

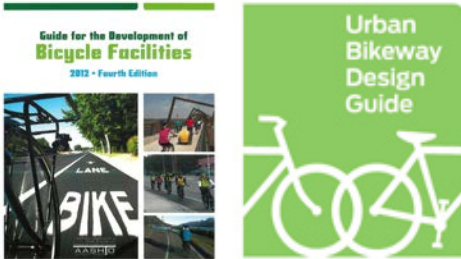


FINAL PLAN

DEVELOPMENT STANDARDS

BIKE FACILITY TYPES AND STANDARDS

See the Types of Bicycle Facilities section for those that are recommended as part of this plan. As all long term plans are meant to be adaptable to new information, this one should be reviewed at regular intervals to see if any standards have changed. At the time this document was created there were several guidelines that apply, including The 2012 American Association of State Highway and Transportation Officials Guide for the Development of Bicycle Facilities (AASHTO), and The National Association of City Transportation Officials Urban Bikeway Design Guide (NACTO). It is recommended that these guidelines as well as the standards outlined below be followed unless new standards or information become available.



BIKE LANE WIDTH

Both NACTO and AASHTO recommend that the minimum width of a bike lane shall be 4 feet where there is a clear graded shoulder for recovery. The consultant team would further recommend that the clear graded shoulder be at least 5 feet wide before any drop off greater than 2 feet and that the closest vertical object be at least 2 feet from the edge of the bike lane. A bike lane shall have a minimum width of 4.5 feet next to a straight curb and only for short distances. The standard width of bike lane should be 5 feet or wider where there is a curb present and there is no on street parking. Where on street parking is adjacent to the bike lane, then the width of the lane shall be 6 feet minimum to allow for cars to open there doors into the bike lane without conflict. If possible, where parking is adjacent to the bike lane, then a 7 feet lane should be installed. Bike lanes shall be delineated from vehicular lanes by a solid white 6 inch stripe and between adjacent parking by a 4 inch solid white stripe.

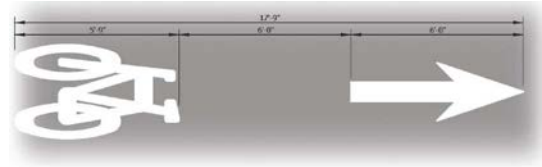


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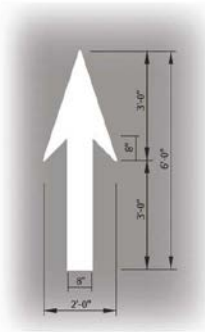
DEVELOPMENT STANDARDS

BIKE LANE MARKING AND SIGNAGE

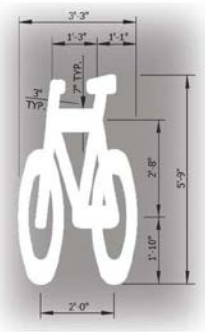
Bike lane markings shall consist of a bicycle symbol and an arrow placed together in the center of the lane. MUTCD sign R3-17 will also be used in conjunction with these markings. The bicycle symbol shall be placed so that it is the first symbol to be seen followed by the arrow. Bike lane markings and signage shall be placed at the start of each bike lane, after an intersection, after a bike path crossing, and after a major approach. Bike lane markings should be placed no more than a 1000 feet apart in rural sections and no more than 350 feet apart in urban sections. Signs can be placed further apart in between intersections and can be placed every other occurrence of placing the bike lane markings. See illustrations to the left for more information on standard sizes. Signs should also be placed warning users of a bike lane ending and when the bike lane continues on the other side of an intersection with a supplemental "AHEAD" plaque. Bike lanes are appropriate on roadway with speeds under 45 mph.



BIKE & ARROW DETAIL



BIKE LANE ARROW

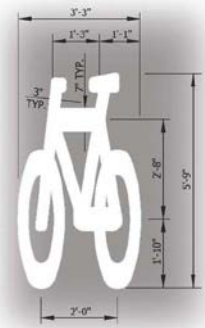
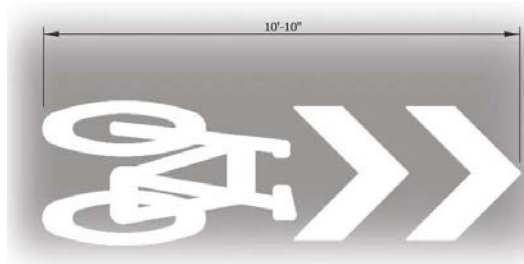


BIKE LANE SYMBOL

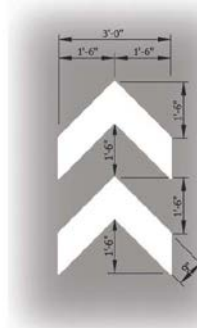
SHARED ROADWAY MARKING AND SIGNAGE

Markings shall consist of a bicycle symbol and chevrons placed together to create a "Sharrow". Sharrows shall be placed in the center of the lane to indicate where the bicyclist should ride. MUTCD signs W11-1 (Bike Symbol) with W16-1P (Share the Road) will also be used in conjunction with these markings. The bicycle symbol shall be placed so that it is the first symbol to be seen followed by the chevrons. Bike lane markings and signage shall be placed at the start of each shared roadway, after an intersection, after a bike path crossing, and after a major approach. Markings should be placed no more than 250 feet apart on low volume roads and no more than 100 feet apart in urban sections.

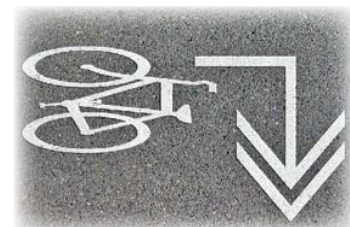
For wayfinding purposes, the orientation of the chevron in the sharrow symbol marking may be adjusted to direct bicyclists along discontinuous routes.



SHARROW SYMBOL



SHARROW CHEVRONS



MODIFIED SHARROW SYMBOL



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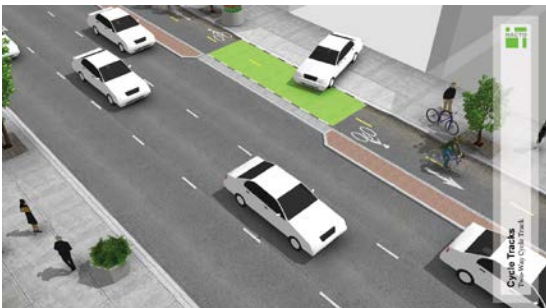
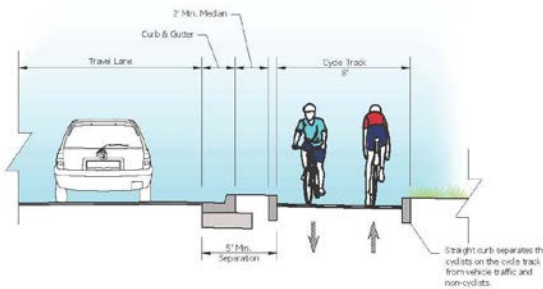
Signs can be placed further apart in between intersections and can be placed every other occurrence of placing the bike lane markings. Signs should also be placed warning users of the shared roadway ending.

On roadways where vehicles and bikes share the same route, alternate signs “W11-1” and “W16-1” with sign “R4-11.” This will bring extra attention to the vehicle that cyclist has the right to use the entire width of the travel lane. Use sign “R4-11” to indicate where bikes merge into traffic when a designated bike lane comes to an end. See illustrations to the left for standards.

At non-signalized roadway intersections where a non bike and pedestrian route crosses with a designated bike and pedestrian route, place the “2-Way Crossing” sign at either side of that intersection. Additionally, place the “2-Way Crossing” sign at the exit of commercial drives if it crosses with a shared-use path.

CYCLE TRACK MARKING AND SIGNAGE

A Cycle Track is a combination of a separated path and a conventional bike lane in that it is buffered from motor traffic, but is still a part of the roadway. There are two types of Cycle Tracks: a one-way cycle track and a two-way cycle track. Cycle tracks work best in locations where there are not too many roadway intersection crossings. It is recommended that each cycle track be separated from the travel-way by 5 feet and use a raised median for protection of the cyclists. A cycle track in a constrained area shall have minimum separation of 3 feet from the travel-way and be separated by delineator bollards.



A two-way cycle track shall have a minimum width of 8 feet in constrained areas and it is recommended that the desired width should be 10 feet or wider to accommodate the volume of cyclists. A one-way cycle track has a lane on each side of the roadway riding with traffic. The minimum width for a one-way cycle is 5 feet.

Drive crossings should be kept to a minimum and marked with conflict zone markings at each crossing.

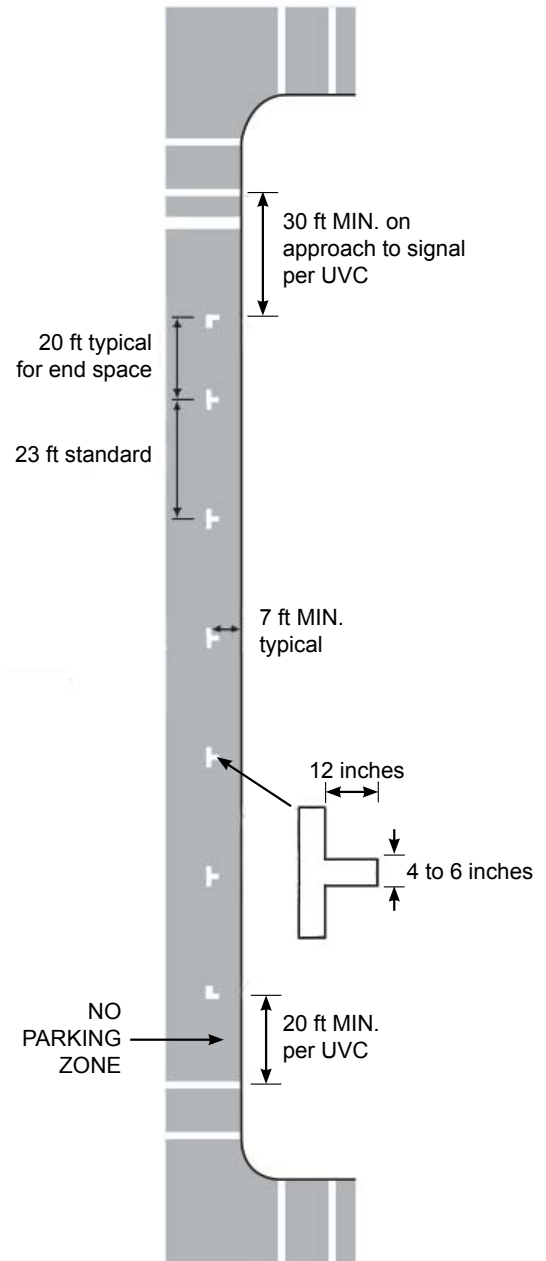
FINAL PLAN

DEVELOPMENT STANDARDS

SHARED ROADWAY ROUTES WITH MARKED AUTOMOBILE PARKING

Marking automobile parking along shared roadway routes has several safety functions for bicyclists and pedestrians. For bicyclists it better defines the travel lane for vehicles and reduces the perceived lane width even when parked vehicles are not present. This has the effect of traffic calming on the route. In areas where the parking is not heavily used, the parking area can be used as a refuge for more inexperienced cyclists as long as they do not have to weave in and out of the travel lane. For pedestrians it moves the travel way further from the walking space and provides a greater level of comfort.

Parking spaces should be marked based upon the 2011 Indiana Manual for Uniform Traffic Control Devices. The marked parallel parking space shall typically be 8 feet wide by 23 feet long. In certain circumstances on low volume roadways it may be possible to reduce the width of the space to 7 feet. Each space shall be denoted by two solid white transverse stripes 6 inches wide in the configuration of a "T" or "tick" (see illustration).





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CONFLICT ZONE MARKINGS

Vehicular crossings of bicycle facilities can happen at intersections and at private drives or entrances. Care must be taken by both bike and vehicles to watch out for one another in these transition zones. Marking these crossings to bring attention to these conflict areas can be helpful. Several options are available for marking these area:

1. An epoxy-modified, acrylic, waterborne coating has been successfully used for bike lanes. There are several colors available and selection should be based upon the color choice that provides the most contrast and matches with the amenities/ color scheme selected along that particular route.
2. Cabot Deck Stain is another option that might be considered on a trial basis. This coating has been used by the City of Portland, Oregon, to color neighborhood road intersections with less than 2,500 VPD.



Example of Epoxy Bike Coating on Asphalt

BICYCLE FRIENDLY CASTINGS

Bicycle friendly castings for drainage inlets are necessary where bicycle facilities are present. It is important to make sure that a bicycle tire will not fit into the grate opening and cause a bicycle user to be thrown from the bike causing injury.

The gap between the drainage grate and its frame should be 1 inch or less. Several casting types are available. The most versatile is the octagon style.



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BICYCLE FACILITY AMENITIES:

BICYCLE PARKING

Bicycle Parking should follow the Association of Pedestrian and Bicycle Professionals (APBP) Bicycle Parking Guidelines 2nd Edition. At a minimum bicycle parking should offer a rack that supports the bicycle in at least two spaces, allows locking the frame and at least one wheel with a “U-Lock”, resists rusting, resists cutting, resists bending, and is securely anchored to the ground. An example of a rack meeting this criteria would be a “U-rack”. The rack should be coated with powder coating or thermoplastic to reduce maintenance. Racks that only support the bike by the front wheel should not be used.

Bicycle racks should be spaced a minimum of 36 inches apart from one another when placed side by side and a minimum of 24 inches from the nearest obstruction. Design should take into account that a bicycle is a minimum of 6 feet long.

Further considerations should be made for bicycle parking that is intended to be for longer than 2 hours. Examples are areas where a considerable number of people who use the parking for commuting. Bicycle parking that is intended for longer than 2 hours should provide shelter or enclosure, be as close as possible to building fronts and in a secure location with active surveillance. It might even be wise to consider bicycle lockers or a supervised area.



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BICYCLE REPAIR STAND

Most experienced riders will carry some repair tools with them, however casual riders may be less likely to have them. A repair stand with tools will come in handy if placed around the community in convenient locations and or at locations where organized bicycle rides are likely to start. The stand conveniently holds the bike by the seat and at a height easier for working on the bike. There are different configurations, but tools for minor repairs are secured to the stand by stainless steel aircraft cable. Tools that should be provided are allen wrenches, tire levers, screwdrivers, and a crescent wrench. The finish should be powder coated to match surrounding amenities.



BICYCLE PUMP BOLLARD

Many experienced riders will carry small bicycle pumps or air canisters for emergency repairs, but a good bike pump always comes in handy. A secure urban bike pump in the shape of a bollard can provide cyclist with air while still being vandal resistant and aesthetically pleasing. The pump is securely attached to a concrete surface and the pump design is sturdy enough to handle urban conditions. The hose should be made of cut resistant material.



BUS STOP

Bus Stops within in the Ccity needs to accommodate safety and comfort while pedestrians wait on transportation. Bus stops should be covered to protect from the elements, but transparent for visibility. Lighting should be provided for safety and a directory routes should be provided along with scheduled stops. A firm and stable pad should be provided for accessibility and an appropriate ADA ramp to access the bus.



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SHARED-USE PATH TYPE

It is recommended that each shared-use path be a universally accessible multi-use path. The American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (2012) and Chapter 51 of the Indiana Department of Transportation (INDOT) Design Manual defines a shared-use path as an off-road, two-way facility designed for use by bicyclists, in-line skaters, wheelchair users, and pedestrians on exclusive right-of-way with minimal cross flow by motor vehicles. This means that the paths will have to be wide enough to accommodate two way travel for each type of use. In order to allow accessibility to each use, the path's surface must be adequate and slopes must follow guidelines developed by the US Access Board or regulations from the US Department of Justice. At the time this document was created there were several guidelines that apply: 1) Guidelines for Shared Use Paths; 2) Guidelines for Outdoor Developed Areas; and 3) Guidelines for Pedestrian Facilities in the Public Right-of-Ways. Although INDOT and AASHTO regulations may not be required for all shared-use paths, it is recommended that these guidelines be followed on all paths applications.

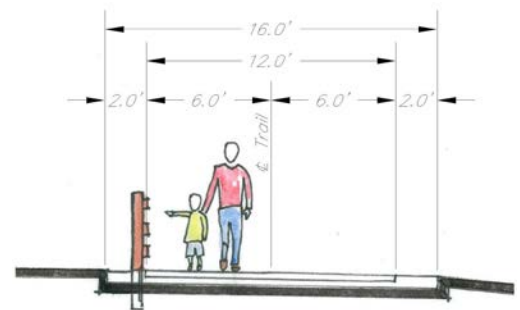


Shared-Use Path
Clear Creek Trail, Bloomington, IN

SHARED-USE WIDTH

AASHTO recommends a minimum width of 10 feet for shared-use paths, with 2 foot wide graded shoulders on either side of the path. However, when a higher number of users are anticipated, at least a 12 foot wide trail with shoulders should be employed. This allows for two 6 foot wide lanes that will accommodate several different types of users.

Therefore, the design team recommends using a 10 foot wide path (minimum) with 2 foot grass shoulders wherever possible. Only where absolutely necessary should an 8 foot path with shoulders be implemented. This instance should only happen when the shared-use path is considered a connector path (a path that will have minimal traffic and isn't a through path) and/or when it is not feasible to fit a larger width of path due to right-of-way or other limitations.





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SHARED-USE SLOPE

It is important that the path cross slope provide positive drainage, but not create a non-traversable slope for trail users or those in wheel chairs. For this reason all cross slopes shall be no more than 2%. Trail shoulders create recovery areas for bicycle users and should not have cross slopes greater than 4%.



Side slopes beyond the shoulders should not be greater than 4:1. Steeper slopes are non-mowable and therefore create maintenance issues. Additionally, slopes steeper than 3:1 within 5 feet of the trail's edge must be protected.

Longitudinal trail slope should be no greater than 5% in most circumstances. The INDOT Design Manual gives more guidance on when it is permissible to exceed this guideline and appropriate mitigation techniques.

SHARED-USE SURFACE

The primary concern with path surfacing is accommodating a variety of path users and providing accessibility. While crushed stone is less expensive to construct and is more forgiving for runners and walkers, it does not accommodate all users. It is non-traversable for in-line skaters and can be difficult for people in wheel chairs because not all stone paths meet the definition of firm and stable. Asphalt, on the other hand, can accommodate all types of users, and even though initial construction costs are higher, it lasts longer and requires less annual maintenance.



Shared-Use Path
Lafayette, IN

In order to preserve the asphalt, consideration should be given to using an oil sealant right after construction. One popular product is a bio based / soy bean product called RePlay. Regular treatment will help to keep the asphalt from becoming dry and rigid which can lead to failure and cracking. See the Shared-Use Path Maintenance Section for further recommendation.



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NATURAL AREAS / RUGGED SHARED-USE PATHS

This master plan identifies several paths that are through natural areas. These areas are more natural and rugged in character. Due to this fact, it may be necessary to use standards that allow for steeper slopes, however, they must still be safe for bicyclists to negotiate and accessibility must be provided unless another route can be used to access areas that someone might want to get to. In these instances, it is important to use a combination of the US Access Board's 'Guide for Outdoor Developed Areas' and AASHTO's 'Guide for the Development of Bicycle Facilities'. Maintenance is additionally a consideration for path surfacing.

Longitudinal Slope:

- 5% to 8.33% - 200 Feet Max. (length between landings / resting intervals)
- 8.33% to 10% - 30 Feet Max. (length between landings /resting intervals)

Cross Slope

- 2% Recommended
- 3% Maximum

Width:

- 8 Feet Minimum for Two Way Bike Travel

Resting/Landing Areas:

- Width - As wide as Trail or more
- Length - 10 Feet

Surface:

- Firm and Stable (As defined by US Access Board)
- Recommend Asphalt or Concrete for Slopes Greater than 5%
- Crushed Limestone (#73s)
 - Up to 5% (Stone will start to erode at slopes greater than 5%)
 - Limits Users of Shared-Use Paths.
- Alternative Surface Material
 - *Road Oyl*:
Formulated from pine tree resin, this cold applied product works best as a pavement binder when mixed with dense graded aggregate. Once the water evaporates from the mixture, the surface becomes very hard and resembles an asphalt surface. It can be difficult to apply and is more expensive than other binders, but is probably one of the better surface stabilizers available.
 - *Stabilizer*:
This is an organic and non-toxic product created with seed hulls of the plantago plant. The product is not able to stabilize aggregate larger than 3/8" in diameter. Some surface ravelling can occur and become somewhat soft when exposed to moisture. As moisture evaporates the surface will become firm again. Seeds may also be able to sprout in the surface.
- Mulch or unreinforced dirt would not be acceptable



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Shared-Use Path Characteristics Signage (at Trailhead or Access Point) to include:

- Length of Path or Path Segment
- Surface Type
- Typical and Minimum Path Width
- Typical and Maximum Running Slope (Profile / Graph Showing Where Slopes Occur on Path)
- Typical and Maximum Cross Slope (Graph Showing Location of Slopes on Path)

Construction:

- Environmentally sensitive construction techniques should also be considered for use in riparian zones and floodway areas well known to be periodically inundated by water and/or contain high quality vegetation. These techniques may include the use of small, light-weight equipment as well as increased erosion and sediment control measures.

DNR PERMITTING PROCESS

Any proposed shared-use path or bridge structure within the floodway of a river, stream or creek that has a drainage area larger than one square mile requires an Indiana Department of Natural Resources (IDNR) Construction in a Floodway Permit. A shared-use path section and multiple bridges constructed in a single phase can be constructed under one permit provided they all occur within the same tributary. Each additional phase will require a separate permit even if construction occurs along the same tributary.

Construction in a Floodway Permit typically takes 5 to 6 months to obtain and requires a \$200 permit fee. Hydraulic modeling may be required to identify the impacts on the floodway. Boardwalk sections would also be covered under the permitting process. IDNR would consider the foundation spacing, the amount of fill required and the overall impacts to the floodway in analyzing the permit application.

OTHER PERMITS

There are several other permits that may be required in order to construct a shared-use path. However, until actual construction documents are created it is hard to say which routes will require which permits. Below is a list of some of the more common permits that can be required.

1. Rule 5 – Required for any land disturbance over 1 acre.
2. US Army Corps of Engineers 404 Permit.
 - a. Nationwide - Any disturbance of a stream or navigable waterway below ordinary high water and less than 350 lineal feet in length. Typically for very small disturbances.
 - b. Regional General - Any disturbance of a stream or navigable waterway below ordinary high water and less than 350 lineal feet in length.
 - c. Individual – Any disturbance of a stream or navigable waterway below ordinary high water and over 1000 lineal feet in length.
3. IDEM Section 401 – Required any time an Army Corps 404 permit is required.

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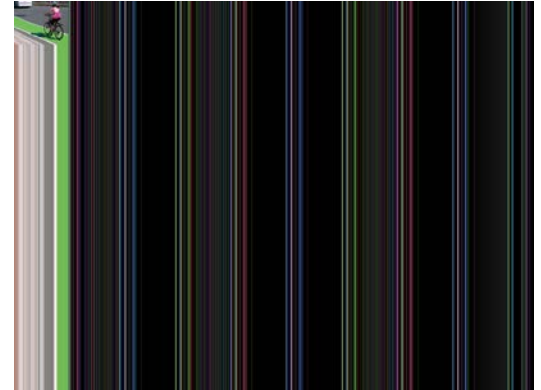
SHARED-USE PATH SUPPORT FACILITIES:

Providing accessibility to all users at key locations throughout the city is important to the success of each shared-use path. Along with accessibility, users require that the path have certain facilities to meet the needs of its use. These support facilities can be broken down into four categories: major trailheads, shared use trail heads, minor trail heads, and community access points. In addition to these public facilities, partnerships should be developed between the city and local businesses to provide secure bicycle parking and other path support facilities as a part of their building or property. This will not only enhance their business but it will also enhance the opportunities given to the path users.

Major Trailheads:

Major trailheads provide the greatest amount of amenities to path users and are recognizable points of access. They are like mini-parks alongside the path that may include parking areas, shelters, restrooms, drinking fountains, benches, trash receptacles, picnic tables, bicycle racks, path signage, corridor access access, and landscaping.

Due to the scope and type of facilities normally required for a major trailhead, it can be difficult to locate them within the narrow constraints of a shared-use corridor. Typically it is necessary to find parcels of land adjacent to the corridor for development. These can be city-owned, such as parks or street right-of-way, or privately-owned properties that are created and operated with the owner's cooperation. These usually require the development of all new amenities for users' needs.



Major Trailhead Example - Erie Lackawanna Trail
Griffith, Indiana



Major Trailhead Example - C&O Trail
Merrillville, Indiana



Major Trailhead Example - C&O Trail
Merrillville, Indiana



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Shared Use Trailhead Example - Twigg Rest Park
Terre Haute, Indiana



Shared Use Trailhead Example - Friendship Gardens
Plainfield, Indiana



Minor Trailhead Example - Clear Creek Trail
Bloomington, Indiana



Shared Use Trailheads:

Shared use trailheads are similar to major trailheads except they share amenities with other existing or potential uses. They are usually city owned and in many cases need only to have their amenities slightly upgraded in order to meet path users' needs. These trailheads may or may not have existing shelters. This trailhead should be easily accessible from the path, and include amenities such as trash receptacles, bicycle racks, and benches.

Minor Trailheads:

Minor trailheads are similar to major trailheads in that they provide amenities to serve shared-use path users, but on a smaller scale. They usually occur more frequently and can be situated within the trail right-of-way. Minor trailheads are located between major trailheads and at certain path intersections. Minor trailheads may provide benches, trash receptacles, bicycle racks, landscaping and signage, but usually will not provide parking.

Community Access Points:

The last type of shared-use path support facility is the community access point, which provides a minimal amount of amenities such as a trail directory sign or wayfinding sign and a connector path. It is the most frequently occurring type of support facility and provides citizens of adjacent neighborhoods access to the path. Community access points simply provide an informal and direct access between community and trail much like the driveway connects to the street.

They are important in fostering a community's adoption of the path and getting users to respect the rights of private property owners by establishing designated points of access.

Locations of community access points should be determined in consultation with adjacent landowners and through the selection of logical places to enter the right-of-way from surrounding communities.

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BRIDGE DESIGN STANDARDS

All bridges will be designed for bicycle and pedestrian traffic. Due to maintenance and emergency needs the bridges will occasionally need to be used by light vehicular traffic, such as passenger vehicles and light trucks. Therefore, the structural design should be based on a five-ton vehicular loading.

Typically, the width of the finished deck surface is a minimum of 12 feet. This allows for a minimum 8 foot wide path with two foot shoulders on each side. The deck should be a structural concrete slab or timber decking spanning between superstructure members on all standard bridges. Timber decks are generally appropriate for renovated historic bridges.

All bridge railing should consist of tubular metal shapes, finished in the appropriate color. Color of bridges and bridge railing shall be based upon the color designated for the trail. Railings should be parallel with the trail centerline and 42 inches in height as recommended by AASHTO. The railing should be side mounted to the concrete bridge deck or the existing structure as indicated by each bridge's configuration. Where bridges cross roadways, an enclosure or high fence should be considered to prevent objects from falling onto the roadway below.

An approach barrier railing should be included at each end of each bridge. The approach barrier railing may consist of additional metal railing, wood railing, or stonewalls.

The approach pavement at the ends of the bridges should be a continuation of the trail pavement, with some variation based on each bridge configuration. Concrete approach slabs should be utilized where new construction dictates that the approaches are located on new fill material.

Adaptive reuse of historic bridge structures should be considered wherever possible. The reuse of these structures presents opportunities for historic and cultural interpretation and provides an opportunity for a signature gateway bridge.



Example of a Standard Bridge on the Monon Trail
Indianapolis, Indiana



Example of a Standard Bridge on the Monon Trail
Indianapolis, Indiana



Example of a Gateway Bridge on Tracy Trail
Greenwood, Indiana



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STREET INTERSECTION DESIGN:

Each street intersection should be examined individually as each has unique characteristics. Uniformity in the use of traffic control devices is critical to encourage proper and predictable behavior by shared-use path users. The Manual on Uniform Traffic Control Devices (MUTCD) shall be followed for size, shape, color and placement of signs on both the path and the street. In addition, coordination with the City should ensure the proper design and layout of traffic control devices necessary to warn vehicular traffic on public streets of path crossings.



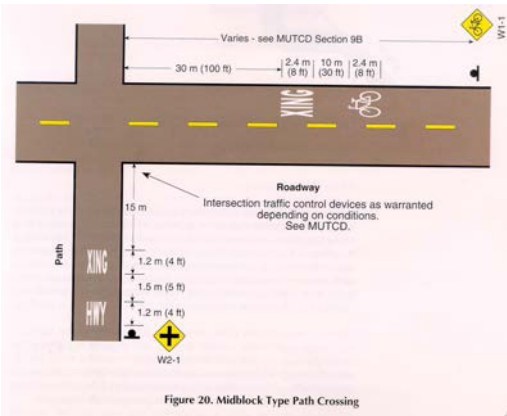
Example of a Street Crossing on the Monon Trail
Carmel, Indiana

All street crossings will occur as at-grade. Traffic will have the right-of-way and path users, at most crossings, will have to stop.

The team devised three different types of street crossing treatments to deal with the various at-grade crossings throughout the city.

At-Grade Road Crossing - Level 1:

- Used on local roads with a maximum of two lanes. Speed limit should be under 40 mph.
- Warning Signs of an upcoming intersection will be placed on the roadway based upon MUTCD standards.
- No Motor Vehicles signs placed facing the street at all path intersections
- Stop sign along the path placed approximately 10 feet from the edge of the street.
- Crosswalk pavement markings at crossing point.
- "Trail Xing" markings on the roadway



Example of an At-grade Crossing Level 1 -
'Guide for the Development of Bicycle Facilities' -
AASHTO 1999

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At-Grade Road Crossing - Level 2:

- Used on all roads with a maximum of two lanes and speed limit over 40 mph or greater.
- All treatments of a Level 1 Road Crossing apply
- In addition to Level 1, it is recommended that overhead flashers with signage be used, preferably with a motion activated warning signal. Flashers that are always on tend to be ignored or not noticed by vehicular drivers because they do not necessarily indicate that a path user is in the area.



Example of an At-grade Crossing Level 2 - Monon Trail Carmel, Indiana

At Grade Road Crossing - Level 3:

- Used on all roads where there are more than two lanes of travel
- All treatments of a Level 2 Crossing apply
- In addition to Level 2, median refuge areas allow path users to cross one direction of traffic at a time (additional street right-of-way may be required)
- If, and ONLY IF, a refuge island isn't feasible, speed tables are a secondary option.

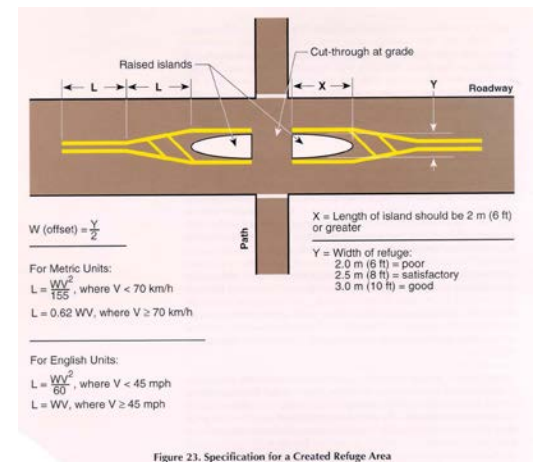


Figure 23. Specification for a Created Refuge Area

Example of a Midblock Crossing Level 3 - "Guide for the Development of Bicycle Facilities" - AASHTO 1999



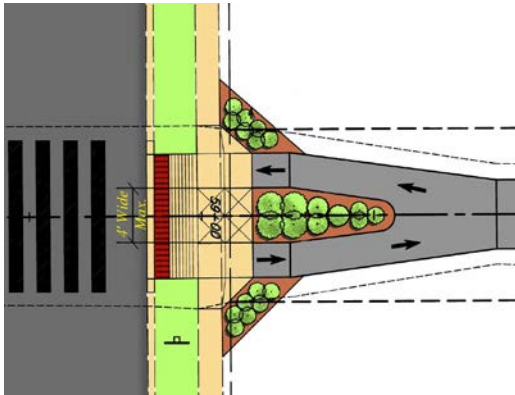
Example of a Speed Table

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Shared-Use Path Entry At Public Road Crossings

A public road crossing provides an opportunity to bring identity and attention to the path. It also should provide plenty of room for users to cross without having conflicts with other users crossing in the opposing direction. Restricting vehicular access without restricting maintenance vehicles can also be a concern. The following is a list of options to consider based upon available right-of-way.



Example of a Split Entry for Trail - Munger Trail Lafayette, Indiana



Example of a Concrete Node Entry without Bollards

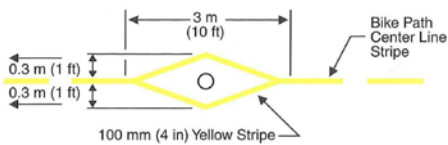


Figure 26. Barrier Post Striping

Example of a Bollard Location and Striping - 'Guide for the Development of Bicycle Facilities' - AASHTO 1999



Example of a Concrete Node Entry with Bollard

- Option 1: Split entry with a 4 foot wide median. The plantings shall be no taller than 6 inches. This will allow for easy flow of trail traffic, while allowing maintenance vehicles access. See detail at left.
- Option 2: Concrete node without a bollard or central median. This option should be used if the area appears to be too narrow or there is not enough right-of-way for a split entry, and the risk of motor vehicles entering the path is low.
- Option 3: Concrete node with bollard. If the area appears to be too narrow and it is believed that public vehicles might try to access the trail in that area, a bollard should be added. The bollard should be easy to collapse or remove and only used when absolutely necessary, as the bollard itself is an obstacle for path users to negotiate around. See the Site Furnishings section for bollard types.

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RAILROAD INTERSECTION DESIGN

Due to the speed of train travel, sight distance needed to stop a train, and regulatory stipulations, it is recommended that proposed railroad crossings occur at existing road crossings wherever possible. If an existing road crossing is not available then a bridge or tunnel may have to be utilized. Railroad crossings will follow the guidelines established in the Federal Highway Administration's 'Railroad-Highway Grade Crossing Handbook – 2nd Edition FHWA-TS-86-215', AASHTO, the MUTCD, and the requirements and specifications of the individual railroad companies.

It is advised to abide by the following treatments as a minimum for railroad crossings:

- A rubber panel crossing will be used with an asphalt approach.
- A railroad warning sign shall be placed a minimum of 115 feet from the nearest rail
- A Crossbuck sign will be placed 15 feet from the nearest rail and shall have a sign denoting number of track crossings.
- Where there are existing gate arms, a new pedestrian gate shall be placed if the path must go outside the post.
- A 24-inch stop bar will be placed approximately 15 feet from the nearest rail.
- The shared-use path will have a minimum 45 degree skew from the center line of the rail with 90 degrees being desirable.
- The path's pavement width will be widened to 14 feet.
- Railroad pavement markings will be placed adjacent to the rail warning sign.



Existing Rubber Panel, Rail Crossing - Amtrak Rail Line
Michigan City, Indiana

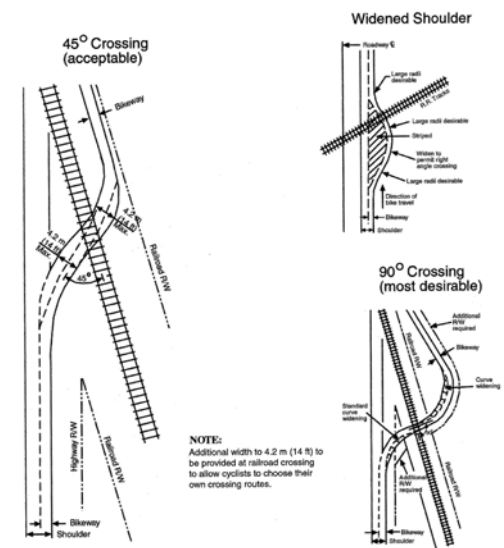
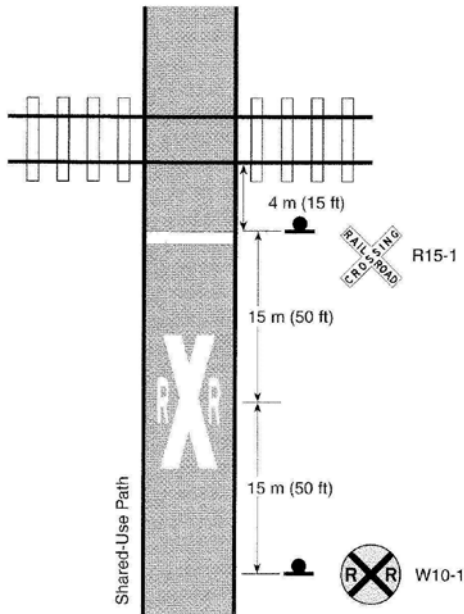


Figure 27. Railroad Crossings

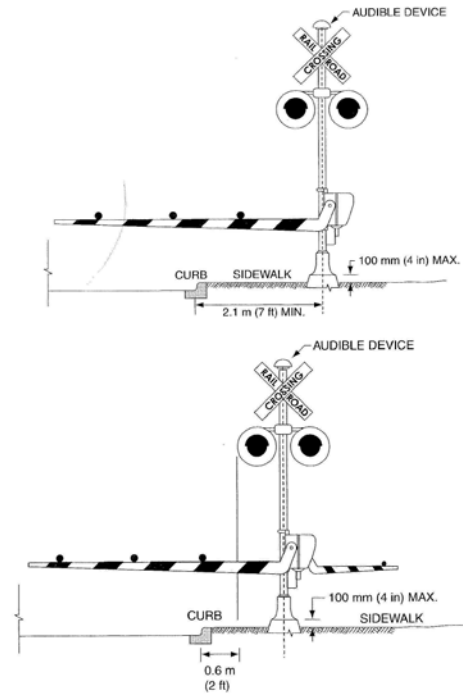
Rail Crossing Standards
'Guide for the Development of Bicycle Facilities' -
AASHTO 1999

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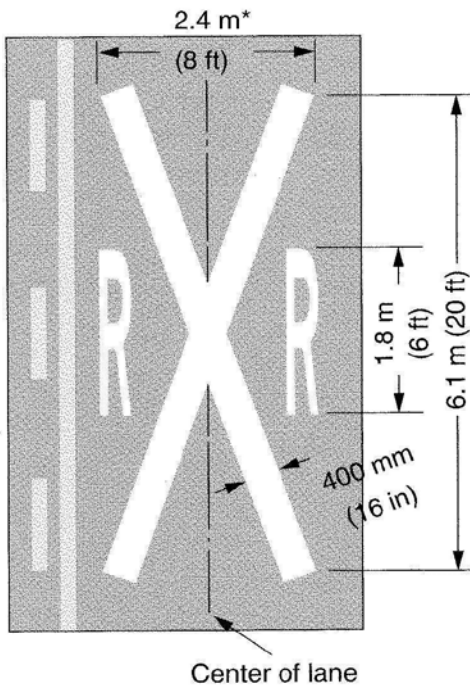
DEVELOPMENT STANDARDS



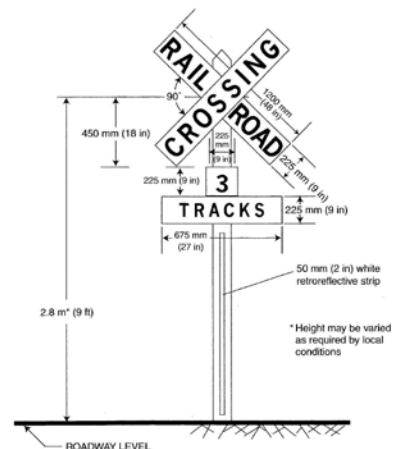
MUTCD (Figure 9B-3) Railroad Sign and Markings Locations for Shared-Use Paths



MUTCD (Figure 10D-3 and 10D-4) Typical Gate Arm Placement in Relation to Paths



MUTCD (Figure 8B-3) Pavement Markings for Rail Grade Crossings



MUTCD (Figure 8B-1) Rail Grade Crossing Crossbuck

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SHARED-USE PATH SIGNAGE

There are many different issues to consider in the design of signs for a shared-use path. Signs along the system will need to serve a variety of purposes, including: providing traffic control along the path, alerting users to potential hazards, identifying path access points, providing historic information, providing educational information, indicating path distance, and providing orientation on the path and to surrounding communities.

Signs will need to be located so they are legible to path users and must be constructed in methods and materials that are somewhat vandal resistant and easy to maintain.

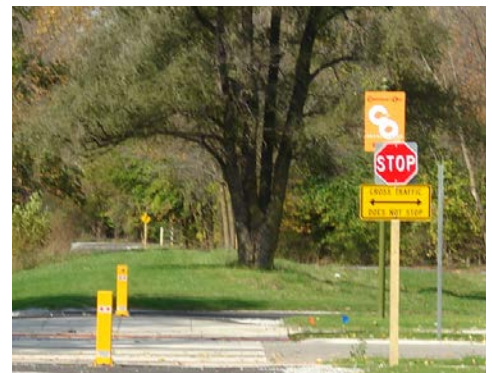
The need for different types of signs must be balanced with the idea of creating a visually pleasing landscape in which to use the shared-use path. The paths will feature a system of signage to clearly communicate a variety of messages in a graphically consistent manner. The signage system is divided into the following categories: Shared-Use Path Traffic Signs, Shared-Use Path Identity Signs, Shared-Use Path Guidance and Interpretive Signs, and Mile Markers.

Shared-Use Path Traffic Signs:

The shared-use path system will be a transportation corridor and, therefore, must have recognizable transportation signs that follow MUTCD guidelines. The shared-use path traffic signs will include regulatory and warning signs, such as: STOP, YIELD, and TRAIL NARROWS signs.

The design of the shared-use path traffic signs should be consistent from path to path. Signs can have graphic information on one or both sides, reducing the overall number of signs needed. Signs should be placed 3 feet from the path's edge and be mounted at a height of 5 feet.

If the shared-use path is parallel with a roadway, "Yield To Trail Users" signage should be mounted to warn motorists when crossing at an intersection that pedestrians and bicyclists may also be crossing in the roadway. This provides added safety for both the motorist and pedestrian.

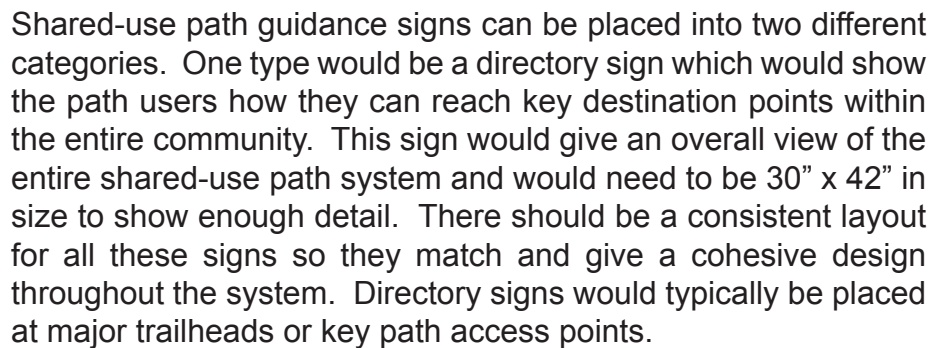




The shared-use path system will have numerous points of access. It is important that these points of entry be identified for the public in an appropriate and consistent manner. The shared-use path identity sign is intended to serve two functions: identify the main entry points to the path, and establish for the public a consistent and lasting identity for the path. By selecting a consistent treatment for each path it will help the user to know which route they are currently on. Each sign should be designed to incorporate a unique feature of each path. The city park's logo should be incorporated into each sign and the identity sign should follow the same color scheme as the route it is representing. The identity sign should be 9 feet to the bottom of the sign, minimum, to provide visibility and clearance. The signs should be visible by the public at the shared-use path and street intersections and at other significant access points.

Shared-Use Path Guidance & Interpretive Signs:

Along the path, there should be several different types of signs that provide the user with guidance information such as points of interest, path support facilities, and orientation.



The second type of guidance sign is a wayfinding sign. This type of sign is a map indicating amenities that are within close proximity to your current location on the path. These signs should be located at intersecting routes. A wayfinding sign should be no larger than 24" x 36", but at a scale that shows much more detail than the directory signs. The image located at the top of the next page represents an example of this type of sign.

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Interpretive signs are another type of sign that provide educational information to path users and enhance their experience. These signs help to convey the historical, cultural, or ecological significance of certain points along the path. Examples would be the importance of protecting wetlands or water bodies, geological formations unique to the area, or a historically significant feature within the community.

With all these functions, the materials that the signs are made of must be flexible enough to incorporate a variety of graphic information and, yet, be consistent in appearance and presentation. It is recommended that a high pressure laminate be used for the directory, wayfinding, and interpretive signs. High pressure laminates provide high quality graphics and longevity at a reasonable price. A ½ inch thick sign should be employed to avoid the use of a frame. A high pressure laminate sign has a very clean print, has a low replacement cost, and resists shattering, and typically has a warranty period of 10 years. The interpretive signs and guidance signs should be mostly conveyed graphically, with minimal text and at a size that is at a comfortable height.



Mile Markers:

Mile markers provide orientation for the path users and emergency personnel as well as traveled distance along the path. Distance should be marked in quarter-mile intervals or less by transverse pavement markings placed directly on top of the path. Information included on the markers should be distance in miles and each trails logo. The top mile marker image to the right shows a type that is easily readable and reduces conflicts during routine maintenance such as mowing.





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SITE FURNISHINGS

In addition to signage, the design of the shared-use path system will include site furnishings to accommodate the needs of the path users along the length of the entire route. Amenities such as benches, informal seating areas, trash receptacles, bicycle racks, and bollards will be clustered together at major, minor, and shared-use trailheads.

Locations of amenities along paths will depend on the characteristics of each path segment and should be addressed on a case by case situation. The purpose of most shared-use paths is to move people between various locations and for recreation. As such people are less likely to stop in between access points. Benches generally should be located at overlook points along paths where appropriate and where enough right-of-way exists. Paths located in sections of the city where there is a more elderly population or where there might be a need for people to stop more frequently may require benches to be placed in between access points. Paths located near hospitals may need to have benches placed more frequently if the hospital plans to use the route for rehabilitation programs.



Along with path signage, site furniture will be among the most frequently utilized elements along the path, setting the tone for the overall image of the path system in the minds of the users. It is important that design standards for the paths' site furnishings be established to ensure overall consistency of design and path image. The colors should be consistent with the route color scheme that the furnishing is located along. Along with consistency of color, a consistent style of furnishings needs to be established and followed as paths begin to be constructed. Establishing a color and style to use throughout the path it will minimize the amount of cost for the City because replacement parts can be stockpiled for one style of bench instead of five styles. See the following product information for consistency in site furnishings.

For federally funded projects it will be important to use the information in this document to complete the proprietary selection form.

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Benches:

- Minimum of 6 feet long
- Color and style should match other amenities along the trail for a cohesive look
- Arm rests should be provided to help those that are more physically challenged
- A backrest should be provided to help those that are more physically challenged
- Powder or plastisol coating should be applied to reduce maintenance
- Option: Center Arm can be provided to keep people from sleeping on the bench
- The bench must have a firm and stable pad underneath it and provide a 3 foot wide area for a wheelchair to sit next to it



Trash Receptacle:

- Color and style shall match benches and other amenities to help with cohesion
- Minimum size of 32 gallons to reduce emptying
- A flare top lid will help to keep water from collecting in the trash bag
- A liner helps to reduce leaking of refuse on to surrounding surfaces
- The receptacle must have a firm and stable access path to it



Bicycle Rack:

- 36" Bike Loop
- Color: Color to be based on designated trail color
- Installation: In accordance with manufacturer's instructions
- Style: Loop (supports bicycle in two spots)





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Bollard:

- Use: Only in problem areas where motorized vehicle access seems to be more prevalent
- Collapsible is preferred to allow access for maintenance or emergency vehicles
- Color to match other amenities for cohesion



Drinking Fountain:

- Color: To match other amenities for cohesion
- Installation: In accordance with manufacturer's instructions
- Style: Two fountain heights with one fountain ADA accessible and dog bowl fountain
- The fountain must have a firm and stable access path to it





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SHARED-USE PATH LANDSCAPING

The shared-use path system, due to its overall length and diverse scenery, may require more landscaping in urban areas and less in rural areas. The presence of mature vegetative cover not only adds to the natural beauty of the path experience, but also minimizes the amount of new landscaping necessary to improve the appearance of the path system and screening of the path from undesirable views and adverse adjacent path conditions.

In areas along the path where the appearance warrants improvement and no existing vegetation is present, plantings of trees, shrubs and ground cover should be considered to create a linear park effect alongside the route. New plantings should also be used to identify and improve “entrances” to parks (trail access points) and street crossings.

In addition, plantings should be used to screen certain land uses adjacent to the corridor (such as business service areas and industrial sites) and to separate the path from other improvements within the right-of-way (such as parking lots). Native plant material should be used where possible in an effort to keep landscape maintenance to a minimum and to maximize the ecological benefits of the plantings.

SHARED-USE PATH LIGHTING

The system is intended for use during daylight hours only; therefore it is not anticipated that the shared-use paths will need trail lighting. However, the installation of security lighting at trailheads, road crossings, bridges, and other activity areas should be considered if conditions warrant. Should conditions deem lighting to be necessary, there should be a standard lighting choice throughout all of the system.

SHARED-USE PATH MAINTENANCE ISSUES AND SAFETY

Maintenance costs are expected to be a minimum for the first 5-10 years. Costs will vary depending on the amount of paths needing to be maintained and the location of the paths. On a typical mile-long trail, maintenance could cost approximately \$3,000 per year. Long term maintenance costs could consist of repairing any asphalt damage. Over 20 years it could be anticipated to spend approximately \$10,000 to \$20,000 on asphalt repair. The city or parks department should have a general maintenance fund set aside for this. Below is a list of general system maintenance items to keep in mind during the upkeep of the shared-use paths:

- Treat any wooden railing at least every 5 years to keep from rotting
- Properly prune trees above trails and shoulders to maintain 12 feet of vertical clearance.
- Properly prune trees and shrubs to maintain at least 5 feet of horizontal clearance from trail pavement edge. Use horticultural accepted pruning techniques and do not “top” trees (do not cut mid branch). Improper pruning can put stress on trees and cause more harm to the public in the long run.
- Properly prune any dead limbs out of trees to protect trail users. Remove any existing trees within close proximity that may die over time to protect trail users.
- Perform routine maintenance: mowing, clearing, trimming, vandalism repair, and litter control.



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- Edge pavement or shoulder periodically to prevent roots/vegetation from compromising pavement.
- Seal cracks in pavement every 2 years to prevent debris build up, water from entering base, and continued deterioration. Rubberized sealant is recommended
- Consider using a seal coat every 4 years to arrest deterioration, prevent water filtration, restore oils to upper surface, and prevent loss of fines

Path maintenance costs could be reduced by utilizing local volunteers and other programs for simple tasks like litter removal and storm clean-up. A full time employee could be the designated volunteer coordinator and help manage resources and efforts. The Cardinal Greenway is a good example of where a volunteer system has been used to reduce maintenance costs and would be a good resource for how to make one successful. Also, youth scouting organizations, community corrections programs, community service programs, and youth programs could be utilized to do these tasks. More stringent repairs, like sealing asphalt and repairing cracks should still be handled with city forces or a contractor.

Another area where volunteers can help reduce cost is through regular patrols of the shared-use path systems. Since many path users will use the system daily for recreational or commuting needs, they can monitor any unwanted behavior simultaneously. Their responsibility would not be to address any unwanted behavior, but rather report it immediately to the proper authorities. In this way, the program can help to reduce the number of law enforcement officers that would need to be dedicated to the trail system and the need to install call boxes along the trails. Examples for places to find local volunteers would be local bicycle clubs, avid cyclists, alternative transportation advocates, etc.

ACCESSIBILITY

As mentioned previously, all new path construction must follow guidelines developed by the US Access Board or regulations from the US Department of Justice. At the time this document was created there were several guidelines that applied: 1) Guidelines for Shared Use Paths; 2) Guidelines for Outdoor Developed Areas; and 3) Guidelines for Pedestrian Facilities in the Public Right-of-Ways.

Some of these accessibility standards have already been addressed in other sections of the design guidelines, but there are a few others to consider:

- Ramps – See Guidelines for Pedestrian Facilities in the Public Right-of-Ways
- Detectable warnings – See ADA Chapter 7: Communication Elements and Features, Section 705 and Guidelines for Pedestrian Facilities in the Public Right-of-Ways
- Push buttons (activation)/signalization standards – See Guidelines for Pedestrian Facilities in the Public Right-of-Ways
- Site amenities – See Accessibility Guidelines for Outdoor Developed Areas



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PEDESTRIAN FACILITIES

The downtown walking area already has a high level of pedestrian service. There are several design treatments that were proposed as part of the final pedestrian plan. All elements installed should follow the guidelines as outlined in the AASHTO Guide for the Planning, Design, and Operations of Pedestrian Facilities. Below are some treatments that would help support the existing sidewalk network.

1. Crosswalks shall have “piano bar” striping to provide more visibility
2. Intersection Treatments
 - a. Install refuge islands where the width of the lanes to be crossed is greater than 75 feet or a pedestrian walking at 2.5 feet/second cannot completely cross the street during a signalized walk cycle.
 - b. Consider bump outs at intersections where on-street parking is present to lessen the crossing distance
 - c. Mid-block crossings should consider Hawk signalization
3. Street trees should be planted a maximum of 40 feet apart. Street trees should have the following characteristics
 - a. Non-invasive varieties
 - b. Vase shaped as to not impede pedestrian or vehicular traffic
 - c. Maximum height of 40 feet
 - d. Maximum width of 20-25 feet
4. Tree grates should be considered to give street trees a maximum root zone, while not impeding the pedestrian walking area. This will help to cut down on tree roots heaving the existing walks as well
5. Install a downtown pedestrian support facility including the following:
 - a. Public restroom building
 - b. Shelter for shade
 - c. Benches for resting
 - d. Trash receptacles
 - e. Trees for shade
 - f. Pedestrian directory signs
 - g. Drinking fountain
 - h. Pet waste disposal
 - i. Bike racks
 - j. Public art
6. Countdown crosswalk signals with auditory warning
7. More trash receptacles
8. More benches for resting
 - a. Benches should have arm rests and back rests to help those people that are more physically challenged
9. An ADA transition plan needs to be completed that includes assessment of the existing facilities and a plan for correcting those areas not in compliance