDELINES

- Bicycle crossing markings or crosswalks are recommended at any intersection that has a separated bike facility.
- Markings should match the width of the corresponding bike facility and can range from dotted outside lines to colored pavement and bike symbols.
- Bike signal heads are recommended at signalized intersections that have separated bike facilities (p. 18).
- Bike boxes and two-stage turn queue boxes are recommended at signalized intersections with high volumes of left turning bicyclists and right turning vehicles (p. 19).

BENEFITS

- Raises awareness and visibility for both bicyclists and motorists at potential conflict areas.
- Guides bicyclists through the intersection in a straight and direct path.
- Increases bicycle level of comfort by delineating the bicycling zone.
- Makes bicycle movements more predictable.
- Reduces conflicts between bicyclists and turning motorists.

CONSIDERATIONS

- These measures may not be applicable for crossings in which bicycles are expected to yield priority or when bicyclists and pedestrians share a facility such as a sidepath.
- The level of treatment required at an intersection will depend on the bicycle facility type used, whether bicycle facilities are intersecting, the adjacent street functions, and surrounding land uses.



BICYCLE SIGNAL

SAFETY ●●●●● COST ●●●●○ FEASIBILITY ●○○○○

DEFINITION

Bicycle signals facilitate the movements of bicycle traffic through intersections. They increase the safety at intersections by restricting the movements of different vehicles and preventing potential conflicting movements.



Photo Source: Toole Design Group (Left), Dan Burden (Right)



Photo Source: Adam Coppola Photography

DESIGN GUIDELINES

- Bicycle signal heads are very similar to traditional signal heads in their three-phase design. The signal displays a bicycle symbol instead of a solid circle to help clarify its use.
- When using a bicycle signal head at an intersection, right turn on red should be prohibited for vehicles and communicated clearly with signage.
- The signal head should be in a position that is clearly visible to both bicyclists and motorists from the same approach.
- A supplemental “bike signal” sign can be placed below the signal head to increase awareness.

BENEFITS

- Separates bicycle movements from conflicting motor vehicle, streetcar, light rail, or pedestrian movements.
- Protects bicyclists in the intersection, which may improve real and perceived safety at high-conflict areas.
- Improves operation and provides appropriate information for bicyclists (as compared to pedestrian signals).
- Helps to simplify bicycle movements through complex intersections and potentially improve operations or reduce conflicts for all modes.

CONSIDERATIONS

- Bike signal heads are best used at signalized intersections that have separated bike facilities. While there is no standard threshold or warrant for bike signals, each intersection should be studied before choosing to implement this type of control device.
- Signal timing with bicycle-only indications should consider activating the signal with each cycle prior to implementation with detection. This will increase awareness of the interval for motorists and bicyclists.
- Leading intervals for bicyclists also help to increase pedestrian safety by decreasing right turn conflicts on green.



BIKE BOX & TWO-STAGE TURN QUEUE BOX

SAFETY ●●●●● COST ●●○○○ FEASIBILITY ●●●●○

DEFINITION

A bike box is a designated area at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase. Bike boxes are often necessary when bike lanes are shifted from one side of the roadway to the other.

Two-stage turn queue boxes offer bicyclists a safe way to make left turns at multi-lane signalized intersections from a right-side cycle track or bike lane, or right turns from a left-side cycle track or bike lane. Two-stage turn queue boxes may also be used at unsignalized intersections to simplify turns from a bicycle lane or cycle track, as for example, onto a bicycle boulevard. Multiple positions are available for queuing boxes, depending on intersection configuration.



Photo Source: Kimley-Horn



Photo Source: Toole Design Group (Left), Steven Faust, AICP (Right)

DESIGN GUIDELINES

- A box formed by transverse lines shall be used to hold queuing cyclists ahead of vehicular traffic, typically 10 to 16 feet deep.
- Stop lines shall be used to indicate the point behind which motor vehicles are required to stop in compliance with a traffic control signal. Pavement markings shall be used and centered between the crosswalk line and the stop line to designate the space as a bike box.
- A “No Turn on Red” sign should be installed overhead to prevent vehicles from entering the bike box.

BENEFITS

- Bike boxes increase visibility of cyclists at intersections while also giving them priority. Pedestrians also enjoy the benefit of increased space from vehicles while crossing the intersection due to the bike box design.
- Bike boxes reduce the amount of signal delay for cyclists while prioritizing them in the sequence. Cyclists are also physically grouped together to help clear the intersection quickly, minimizing the delay for transit as well as motorists.

CONSIDERATIONS

- Bike boxes are most effective where there is a high volume of turning by cyclists or a forced shift in bike facilities.
- Installing bike boxes or two-stage turn queue boxes only requires paint, however the maintenance is demanding to maintain distinguishing facilities.
- At midblock crossing locations, a two-stage turn queue box may be used to orient bicyclists properly for safe crossings.



BUFFER TREATMENTS

SAFETY ●●●●○ COST ●●●○○ FEASIBILITY ●●●○○

DEFINITION

One way to increase the bicyclist's experience is to utilize enhanced buffer treatments beyond striping. Buffers that provide more physical separation will increase the bicyclist's comfort level. Common buffer treatments include vertical delineators, concrete barriers, raised pavement markers, and planter boxes. Buffer treatments can also serve as a tool for beautification, integrating art and place-making elements into a streetscape.

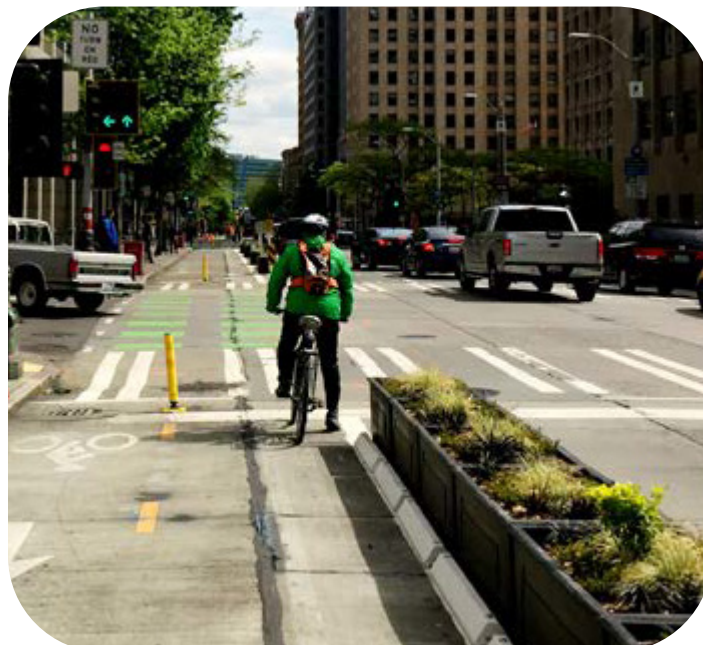


Photo Source: Megan Kanagy



Photo Source: Kimley-Horn (Left), Kimley-Horn (Right)

DESIGN GUIDELINES

- Buffer treatments can be applied to streets with higher travel speeds, traffic volumes, and/or amounts of truck traffic.
- Simple paint buffers must have two solid white lines to buffer the bike lane. The buffer area shall have interior diagonal cross hatching or chevron markings if the buffer is 3 feet in width or wider.
- When buffering a bike lane from a parking lane, a minimum 1.5-foot width (in addition to the travel lane side buffer) is recommended to encourage cyclists to ride outside of the door zone of parked cars.

BENEFITS

- Increases level of comfort for bicyclists by increasing the amount of space between them and vehicles.
- Appeals to a variety of users, encouraging bicyclists of all ages and abilities to use the facilities that are perceived as safer.
- Can be wide enough to allow bicyclist to pass one another or ride side-by-side without motorists encroaching into the bike lane.
- Can be adapted to display artistic elements or branding them to contribute to place-making.

CONSIDERATIONS

- Install temporary options first to test the locations and breaks of the buffers before replacing them with permanent fixtures.
- Special consideration should be given at transit stops to manage bicycle and pedestrian interactions.



SHARED-USE PATH/SIDEPATH/TRAIL

SAFETY ●●●●● COST ●●●●● FEASIBILITY ●●●○○○

DEFINITION

Shared-use paths, sidepaths, and trails function similarly to each other. They are physically separated from motorized vehicles, either by a landscaped buffer or a barrier, and can follow a roadway or other independent alignment.

These facilities are particularly useful when roadway width is limited and providing an on-street bike facility is not possible. These paths are designed for two-way travel, and in addition to bicyclists, path users may include pedestrians, skaters, or other non-motorized vehicles.



Photo Source: Kimley-Horn (Left), Kimley-Horn (Right)



Photo Source: Adam Coppola Photography

DESIGN GUIDELINES

- The minimum paved width for a shared-use path is 10 feet. In constrained areas or when low traffic is expected, a reduced width of 8 feet may be used.
- The minimum recommended distance between a sidepath and adjacent roadway edge is 5 feet on a high-speed roadway. A barrier should be provided where the separation is less than 5 feet.
- When interacting with an intersection, appropriate signage and markings should be included.
- When designing a system of paths that follows an independent alignment, signage and wayfinding should be installed for users to navigate the system.
- Design speed on the bicyclist should be considered for curves and tapers. Bicyclists' design speed is generally considered to be 18 mph.

BENEFITS

- Attracts a wider variety of user ages and abilities due to the enhanced safety of a fully separated facility.
- Provides access to destinations along limited-access freeways where other bike facilities would be inappropriate.

CONSIDERATIONS

- Each end of a sidepath should directly connect to another bike facility such as an on-street bike lane, another trail or path, or to a bicycle-compatible local street.
- Avoid building along roadways with frequent street or driveway crossings. At intersections, bicyclists will often be out of the line of sight for turning vehicles.
- Providing amenities such as benches and bicycle repair stations at trailheads improves comfort and user-experience.



PAVED SHOULDER

SAFETY ●●○○○ COST ●○○○○ FEASIBILITY ●●●●●

DEFINITION

Standard bicycle facilities and sidewalks may not always be feasible to install, particularly in rural areas. In these contexts, paved shoulders can provide a space for bicyclists and pedestrians to travel. Paved shoulders are directly connected to the adjacent roadway and exist in the extra pavement width usually required for shoulder space.



Photo Source: Chuck Haney



Photo Source: Dan Burden (Left), Bob Boyce (Right)

DESIGN GUIDELINES

- The preferred minimum width for a paved shoulder is 6 feet when intended for use by pedestrians and 4 feet for use by bicyclists.
- Additional shoulder width (minimum of 8 feet) is recommended on roadways with high expected bicycle use or those with speeds above 50 mph.
- On roads with high speeds, raised pavement markers and rumble strips along the roadway edge can be difficult for bicyclists to maneuver around. Design of these features should provide a clear path for bicyclists to maneuver between the shoulder and adjacent travel lane.
- Signage should be placed along the facility to indicate possible bicycle and pedestrian usage.

BENEFITS

- Increases awareness to the presence of bicyclists and pedestrians in areas where drivers may not be anticipating them.
- Common on rural roads which tend to have long stretches without conflicts or intersections, making for an ideal route for long distance cyclists.
- Extends the life of travel lanes.

CONSIDERATIONS

- Paved shoulders should only be used as an alternative to sidewalks when a road is not at its final build-out. Sidewalks or bike facilities should be added when curb and gutter is installed along the roadway.
- At intersections and driveways, consider striping a dashed line along the limits of the facility to alert drivers.



CONNECTIVITY

SAFETY ●●●●○ COST ●●●○○ FEASIBILITY ●●●○○○

DEFINITION

Connectivity plays a major role in making every mode of transportation more efficient and accessible for users. For bicyclists and pedestrians, connectivity means building networks (bicycle lanes and sidewalks) that frequently intersect and connect to other bike lanes and sidewalks. This connectivity allows pedestrians and cyclists to access more destinations more efficiently. Several best practices exist that help make cities and communities more connected and user-friendly.



Photo Source: provocleanair.org



Photo Source: Adobe Stock

TOOLS

- Connectivity Index – measures the relative degree of connectedness within a transportation network by relating the number of streets (or links) to intersections (or vertices).
- Promote street connectivity – increasing the number of street connections for any given roadway will make that thoroughfare safer and more accessible. Improved street connectivity provides people with a greater variety of routes and destinations. This also helps facilitate dispersion of traffic in a more efficient manner.
- Anticipate future street connections – careful planning can help create a more efficient and equitable transportation system for the future. Cities can promote reasonable street spacing while also anticipating future street connections. Smart growth policies can increase connectivity and accessibility for all modes and abilities in the future.
- Closing existing network gaps – cities that invest in active transportation facilities often encourage more residents to use those facilities. Facilities could include sidewalks and sidepaths, on-street bike lanes, trails, or other connections between neighborhoods.

BENEFITS

- Provides more route choices allowing for traffic to disperse evenly across a network.
- Prevents congestion at entrances and exits of neighborhoods by giving users more options.
- Increases safety by providing cyclists and pedestrians with proper facilities for their whole trip, removing the need to travel on unpaved pathways or narrow shoulders.
- Encourages usage of multimodal networks by increasing frequency and visibility of the network.

CONSIDERATIONS

- Bicycle and pedestrian facilities should connect with other paths or local roadways and should not result in a dead end for non-motorists.
- Future traffic modeling and thoroughfare planning can help anticipate roadway spacing, multi-modal gaps, and other connectivity solutions.



ACCESS MANAGEMENT

SAFETY ●●●●● COST ●●●●○ FEASIBILITY ●●●○○

DEFINITION

Local governments can utilize access management to control where roadway users enter and exit areas of high demand such as commercial or employment centers. Good access management minimizes crashes that are caused by vehicles making unsafe turning movements, failing to yield to bicyclists and pedestrians, or unpredictable driver behavior.

Limiting the distance between driveways also creates a more comfortable experience for pedestrians. A more continuous sidewalk network is more likely to be perceived as safe for users.



Photo Source: NYCDOT

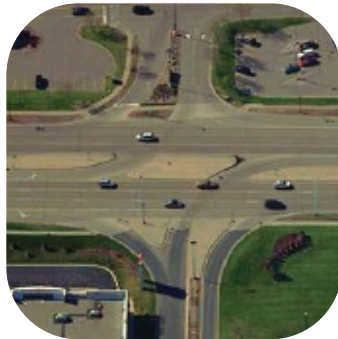


Photo Source: Dan Burden (Left), FHWA (Right)

TOOLS

- Access/Driveway Spacing – driveway closure, consolidation, or relocation can all improve access management and safety for all modes. Less turning opportunities improves traffic flow and reduces the number of conflict points with other vehicles and non-motorists.
- Safe Turning Lanes – several treatment options exist to improve the safety of turning movements. These include left-only, right-only, and interior two-way left configurations.
- Median Treatments – a raised median reduces conflict points along roadways by precluding cross-roadway movements. Roundabouts can also be effective tools to improve access management.

BENEFITS

- Increases safety for bikes and pedestrians by limiting the opportunities for conflicts
- Increases efficiency for motorists by creating turn pockets for queueing
- Efficient access management helps the local economy and removes barriers for customers.

CONSIDERATIONS

- Access management balances overall safety and corridor mobility with the access needs of adjacent land uses.
- Stakeholders along a corridor should be involved in the access management decision making process.
- If driveway consolidation is implemented, proper precautions should also be taken to ensure bicyclists and pedestrians are visible by motorists and safe.



TRAFFIC CALMING

SAFETY ●●●●● COST ●●●●○ FEASIBILITY ●●○○○

DEFINITION

Some roadways discourage pedestrian uses due to roadway design that allows unsafe driving behaviors. Traffic calming is a method of promoting responsible driving behavior through street design without relying on traffic control devices such as signals, signs, or police enforcement. If implemented correctly, these design strategies can reduce traffic speeds, frequency and severity of crashes, and noise level.



Photo Source: Dan Burden



Photo Source: Kimley-Horn (Left), Kimley-Horn (Right)



TOOLS

- Speed Humps/Tables – vertical deflection that raises a portion of the road by 4 inches or less accompanied by striping or signage to warn motorists.
- Speed Cushions – another form of vertical deflection similar to speed humps, that are interrupted by breaks along the roadway to allow for the passage of emergency vehicles.
- Chicanes – a series of raised or delineated curb extensions on alternating sides of a street forming an S-shaped travelway.
- Traffic Circles – raised or delineated islands placed at intersections that reduce vehicle speeds and raise driver awareness of other incoming traffic while moving through the circle.
- Pinchpoints – a set of curb extensions or edge islands placed on either side of the street to narrow the center of the lane such that two drivers must slow down to pass through simultaneously.
- Road Diets – redesigning roads with wider pavement widths than are required for existing or projected traffic volumes, to accommodate more modes of traffic. Often uses multiple traffic calming measures to build a safer and more complete roadway.

BENEFITS

- Each of these traffic calming tools function to reduce the speed of vehicles, increasing safety for all modes of transportation.
- Some tools also provide opportunities for public art installations and placemaking elements.

CONSIDERATIONS

- Traffic calming measures are typically most appropriate in neighborhood or mixed-use settings where there is a high demand for bicycle and pedestrian activity.
- Traffic calming measures can be implemented on a case by case level or can be developed into a citywide program if the demand exists.
- Successful implementation often involves local neighborhood participation to best identify issues and explain the intent of the new design.



ADA COMPLIANCE

SAFETY ●●●●● COST ●●●○○ FEASIBILITY ●●●○○

DEFINITION

The Americans with Disabilities Act (ADA) was passed in 1990, prohibiting discrimination based on disability and defining design standards that promote access for individuals with disabilities. Enforcing ADA compliance ensures that the infrastructure in a community is inclusive and accessible to people of all abilities. ADA compliance is not just a strategy for cities to implement, but a federal law with requirements that need to be a priority both for new construction and when upgrading existing pedestrian facilities.



Photo Source: Kimley-Horn



Photo Source: Dan Burden (Left), Kimley-Horn (Right)

TOOLS

- Pedestrian Access Routes/Sidewalks – continuous and unobstructed path of travel provided for pedestrians with disabilities. Surfaces should be smooth, stable, and slip resistant.
- Ramps/Curb Ramps – ramps and curb ramps allow for a smooth transition between pedestrian routes at different elevations, replacing the need for a step or stair.
- Textured and Colored Surfaces – detectable warning surfaces consist of small truncated domes and provide texture and color contrast from the surrounding pedestrian route. These surfaces alert pedestrians as they approach vehicular travel areas.
- Audible and Visual Assistance – accessible pedestrian signals and pushbuttons communicate information about the “walk” and “don’t walk” intervals at signalized intersections in non-visual formats such as audible tones and vibrotactile surfaces. Countdown pedestrian signals provide visual crossing time information, allowing the pedestrian to better understand when it is safe to cross at a signalized intersection.

BENEFITS

- While these tools are designed to meet the mobility needs of individuals with disabilities, they are useful to all users by increasing the comfort and safety of pedestrians.
- Additional funding sources exist at the federal level to help implement projects with ADA as their primary goal.
- Areas that are not ADA compliant create safety problems, thereby detracting usage. By improving facilities to meet these standards, this will increase walkability in the area.

CONSIDERATIONS

- Government entities with more than 50 employees are required to complete an ADA Self-Evaluation to identify accessibility barriers and develop an associated ADA Transition Plan to schedule the removal of those barriers.



ENHANCED STREETSCAPING

SAFETY ●●●○○ COST ●●●○○ FEASIBILITY ●●●●●

DEFINITION

Streetscaping is an approach to supporting multiple functions of the space between the street and property line as well as an increased investment in landscaping and building materials to make the street more attractive and visually interesting. Investing in streetscaping promotes a lively street environment that adds economic value by enabling private commercial activity to spill into the public realm.



Photo Source: Dan Burden (Left), Adobe Stock (Right)



Photo Source: Adobe Stock

TOOLS

- Landscaping elements – increasing the amount of street trees, planter boxes, and other native plants enhance the natural beauty of an area while also lowering temperatures and providing shade to users.
- Street furniture – includes benches, bike racks, transit shelters, trash or recycling bins, and other items for users to interact with.
- Paving materials – using materials like brick pavers improves the attractiveness of a roadway. Concrete can also be colored and have designs pressed into it that have the appearance of bricks or textured stone. Crosswalks are a good point of entry into this type of improvement.
- Drainage systems – bioswales and rainwater gardens can help naturally aid stormwater drainage systems by decreasing the amount of impervious surfaces.

BENEFITS

- Streetscaping helps establish a sense of place where people want to go and spend time.
- Enhanced streetscapes can activate the pedestrian realm, bringing shopping and dining out onto the public environment to boost the local economy.
- Streetscape tools also help slow down vehicles by installing features that cause motorists to pay closer attention to their surroundings, especially when paired with traffic calming tools.

CONSIDERATIONS

- Enhancing streetscape design along commercial corridors with high pedestrian volumes can help attract more commercial and residential usage.
- These types of improvements are highly compatible with mixed-use developments and high-density residential areas.
- In a commercial area, enhanced streetscaping elements can be funded by establishing a public improvement district, or PID, whereby businessowners pay more in taxes in return for higher quality maintenance and roadway improvements.



SIGNAGE & WAYFINDING

SAFETY ●●○○○ COST ●○○○○ FEASIBILITY ●●●●●

DEFINITION

Wayfinding involves the strategic placement of signage or other markers that help people, especially visitors, find their way to a destination, including entertainment districts, monuments or museums, universities, or natural features. Wayfinding is also used for navigating bike routes and shared use paths or trails. It can also be a tool for branding and marketing certain areas of a city.



Photo Source: Laura Sandt



Photo Source: Adobe Stock (Left), Sarah Heaton Kennedy (Right)



TOOLS

- Branding – the usage of consistent font styles and colors help users quickly identify what networks each sign belongs to.
- Character Areas – special design standards can be implemented in different districts of a city to help define its character and help users understand their location.
- Landmarks – by calling out certain destinations in an area as landmarks, this helps users get a sense of where things are based on their proximity to each one. This also helps users navigate back to a place they have been by making it easier for them to recall what was around them.
- Gateways – establish when a user is entering or exiting a defined area by either placing a large sign or a full gateway for them to walk or drive through.

BENEFITS

- Helps point out the landmarks or trail systems that might have otherwise gone unnoticed.
- Guides pedestrians and cyclists throughout various hiking and bicycling routes in a region.
- Establishes a sense of place and aesthetics for a special district in the city.

CONSIDERATIONS

- When designing for vehicles, use simple, easily identifiable symbols (i.e. a large “P” to indicate the location of parking facilities).
- When designing for pedestrians, include frequent markers to help users understand where they are within a district or system (i.e. mile markers along a trail network).
- Improved signage in a special district pairs well with other streetscape improvements such as benches, shade facilities, and public art.
- The style and branding of a new wayfinding system should represent the culture of the area.



MID-BLOCK CROSSING MATRIX

To help determine which crossing tool is most appropriate for mid-block crossings in the study area, a crossing tool decision matrix was created. This matrix lists the conditions for each of the three proposed road classifications that warrant each type of crossing tool. For more information on Mid-Block Crossings and when they are best utilized, please reference page 5 of this document.

| Crossing Tool | Collector Criteria | Secondary Arterial Criteria | Primary Arterial Criteria |
|---|--------------------|-----------------------------|---------------------------|
| Markings & Signage | Always | - | - |
| Rectangular Rapid Flashing Beacon (RRFB) | > 5,000 vpd | < 12,000 vpd | - |
| Pedestrian Hybrid Beacon | - | > 12,000 vpd | < 12,000 vpd |
| Pedestrian Refuge Island | - | > 12,000 vpd | |

AMARILLO
area



IN MOTION