Albuquerque Bikeways and Trails Master Plan Design Guidelines

The City of Albuquerque has been working to implement on- and off-street projects to encourage walking and cycling, improve safety and accessibility, and enhance the quality of the walkway and bikeway networks so that these activities become integral parts of daily life. While Albuquerque is growing, it has a predominantly built urban environment, and many future projects will involve retrofitting existing streets and intersections. The city has a moderate demand for on-street parking, an auto-oriented roadway system reliant on high-capacity arterials, and many other complex situations. When looking to implement sidewalks and bike lanes or other improvements on City of Albuquerque streets, most standard design manuals offer limited solutions.

The Albuquerque Bikeways and Trails Master Plan Design Guidelines are designed to provide an exhaustive range of design options for bicycle and trail treatments. These design concepts are based on current bikeway and trail design guidelines for typical situations provided in City of Albuquerque documents, including:

- City of Albuquerque Development Process Manual (DPM)
- City of Albuquerque Trail and Bikeways Facility Plan
- City of Albuquerque On-Street Bicycle Plan

In addition, Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities, and the Manual of Uniform Traffic Control Devices (MUTCD) 2003, Part 9 Traffic Controls for Bicycle Facilities and 2009 update were also used. The Albuquerque Bikeways and Trails Master Plan Design Guidelines use these documents as a baseline for minimum conditions. An innovative design treatments section following provides creative solutions that have been used nationally and internationally to provide bikeways appealing to a wide range of users.

The following are key principles for these pedestrian and bicycle guidelines:

- The bicycling and trail environment should be safe. Bicycle routes, pathways, crossings, and should be designed and built to be free of hazards and to minimize conflicts with external factors such as noise, vehicular traffic and protruding architectural elements.
- The bicycle and trail network should be accessible. Bicycle routes, pathways and crosswalks should ensure the mobility of all users by accommodating the needs of people regardless of age or ability. Bicyclists have a range of skill levels, and facilities should be designed for use by experienced cyclists at a minimum, with a goal of providing for inexperienced / recreational bicyclists (especially children and seniors) to the greatest extent possible. In areas where specific needs have been identified (e.g., near schools) the needs of appropriate types of bicyclists should be accommodated.
- The bicycle and trail network should connect to places people want to go. The bicycle and trail network should provide a continuous direct routes and convenient connections between destinations, including homes, schools, shopping areas, public services, recreational opportunities and transit.
- The bicycling and trail environment should be clear and easy to use. Bicycle routes, pathways and crossings should be designed so people can easily find a direct route to a destination and delays are minimized. Most roads in Albuquerque are legal for the use of bicyclists, meaning that most streets are bicycle facilities and should be designed, marked and maintained accordingly.
- The bicycling and trail environment should provide good places. Good design should enhance the feel of the bicycle and trail environment. A complete network of on-street bicycling facilities should connect seamlessly to the existing and proposed off-street pathways to complete recreational and commuting routes around the city.
- Bicycle and trail improvements should be economical. Improvements should be designed to achieve the maximum benefit for their cost, including initial cost and maintenance cost as well as reduced reliance on more expensive modes of transportation. Where possible, improvements in the right-of-way should stimulate, reinforce and connect with adjacent private improvements.

Design guidelines are intended to be flexible and can be applied with professional judgment by designers. Specific national and state guidelines are identified in this document, as well as design treatments that may exceed these guidelines.
National and State Guidelines/Best Practices

The following is a list of references and sources utilized to develop design guidelines for the Albuquerque Bikeways and Trails Master Plan Design Guidelines. Many of these documents are available online and are a wealth of information and resources available to the public.

Federal Guidelines


State and Local Guidelines

• Albuquerque Public Works Department, Neighborhood Traffic Management Standards.
• New Mexico Department of Transportation, New Mexico Bicycle-Pedestrian-Equestrian Advisory Plan, 2009.
• New Mexico. (1978). Night Sky Protection Act. (Section 74-12-11 NMSA 1978) http://law.justia.com/newmexico/codes/nmrc/jd_74-12-3-1b725.html
• Best Practices Documents
Design Toolbox

1. On-Street Facility Design Guidelines ................................................. 1
   1.1. Facility Selection .............................................................................. 1
   1.2. Shared Roadways ........................................................................... 2
   1.3. Shoulder Bikeways ......................................................................... 3
   1.4. Wide Curb Lane ........................................................................... 4
   1.5. Bike Lanes ..................................................................................... 5
       1.5.1. Guidelines for Bike Lanes ........................................................ 6
           1.5.1.1. Bike Lane Adjacent to On-Street Parallel Parking .............. 6
           1.5.1.2. Bike Lane Adjacent to On-Street Diagonal Parking ............ 7
           1.5.1.3. Bike Lane Without On-Street Parking ............................... 8
       1.5.2. Bike Lanes at Roundabouts ..................................................... 9
       1.5.3. Retrofitting Existing Streets with Bike Lanes ........................... 10
           1.5.3.1. Roadway Widening .......................................................... 10
           1.5.3.2. Lane Narrowing (Road Diet 1) ......................................... 11
           1.5.3.3. Lane Reconfiguration (Road Diet 2) ................................. 12
           1.5.3.4. Parking Reduction (Road Diet 3) ..................................... 13
   1.6. Bicycle Boulevards ....................................................................... 14
       1.6.1. Level 1: Bicycle Boulevard Signing ........................................ 17
       1.6.2. Level 2: Bicycle Boulevard Pavement Markings ....................... 18
       1.6.3. Level 3: Bicycle Boulevards at Minor Unsignalized Intersections ... 19
       1.6.4. Level 3: Bicycle Boulevards at Major Unsignalized Intersections ... 20
       1.6.5. Level 3: Bike Routes/Boulevards at Offset Intersections ............. 20
       1.6.6. Level 4: Bicycle Boulevard Traffic Calming ........................... 21
       1.6.7. Level 5: Bicycle Boulevard Traffic Diversion .......................... 22

2. General Intersection Design Guidelines ............................................ 23
   2.1. High-Visibility Crosswalk Techniques ......................................... 23
   2.2. Marked Crosswalks ..................................................................... 24
       2.2.1. Minimizing Conflict with Automobiles ................................. 24
   2.3. Pedestrian Hybrid Beacon .......................................................... 25
   2.4. Accommodating Bicyclists at Intersections ................................. 27

3. Off-Street Facility Design Guidelines ................................................. 28
   3.1. Shared-Use Path Design .............................................................. 29
       3.1.1. Shared-Use Equestrian Trail Design ...................................... 30
       3.1.2. Trail Accessibility .................................................................. 31
       3.1.3. Managing Multiple Users ...................................................... 32
       3.1.4. Trail Opportunities ............................................................... 33
           3.1.4.1. Rails-with- Trails ............................................................. 33
       3.1.5. Trails Along Roadways .......................................................... 34
   3.2. Path/Roadway Crossings ............................................................. 35
       3.2.1. Type 1: Marked/Unsignalized Crossings ................................. 37
       3.2.2. Type 2: Route Users to Existing Signalized Intersection ............. 38
       3.2.3. Type 3: Signalized/Controlled Crossings ............................... 38
       3.2.4. Type 4: Grade-separated Crossings ...................................... 39
3.3. Amenities ........................................................................................................40
    3.3.1. Pedestrian-Scale Lighting ...........................................................................40
    3.3.2. Bollards ........................................................................................................40
    3.3.3. Edge Treatments ..........................................................................................41
        3.3.3.1. Fencing ..................................................................................................41
        3.3.3.2. Dense Vegetation .................................................................................41
        3.3.3.3. Open Boundary .......................................................................................41
    3.3.4. Landscaping ..................................................................................................41
    3.4. Path Amenities ................................................................................................42
3.5. Trail Safety and Security ..................................................................................43
    3.5.1. Crime Prevention Through Environmental Design (CPTED) ..................43
    3.5.2. Trail Safety and Security Concerns .............................................................43
        3.5.2.1. Privacy of adjacent property owners .......................................................43
        3.5.2.2. Unwanted vehicle access .......................................................................43
        3.5.2.3. Litter and dumping ...............................................................................43
        3.5.2.4. Trespassing ............................................................................................43
        3.5.2.5. Local on-street parking ........................................................................44
        3.5.2.6. Crime .....................................................................................................44
        3.5.2.7. Vandalism ..............................................................................................44
    3.5.3. Community Involvement with Safety on the Trail .....................................45
        3.5.3.1. Good access to the path ........................................................................45
        3.5.3.2. Good visibility from neighbors ...............................................................45
        3.5.3.3. High level of maintenance .....................................................................45
        3.5.3.4. Programmed events ..............................................................................45
        3.5.3.5. Adopt-a-Path Program .........................................................................45
        3.5.3.6. Path Watch Program .............................................................................45
    3.5.4. Trailheads .....................................................................................................46
4. Wayfinding ...........................................................................................................47
    4.1 On-Street .........................................................................................................48
        4.1.1. Bike Routes ................................................................................................48
        4.1.2. Bike Lanes ................................................................................................48
        4.1.3. Bicycle Boulevards .................................................................................48
        4.1.4. On-Street Signage Guidelines ..................................................................49
    4.2 Multi-use Trails .................................................................................................50
        4.2.1. Trail identification ....................................................................................50
        4.2.2. Trail marking ............................................................................................51
5. Pedestrian and Cycling Supportive Site Design ..................................................53
    5.1.1. Bicycle Routes to Transit .............................................................................53
6. Bicycle Parking .....................................................................................................54
    6.1. Short-Term Bicycle Parking ..........................................................................54
        6.1.1. On-Street Corrals .....................................................................................56
        6.1.2. Shelters ....................................................................................................57
    6.2. Long-Term Parking ........................................................................................57
        6.2.1. Bike Lockers .............................................................................................58
        6.2.2. Bicycle Compounds/Cages ......................................................................59
        6.2.3. Bicycle Rooms ........................................................................................60
1. **On-Street Facility Design Guidelines**

There are a range of different types of bicycle facilities that can be applied in various contexts, which provide varying levels of protection or separation from automobile traffic. This section summarizes best practice on-street bicycle facility design from North America and elsewhere.

1.1. **Facility Selection**

There are a wide variety of techniques for selecting the type of facility for a given context. Roadway characteristics that are often used include:

- Motor vehicle speed and volume
- Presence of heavy vehicles/trucks
- Roadway width
- Demand for bicycle facilities
- User preference
- Land use/urban or rural context

There are no ‘hard and fast’ rules for determining the most appropriate type of facility for a particular location; engineering judgement and planning skills are critical elements of this decision.

A 2002 study combined bikeway dimension standards for ten different communities in North America. The goal of the study was to survey the varying requirements available and provide a best practices approach for providing bicycle facilities. The study included a comparison with European standards, and found that “North Americans rely much more on wide lanes for bicycle accommodation than their counterparts overseas.” The table below shows the results of this analysis, which recommends use of bike lanes or shoulders, wide lanes, or normal lanes. Finally, shows the ‘worldwide speed-volume chart,’ which synthesizes findings from Europe and North America. This final chart is useful for the inclusion of separated lanes, or cycle tracks, and generally has a lower threshold for increasing separation than the North America selection table.

![North American Bicycle Facility Selection Chart](Image)

(King, Michael. (2002). Bicycle Facility Selection: A Comparison of Approaches. Pedestrian and Bicycle Information Center and Highway Safety Research Center, University of North Carolina – Chapel Hill.)
1.2. Shared Roadways

Design Summary

• Any street without specific bicycle facilities, where bicycling is permitted.
• Can be signed connections, often to trails or other major destinations.
• Sign R4-11 BICYCLES MAY USE FULL LANE sign may be used on roadways where no bicycle lanes or adjacent shoulders usable by bicyclists are present and where travel lanes are too narrow for bicyclists and motor vehicles to operate side by side (MUTCD Section 9B.06).

Discussion

A treatment appropriate for commuter riders and those accessing a trail, shared roadways can provide a key connection. Shared roadways are indicated exclusively by signage, which provide key connections to destinations and trails where providing additional separation is not possible.

Roadways appropriate for shared roadways often have a centerline stripe only, and no designated shoulders. Bicyclists are forced to share a travel lane with automobiles. This type of facility can be developed on a rural roadway without curb and gutter. It can also be used on an urban road where traffic speeds and volumes are low (photo), although shared lane markings in addition to signage may be more appropriate in these locations.

Guidance

The DPM defines shared roadways as, “any roadway that may be legally used by both motor vehicles and bicycles and is not specifically designated as a bikeway.”

The DPM states that, “where trails intersect with the street network, safe connections to the on-street bikeway system should be designed.” Shared routes may be an appropriate treatment for such connections.

See also: MUTCD Section 9B. 20 Bicycle Guide Signs.
1.3. Shoulder Bikeways

Design Summary

DPM recommended widths (measured from painted edgeline to edge of pavement):

• 6’ on roadways with posted speed limits of 40 mph or greater.
• 5’ on roadways with posted speed limits of 35 mph or below.
• 4’ may be considered on low-speed, low-volume streets where right-of-way constraints exist.
• Can include pavement markings and ‘Share the Road’ signage.
• See bike lane section (page 12) for additional guidance for determining if bike lanes are required.

Discussion

On streets without adequate space for bike lanes, or on rural roads with a large shoulder, shoulder bikeways can accommodate bicycle travel. Shoulder bikeways are generally used by commuter and long-distance recreational riders, rather than families with children or more inexperienced riders.

In many cases, the opportunity to develop a full standard bike lane on a street where it is desirable may be many years. It is possible to stripe the shoulder in lieu of bike lanes if the area is 50 percent of the desirable bike lane width and the outside lane width can be reduced to the AASHTO minimum. If the available bike lane width is 2/3 of the desirable bike lane width, the full bike lane treatment of signs, legends, and an 8” bike lane line would be provided. Where feasible, extra width should be provided with pavement resurfacing jobs, but not exceeding desirable bike lane widths.

Guidance

The DPM states that, “paved shoulder bikeways are located on uncurbed arterials and collectors and consist of a smooth paved surface that covers all or part of the roadway shoulder.” The DPM also specifies that bike lanes and paved shoulders are the standard treatments for use on arterial or collector streets.

The New Mexico Bicycle-Pedestrian-Equestrian Advisory Plan provides guidance on the use of rumble strips to provide a buffer on roadway shoulders. It also has information about guard rails, pavement edges, and shoulder continuity.

See also: MUTCD Section 9B. 20 Bicycle Guide Signs.
1.4. Wide Curb Lane

Design Summary

- Outside lane widths of 14-16’ (DPM), 14-15’ NM BPE Plan
- The width of the door zone is generally assumed to be 2.5 feet from the edge of the parking lane.
- Place in a linear pattern along a corridor (typically every 100-200 feet).

Recommended Placement:

- At least 11’ from face of curb (or shoulder edge) on streets with on-street parking.
- At least 4’ from face of curb (or shoulder edge) on streets without on-street parking.

Discussion

On wide curb lane bikeways, high-visibility pavement markings called shared lane markings (also known as “sharrows”) are used to position bicyclists within the travel lane. These markings are often used on streets where dedicated bike lanes are desirable but are not possible due to physical or other constraints. Shared lane markings are placed strategically in the travel lane to alert motorists of bicycle traffic, while also encouraging cyclists to ride at an appropriate distance from the “door zone” of adjacent parked cars. Shared lane markings also encourage cyclists to ride in a straight line so their movements are predictable to motorists. Shared lane markings made of thermoplastic tend to last longer than painted ones.

Guidance

The 2009 MUTCD notes that shared lane markings should not be placed on roadways with a speed limit over 35 MPH, and that when used the marking should be placed immediately after an intersection and spaced at intervals no greater than 250 feet thereafter. Placing shared lane markings between vehicle tire tracks (if possible) will increase the life of the markings. (See MUTCD Section 9C.07).
1.5. Bike Lanes

Design Summary

Designated exclusively for bicycle travel, bike lanes are separated from vehicle travel lanes with striping and also include pavement stencils. Bike lanes are most appropriate on arterial and collector streets where higher traffic volumes and speeds warrant greater separation.

The DPM recommends minimum bike lane widths of:

- 5 feet, measured from painted edgeline to edge of gutter, on roadways with posted speed limits of 40 mph or greater.
- 4 feet, measured from painted edgeline to edge of gutter, on roadways with posted speed limits of 35 mph or less.

However, AASHTO and other guidance recommends a five-foot minimum for bike lanes, with four feet only in restricted corridors. This text should be considered for revision to specify that a five-foot bike lane is recommended on streets with posted speed limits of 35 mph or less. In addition, the DPM should specify that bike lanes are measured to the inside edge of the gutter pan, ensuring smooth pavement rather than a gutter edge in the bike lane.

Discussion

Many bicyclists, particularly less experienced riders, are more comfortable riding on a busy street if it has a striped and signed bike lane than if they are expected to share a wide lane. Providing marked facilities such as bike lanes is one way of helping to persuade more tentative riders to try bicycling.

Bike lanes can increase safety and promote proper riding by:

- Defining road space for bicyclists and motorists, reducing the possibility that motorists will stray into the cyclists’ path
- Discouraging bicyclists from riding on the sidewalk
- Reminding motorists that cyclists have a right to the road.

In an urban setting, it is crucial to ensure that bike lanes and adjacent parking lanes have sufficient width, so that cyclists have enough room to avoid opened vehicle doors.

Additional Guidance

The DPM defines bike lanes as, “a lane on the roadway that has been designated by striping, signing, and pavement markings for preferential or exclusive use by bicyclists.” The DPM recommends the provision of bike lanes on all new or reconstructed arterial and collector roadways.

The DPM also specifies that high-speed traffic (posted speed of 40 mph or greater) and the presence of large vehicles (truck, bus, or recreational vehicle) are significant factors affecting the acceptability of potential bikeway locations. In locations where these conditions exist, bike lane widths of 5-feet or greater are recommended.

The AASHTO Guide for the Development of Bicycle Facilities guideline states that “if used, the bicycle lane symbol marking shall be placed immediately after an intersection and other locations as needed… If the word or symbol pavement markings are used, Bicycle Lane signs shall also be used, but the signs need not be adjacent to every symbol to avoid overuse of the signs.”

The New Mexico Bicycle and Pedestrian Plan specifies that “A vertical edge of pavement should not be left in the useable shoulder area or bicycle lane after construction or maintenance”, stating that four feet (minimum) of clear space should be provided and noting that partial overlays create undue hazards for cyclist. See also MUTCD Section 9C.04 Markings for Bicycle Lanes.
1.5.1. Guidelines for Bike Lanes

1.5.1.1. Bike Lane Adjacent to On-Street Parallel Parking

Design Summary

Bike Lane Width
- 6’ recommended when parking stalls are marked.
- 4’ minimum in constrained locations.
- 5’ acceptable if parking not marked (drivers tend to park closer to the curb where parking is unmarked).
- 7’ maximum (greater widths may encourage vehicle loading in bike lane).

Travel Lane Width
- 12’ for a shared lane adjacent to a curb face.
- 11’ minimum for a shared bike/parking lane where parking is permitted but not marked on streets without curbs.

Discussion

Bike lanes adjacent to on-street parallel parking are common in the U.S. and can be dangerous for bicyclists if not designed properly. Crashes caused by a suddenly-opened vehicle door are a common hazard for bicyclists using this type of facility. On the other hand, wide bike lanes may encourage the cyclist to ride farther to the right (door zone) to maximize distance from passing traffic. Wide bike lanes may also cause confusion with unloading vehicles in busy areas where parking is typically full.

Some treatments to encourage bicyclists to ride away from the ‘door zone’ include:

- Installing parking “T’s” and smaller bike lane stencils placed to the left (see graphic at top).
- Provide a buffer zone (preferred design; shown bottom). Bicyclists traveling in the center of the bike lane will be less likely to encounter open car doors. Motorists have space to stand outside the bike lane when loading and unloading.

Guidance

From AASHTO Guide for the Development of Bicycle Facilities:

“If parking is permitted, the bike lane should be placed between the parking area and the travel lane and have a minimum width of 5’. Where parking is permitted but a parking stripe or stalls are not utilized, the shared area should be a minimum of 11’ without a curb face and adjacent to a curb face. If the parking volume is substantial or turnover is high, an additional 1’-2’ of width is desirable.”
1.5.1.2. Bike Lane Adjacent to On-Street Diagonal Parking

Design Summary

Bike Lane Width
- 5’ minimum.
- White 4” stripe separates bike lane from parking bays.
- Parking bays are sufficiently long to accommodate most vehicles (vehicles do not block bike lane).

Discussion

In areas with high parking demand such as urban commercial areas, diagonal parking can be used to increase parking supply. Conventional “head-in” diagonal parking is not recommended in conjunction with high levels of bicycle traffic or with the provision of bike lanes as drivers backing out of conventional diagonal parking spaces have poor visibility of approaching bicyclists.

The use of ‘back-in diagonal parking’ or ‘reverse angled parking’ is recommended over head-in diagonal parking. This design addresses issues with diagonal parking and bicycle travel by improving sight distance between drivers and bicyclists and has other benefits to vehicles including: loading and unloading of the trunk occurs at the curb rather than in the street, passengers (including children) are directed by open doors towards the curb, no door conflict with bicyclists. While there may be a learning curve for some drivers, using back-in diagonal parking is typically an easier maneuver than conventional parallel parking.

Guidance

This treatment is currently slated for inclusion in the upcoming update of the AASHTO Guide for the Development of Bicycle Facilities.
1.5.1.3. Bike Lane Without On-Street Parking

Design Summary

**Bike Lane Width**
- 4’ minimum when no curb & gutter is present.
- 5’ minimum when adjacent to curb and gutter.
- Recommended Width:
  - 6’ where right-of-way allows.

**Maximum Width**
- 8’ Adjacent to arterials with high travel speeds (45 mph+).

**Discussion**
Wider bike lanes are desirable in certain circumstances such as on higher speed arterials (45 mph+) where a wider bike lane can increase separation between passing vehicles and cyclists. Wide bike lanes are also appropriate in areas with high bicycle use. A bike lane width of six to eight feet makes it possible for bicyclists to ride side-by-side or pass each other without leaving the bike lane, increasing the capacity of the lane. Appropriate signing and stenciling is important with wide bike lanes to ensure motorists do not mistake the lane for a vehicle lane or parking lane.

**Guidance**

Recommend bike lane without on-street parking design.*

*Bike lanes may be 4’ in width under constrained circumstances.
1.5.2. Bike Lanes at Roundabouts

Design Summary

- Reduce the speed differential between circulating motorists and bicyclists (25 mph maximum circulating design speed).
- Design approaches/exits to the lowest speeds possible, to reduce the severity of potential collisions with pedestrians.
- Encourage bicyclists navigating the roundabout like motor vehicles to “take the lane.”
- Maximize yielding rate of motorists to pedestrians and bicyclists at crosswalks.
- Provide separated facilities for bicyclists who prefer not to navigate the roundabout on the roadway.
- Indicate to drivers and bicyclists the correct way for them to circulate through the roundabout through appropriately-designed signage, pavement markings and geometric design elements.
- Indicate to drivers, bicyclists and pedestrians the right-of-way rules through appropriately-designed signage, pavement markings and geometric design elements.

Discussion

Research indicates that while single-lane roundabouts may benefit bicyclists and pedestrians by slowing traffic, multi-lane roundabouts may significantly increase safety problems for these users. Multi-lane roundabouts pose the following challenges to bicyclists riding in a bike lane:

- Bicyclists must take the lane before they enter the roundabout to avoid becoming caught in a “right hook,” a situation in which a motorist turns right, across the path of a bicyclist traveling straight. Entry leg speeds must be slow enough for bicyclists to be able to take the lane safely.
- Theoretically, once motor vehicle volumes reach a certain magnitude, there are no gaps in traffic large enough to accommodate a bicyclist.
- Bicyclists must be able to correctly judge the speed of circulating motorists to find a gap that is large enough for them to safely enter the roundabout. This task is particularly difficult if the circulating motorists are traveling at a much higher speed than the bicyclists. In addition, if circulating speeds in a roundabout are much higher than 20 mph, drivers behind a bicyclist may become impatient, and may pass the bicyclist and turn in front of him, creating more risks for the bicyclist.
- As a circulating bicyclist approaches an entry lane, a driver waiting to enter must notice the bicyclist, properly judge the bicyclist’s speed, and yield to him/her if necessary. In a location where there are few bicyclists, motorists may not even register that there is a bicyclist approaching. If a bicyclist is hugging the curb, s/he may be outside the motorist’s cone of vision.

Guidance

The New Mexico Bicycle-Pedestrian-Equestrian Advisory Plan state provides additional guidance for providing bicycle travel around roundabouts.
1.5.3. **Retrofitting Existing Streets with Bike Lanes**

Most major streets in Albuquerque are characterized by conditions (e.g., high vehicle speeds and/or volumes) for which dedicated bike lanes are appropriate to accommodate safe and comfortable riding. Although opportunities to add bike lanes through roadway widening may exist in some locations, most major streets in Albuquerque pose physical and other constraints requiring street retrofit measures within existing curb-to-curb widths. As a result, many of the recommended measures effectively reallocate existing street width through striping modifications to accommodate dedicated bike lanes. The DPM notes that, “the addition of bike lanes as part of arterial and collector rehabilitation is recommended where feasible.” While largely intended for major streets, these measures may be appropriate on some lower-order streets where bike lanes would best accommodate cyclists.

1.5.3.1. **Roadway Widening**

**Design Summary**

- 6’ preferred.
- 4’ minimum (see bike lane guidance).

**Discussion**

Bike lanes could be accommodated on several streets with excess right-of-way through shoulder widening. Although street widening incurs higher expenses compared with re-striping projects, bike lanes could be added to streets currently lacking curbs, gutters and sidewalks without the high costs of major infrastructure reconstruction.

As a long-term measure, the City of Albuquerque should find opportunities to add bike lanes to other major streets where they are needed. Opportunities include adding bike lanes as streets and bridges are widened for additional auto capacity or as property development necessitates street reconstruction.

**Guidance**
1.5.3.2. Lane Narrowing (Road Diet 1)

Design Summary

Vehicle Lane Widths
• Before: 12 to 15 feet; after: 10 to 11 feet.

Bike Lane Width
• See bike lane design guidance.

Discussion
Also called a ‘Road Diet’, lane narrowing utilizes roadway space that exceeds minimum standards to create the needed space to provide bike lanes. Many roadways in Albuquerque have existing lanes that are wider than those prescribed in local and national roadway design standards, or which are not marked. Most standards allow for the use of 11-foot and sometimes 10-foot wide travel lanes to create space for bike lanes. Special consideration should be given to the amount of heavy vehicle traffic and horizontal curvature before the decision is made to narrow travel lanes. Center turn lanes can also be narrowed in some situations to free up pavement space for bike lanes.

Guidance

Example of vehicle travel lane narrowing to accommodate bike lanes.
1.5.3.3. Lane Reconfiguration (Road Diet 2)

Design Summary

Vehicle Lane Widths
• Width depends on project. No narrowing may be needed if a lane is removed.

Bike Lane Width
• See bike lane design guidance.

Discussion
The removal of a single travel lane will generally provide sufficient space for bike lanes on both sides of a street. Streets with excess vehicle capacity provide opportunities for bike lane retrofit projects. Depending on a street’s existing configuration, traffic operations, user needs, and safety concerns, various lane reduction configurations exist. For instance, a four-lane street (with two travel lanes in each direction) could be modified to include one travel lane in each direction, a center turn lane, and bike lanes. Prior to implementing this measure, a traffic analysis should identify impacts.

This treatment is slated for inclusion in the update to the AASHTO Guide for the Development of Bicycle Facilities.

Guidance
1.5.3.4. Parking Reduction (Road Diet 3)

Design Summary

**Vehicle Lane Widths**
- Width depends on project. No narrowing may be needed depending on the width of the parking lane to be removed.

**Bike Lane Width**
- See bike lane design guidance.

**Discussion**

Bike lanes could replace one or more on-street parking lanes on streets where excess parking exists and/or the importance of bike lanes outweighs parking needs. For instance, parking may be needed on only one side of a street (as shown below and at right). Eliminating or reducing on-street parking also improves sight distance for cyclists in bike lanes and for motorists on approaching side streets and driveways. Prior to reallocating on-street parking for other uses, a parking study should be performed to gauge demand and to evaluate impacts to people with disabilities.

**Guidance**

Example of parking removal to accommodate bike lanes.
1.6. Bicycle Boulevards

Design Summary

- Roadway width varies depending on roadway configuration.
- Use D11-1 “Bike Route” sign as specified for shared roadways.
- Shared lane markings may be applied.
- Intersection treatments, traffic calming, and traffic diversions can be utilized to improve the cycling environment, as recommended in the following pages.

Discussion

Treatments for bicycle boulevards include five “application levels” based on their level of physical intensity, with Level 1 representing the least physically-intensive treatments that could be implemented at relatively low cost. Identifying appropriate application levels for individual bicycle.

Traffic calming and other treatments along the corridor reduce vehicle speeds so that motorists and bicyclists generally travel at the same speed, creating a more-comfortable environment for all users. Bicycle boulevards incorporate treatments to facilitate convenient crossings where the route crosses a major street. They work best in well-connected street grids where riders can follow reasonably direct and logical routes and when higher-order parallel streets exist to serve thru vehicle traffic.

Bicycle boulevards/bike routes can be treated with shared lane markings, directional signage, traffic diverters, chicanes, chokers, and /or other traffic calming devices to reduce vehicle speeds or volumes. Bicycle boulevards can employ a variety of treatments from signage to traffic calming and pavement stencils. The level of treatment provided at a specific location depends on several factors, discussed following.

Guidance

- The DPM defines bicycle boulevards as, “a bike route designed to encourage the through movement of bicycles while maintaining local access for motor vehicle travel.”
- Bicycle boulevards have been implemented in Berkeley, Emeryville, Palo Alto, San Luis Obispo, and Pasadena, CA; Portland and Eugene, OR; Madison, WI; Vancouver, BC; Tucson, AZ; Minneapolis, MN; Ocean City, MD; and Syracuse, NY.
**Discussion (continued)**

Bicycle boulevards serve a variety of purposes:

- **Parallel major streets lacking dedicated bicycle facilities**: Higher-order streets typically include major bicyclist destinations (e.g., commercial and employment areas). However, these corridors often lack bike lanes or other dedicated facilities creating an uncomfortable, unattractive and potentially unsafe riding environment. Bicycle boulevards serve as alternate parallel facilities that allow cyclists to avoid major streets for longer trips.

- **Parallel major streets with bicycle facilities that are uncomfortable for some users**: Some users may not feel comfortable using bike lanes on major streets due to high traffic volumes and vehicle speeds, conflicts with motorists entering and leaving driveways, and/or conflicts with buses loading and unloading passengers. Children and less-experienced riders might find these environments especially challenging. Utilizing lower-order streets, bicycle boulevards provide alternate route choices for these bicyclists. It should be noted that bike lanes on major streets provide important access to key land uses, and the major street network often provides the most direct routes between major destinations. For these reasons, bicycle boulevards should complement a bike lane network and not serve as a substitute.

- **Ease of implementation on most local streets**: bicycle boulevards incorporate cost-effective and less physically-intrusive treatments than bike lanes and cycle tracks. Most streets could be provided relatively inexpensive treatments like new signage, pavement markings, striping and signal improvements to facilitate bicyclists’ mobility and safety. Other potential treatments include curb extensions, medians, and other features that can be implemented at reasonable cost and are compatible with emergency vehicle accessibility.

- **Benefits beyond an improved bicycling environment**: Residents living on bicycle boulevards benefit from reduced vehicle speeds and thru traffic, creating a safer and more-attractive environment. Pedestrians and other users can also benefit from boulevard treatments (e.g., by improving the crossing environment where boulevards meet major streets).
It should be noted that corridors targeted for higher-level applications would also receive relevant lower-level treatments. For instance, a street targeted for Level 3 applications should also include Level 1 and 2 applications as necessary. It should also be noted that some applications may be appropriate on some streets while inappropriate on others. In other words, it may not be appropriate or necessary to implement all “Level 2” applications on a Level 2 street. Furthermore, several treatments could fall within multiple categories as they achieve multiple goals. To identify and develop specific treatments for each bicycle boulevard, the City of Albuquerque should involve the bicycling community and neighborhood groups. Further analysis and engineering work may also be necessary to determine the feasibility of some applications.

The City should strive to implement bicycle boulevards of Level 3 or higher, with additional traffic calming or diversion as needed.
1.6.1. Level 1: Bicycle Boulevard Signing

Design Summary

• Signing is a cost-effective yet highly-visible treatment that can improve the riding environment on a bicycle boulevard.
• The City should adopt consistent signage and paint markings throughout the region.

Discussion

Wayfinding Signs (Can be non-standard treatment)
Wayfinding signs are typically placed at key locations leading to and along bicycle boulevards, including where multiple routes intersect and at key bicyclist “decision points.” Wayfinding signs displaying destinations, distances and “riding time” can dispel common misperceptions about time and distance while increasing users’ comfort and accessibility to the boulevard network.

Wayfinding signs also visually cue motorists that they are driving along a bicycle route and should correspondingly use caution. Note that too many signs tend to clutter the right-of-way, and it is recommended that these signs be posted at a level most visible to bicyclists and pedestrians, rather than per vehicle signage standards.

Additional guidance for signage is provided on page 71.

Warning signs
Warning signs advising motorists to “share the road” and “watch for bicyclists” may also improve bicycling conditions on shared streets. These signs are especially useful near major bicycle trip generators such as schools, parks and other activity centers. Warning signs should also be placed on major streets approaching bicycle boulevards to alert motorists of bicyclist crossings.

Guidance

• Alta Planning + Design and IBPI. Bicycle Boulevard Planning and Design Handbook. www.ibpi.usp.pdx.edu/guidebook.php
• AASHTO Guide for the Development of Bicycle Facilities.
• MUTCD.
1.6.2. Level 2: Bicycle Boulevard Pavement Markings

Design Summary
Use pavement markings to designate bicycle boulevards and provide directional/wayfinding information.

Discussion

On-Street Parking Delineation
Delineating on-street parking spaces with paint or other materials clearly indicates where a vehicle should be parked, and can discourage motorists from parking their vehicles too far into the adjacent travel lane. This helps cyclists by maintaining a wide enough space to safely share a travel lane with moving vehicles while minimizing the need to swerve farther into the travel lane to maneuver around parked cars.

In addition to benefiting cyclists, delineated parking spaces also promote the efficient use of on-street parking by maximizing the number of spaces in high-demand areas.

Centerline Striping Removal
Automobiles have an easier time passing cyclists on roads without centerline stripes for the majority of the block length. If vehicles cannot easily pass each other using the full width of the street, it is likely that there is too much traffic for the subject street to be a successful bicycle boulevard. In addition, not striping the centerline reduces maintenance costs. Berkeley paints a double yellow centerline from 40-50’ at uncontrolled or stop-controlled intersections, as well as pavement reflectors to identify the center of the street.

Directional Pavement Markings (Non-standard treatment)
Directional pavement markings (also known as “bicycle boulevard markings” or “breadcrumbs”) lead cyclists along a boulevard and reinforce that they are on a designated route. Markings can take a variety of forms, such as small bicycle symbols placed every 600-800 feet along a linear corridor, as previously used on Portland, Oregon’s boulevard network.

Recently, jurisdictions have been using larger, more visible pavement markings. Shared lane markings could be used as bicycle boulevard markings, as Portland, OR has moved towards using. See shared lane marking guidelines for additional information on this treatment.

In Berkeley, California, non-standard pavement markings include larger-scale lettering and stencils to clearly inform motorists and bicyclists of a street’s function as a bicycle boulevard.

Guidance
- MUTCD.
1.6.3. **Level 3: Bicycle Boulevards at Minor Unsignalized Intersections**

**Design Summary**

- To encourage use of the boulevard and improve cyclists’ safety, reduce bicycle travel time by eliminating unnecessary stops and improving intersection crossings.

**Discussion**

**Stop Sign on Cross-Street**

Unmarked intersections are dangerous for bicyclists, because cross-traffic may not be watching for cyclists. Stop sign on cross streets require crossing motorists to stop and proceed when safe. Stop signs are a relatively inexpensive treatment that is quite effective at minimizing bicycle and cross-vehicle conflicts. However, placing stop signs at all intersections along bicycle boulevards may be unwarranted as a traffic control device.

The DPM specifies that, “Potential on-street bikeway locations should include no more than one stop sign or traffic signal per 1/4 mile. Local street stop control should be reassigned to facilitate through bicycle traffic on designated bikeways. Stop control reassignment requires an engineering study to determine additional measures necessary to minimize neighborhood impacts.”

**Curb Extensions and High-Visibility Crosswalks**

This treatment is appropriate near activity centers with large amounts of pedestrian activity, such as schools or commercial areas. Curb extensions should only extend across the parking lane and not obstruct bicyclists’ path of travel or the travel lane. Curb extensions and high-visibility crosswalks both calm traffic and also increase the visibility of pedestrians waiting to cross the street, although they may impact on-street parking.

**Bicycle Forward Stop Bar (Non-standard treatment)**

A second stop bar for cyclists placed closer to the centerline of the cross street than the first stop bar increases the visibility of cyclists waiting to cross a street. This treatment is typically used with other crossing treatments (i.e. curb extension) to encourage cyclists to take full advantage of crossing design. They are appropriate at unsignalized crossings where fewer than 25 percent of motorists make a right turn movement.

**Guidance**

- Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.*
- MUTCD.
1.6.4. **Level 3: Bicycle Boulevards at Major Unsignalized Intersections**

**Design Summary**
- Increase crossing opportunities with medians and refuge islands

**Discussion**

**Medians/Refuge Islands**
A crossing island can be provided to allow cyclists to cross one direction of traffic at a time when gaps in traffic allow. The crossing island should be at least 8’ wide; narrower medians can accommodate bikes if the holding area is at an acute angle to the major roadway. Crossing islands can be placed in the middle of the intersection, prohibiting left and thru vehicle movements.

**Guidance**
- Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook*.

1.6.5. **Level 3: Bike Routes/Boulevards at Offset Intersections**

**Design Summary**
- Provide turning lanes or pockets at offset intersection, providing cyclists with a refuge to make a two-step turn.
- Bike turn pockets - 5’ wide, with a total of 11’ required for both turn pockets and center striping.

**Discussion**

Offset intersection can be challenging for cyclists, who need to transition onto the busier cross-street in order to continue along the boulevard.

**Bicycle Left-Turn Lane (Non-standard treatment)**
Bicycle left-turn lanes allow the crossing to be completed in two phases. The bicyclist executes a right-hand turn onto the cross-street, and then waits in a delineated left-turn lane if necessary. The bike turn pockets should be at least 5’ wide, total of 11’ for turn pockets and center striping.

**Bicycle Left Turn Pocket (Non-standard treatment)**
A bike-only left-turn pocket permits bicyclists to make left turns while restricting vehicle left turns. Signs should prohibit motorists from turning. Because of the restriction on vehicle left-turning movements, this treatment also acts as traffic diversion.

**Guidance**
- Alta and IBPI. *Bicycle Boulevard Planning and Design Handbook*.

This bike-only left-turn pocket guides cyclists along a popular bike route.
1.6.6. Level 4: Bicycle Boulevard Traffic Calming

Design Summary

- Traffic calming treatments reduce vehicle speeds to the point where they generally match cyclists’ operating speeds, enabling motorists and cyclists to safely co-exist on the same facility.

Discussion

Chicanes (Non-standard treatment)
Chicanes are a series of raised or delineated curb extensions on alternating sides of a street forming an S-shaped curb, which reduce vehicle speeds through narrowed travel lanes. Chicanes can also be achieved by establishing on-street parking on alternate sides of the street. These treatments are most effective on streets with narrower cross-sections.

Mini Traffic Circles
Mini traffic circles are raised or delineated islands placed at intersections, reducing vehicle speeds through tighter turning radii and narrowed vehicle travel lanes (see right). These devices can effectively slow vehicle traffic while facilitating all turning movements at an intersection. Mini traffic circles can also include a paved apron to accommodate the turning radii of larger vehicles like fire trucks or school buses.

Speed Humps
Shown right, speed humps are rounded raised areas of the pavement requiring approaching motor vehicles to reduce speed. These devices also discourage thru vehicle travel on a street when a parallel route exists. Speed humps should never be constructed so steep that they may cause a bicyclist to lose control of the bicycle or be distracted from traffic. In some cases, a gap could be provided, whereby a bicyclist could continue on the level roadway surface, while vehicles would slow down to cross the barrier.

Guidance

1.6.7. Level 5: Bicycle Boulevard Traffic Diversion

Design Summary

- Traffic diversion treatments maintain thru-bicycle travel on a street while physically restricting thru vehicle traffic.
- Traffic diversion is most effective when higher-order streets can sufficiently accommodate the diverted traffic associated with these treatments.

Discussion

**Choker Entrances (Non-standard treatment)**

Choker entrances are intersection curb extensions or raised islands allowing full bicycle passage while restricting vehicle access to and from a bicycle boulevard. When they approach a choker entrance at a cross-street, motorists on the bicycle boulevard must turn onto the cross-street while cyclists may continue forward. These devices can be designed to permit some vehicle turning movements from a cross-street onto the bicycle boulevard while restricting other movements.

**Traffic Diverters (Non-standard treatment)**

Similar to choker entrances, traffic diverters are raised features directing vehicle traffic off the bicycle boulevard while permitting thru travel.

Advantages:
- Provides safe refuge in the median of the major street so that bicyclists only have to cross one direction of traffic at a time; works well with signal-controlled traffic platoons coming from opposite directions.
- Provides traffic calming and safety benefits by preventing left turns and/or thru traffic from using the intersection.

Disadvantages:
- Potential motor vehicle impacts to major roadways, including lane narrowing, loss of some on-street parking and restricted turning movements.
- Crossing island may be difficult to maintain and may collect debris.

Guidance

2. General Intersection Design Guidelines

A wide variety of intersection treatments exist, which provide safe crossing and turning movements of bicyclists on bikeways. Treatments specific to particular facility types were previously discussed; this section addresses general guidelines for crossings.

2.1. High-Visibility Crosswalk Techniques

Design Summary

- Additional treatments can be used to increase visibility of the crosswalk at high-use locations and in locations with high use from school children, elderly pedestrians, or pedestrians with disabilities.

Discussion

Flasher Warning Sign
Flashing warning signs increase the visibility of a crossing by calling attention to the pedestrian crossing location. They can be continuous, timed for rush hours, or activated by a pedestrian push-button. MUTCD Chapter 4L provides information about flashing beacons.

Raised Median (Non-standard treatment)
A median can eliminate grade changes from the pedestrian path and give pedestrians greater prominence as they cross the street. Raised crosswalks should be used only in limited cases where a special emphasis on pedestrians is desired such as at a mid-block crossing; review on case-by-case basis.

Additional guidelines include:

- Use detectable warnings at the curb edges to alert vision-impaired pedestrians that they are entering the roadway.
- Approaches to the raised crosswalk may be designed to be similar to speed humps, or may be designed so they do not have a slowing effect (such as on emergency response routes).
- Use post mounted pedestrian crosswalk signs placed on the median and on the right side of the roadway for each approach.

In-Street “Yield to Pedestrians” Signs and Flashers
In-street “Yield to Pedestrian” signs are flexible plastic ‘paddle’ signs installed in the center of a roadway to enhance a crosswalk at uncontrolled crossing locations. In-pavement flashers may be appropriate on undivided roadways in densely developed areas that do not offer median refuges for crossing pedestrians. See MUTCD Section 2B.12 In-Street and Overhead Pedestrian Crossing Signs.

In-Roadway Lights
In-roadway lights may be used at marked crosswalks to provide additional warning. They are actuated by the pedestrian and flash for a designated amount of time before turning off. See MUTCD Section 4N.02 In-Roadway Warning Lights at Crosswalks for additional information.

Guidance

- MUTCD
2.2. Marked Crosswalks

2.2.1. Minimizing Conflict with Automobiles

Design Summary

- Separating pedestrians and motor vehicles at intersections improves safety and visibility.

Discussion

Parking Control

- Parking control improves visibility in the vicinity of the crosswalk. Parking is prohibited within all intersections and crosswalks unless otherwise signed. At “T” and offset intersections, where the boundaries of the intersection may not be obvious, this prohibition should be made clear with signage.
- In areas where there is high parking demand (as determined by a Traffic Engineer), parking for compact vehicles may be allowed within “T” or offset intersections and on either side of the crosswalk. At these locations, signs will be placed to prohibit parking within the designated crosswalk areas, and additional enforcement should be provided, particularly when the treatment is new.
- Parking shall not be allowed within any type of intersection adjacent to schools, school crosswalks, and parks. This includes “T” and offset intersections.
- Installation of parking signage to allow and/or prohibit parking within any given intersection will occur at the time that the Parking Control section is undertaking work at the intersection.

Advance Stop Bars

Advance stop bars increase pedestrian comfort and safety by stopping motor vehicles well in advance of marked crosswalks, allowing vehicle operators a better line of sight of pedestrians and giving inner lane motor vehicle traffic time to stop for pedestrians. Pedestrians feel more comfortable since motor vehicles are not stopped adjacent to the crosswalk. The multiple threat of motor vehicles is reduced, since vehicles in the inner travel lane have a clearer line of sight to pedestrians entering the sidewalk. Without an advance stop bar, the vehicle in the outer lane may stop for the pedestrian, but the vehicle in the inner lane proceeds, increasing the possibility of a vehicle-pedestrian conflict.

Advanced stop bars should be used:

- On streets with at least two travel lanes in each direction.
- Prior to a marked crosswalk
- In one or both directions of motor vehicle travel
- Recommended 30 ft in advance of the crosswalk.
- A “Stop Here for Pedestrians” sign must accompany the advance stop bar.

Guidance

2.3. Pedestrian Hybrid Beacon

Design Summary

Sequence for a pedestrian hybrid beacon (MUTCD Figure 4F-3).

Guidance from the MUTCD Section 4F. Pedestrian Hybrid Beacons:
- The pedestrian hybrid beacon should be installed at least 100’ from side streets or driveways that are controlled by a STOP or YIELD sign.
- Parking and other sight obstructions should be prohibited for at least 100’ in advance of and at least 20’ beyond the marked crosswalk, or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance.
- The installation should include suitable standard signs and pavement markings.
- If installed within a signal system, the pedestrian hybrid beacon should be coordinated.

Discussion

A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see MUTCD Chapter 4C), or at a location that meets traffic signal warrants but a decision is made to not install a traffic control signal.

The beacon signal consists of a traffic signal head with a red-yellow-red lens. The unit is off until activated, then the signal phasing is:
- The signal flashes yellow to warn approaching drivers.
- A solid yellow advises drivers to prepare to stop.
- The signal changes to a solid red, and a WALK indicator is shown.

The beacon signal converts to an alternating flashing red, allowing the drivers to proceed after stopping at the crosswalk, while the bicyclist or pedestrian is shown the flashing DON’T WALK signal.

Scramble Signals (Non-standard treatment)

Scramble signals can be used at intersections with frequent vehicle/bicycle conflicts, and/or intersections experiencing high bicycle turning movements (especially left turns that force bicyclists to cross vehicle traffic). Scramble signals provide
a simultaneous “All Red” phase for motorists and a green phase dedicated for bicycle/pedestrian movements that enables non-motorized users to cross an intersection using their desired travel path (straight or diagonal).

Scramble signals have been used successfully in Davis, CA; Honolulu, HI; and Portland, OR.

**Guidance**

- MUTCD Section 4F: Pedestrian Hybrid Beacons
2.4. Accommodating Bicyclists at Intersections

Design Summary

At signalized intersections, cyclists should be able to trigger signals when cars are not present. Requiring cyclists to dismount to press a pedestrian button is inconvenient and requires the cyclist to merge into traffic at an intersection. It is particularly important to provide bicycle actuation in a left-turn only lane where cyclists regularly make left turn movements.

Discussion

Loop Detectors

- Bicycle-activated loop detectors are installed within the roadway to allow the presence of a bicycle to trigger a change in the traffic signal. This allows the cyclist to stay within the lane of travel and avoid manoeuvring to the side of the road to trigger a push button.
- Most demand-actuated signals in Albuquerque currently use loop detectors, which can be attuned to be sensitive enough to detect any type of metal, including steel and aluminum.
- Current and future loops that are sensitive enough to detect bicycles should have pavement markings to instruct cyclists how to trip them, as well as signage (see right).

Detection Cameras

Video detection cameras can also be used to determine when a vehicle is waiting for a signal. These systems use digital image processing to detect a change in the image at the location. Cameras can detect bicycles, although cyclists should wait in the center of the lane, where an automobile would usually wait, in order to be detected. Video camera system costs range from $20,000 to $25,000 per intersection.

Detection cameras are currently used for cyclists in the City of San Luis Obispo, CA, where the system has proven to detect pedestrians as well.

Remote Traffic Microwave Sensor Detection (RTMS) (Non-standard treatment)

RTMS is a system developed in China, which uses frequency modulated continuous wave radio signals to detect objects in the roadway. This method is marked with a time code which gives information on how far away the object is. The RTMS system is unaffected by temperature and lighting, which can affect standard detection cameras.

Guidance

- Additional technical information is available at: [www.humantransport.org/bicycledriving/library/signals/detection.htm](http://www.humantransport.org/bicycledriving/library/signals/detection.htm)
3. **Off-Street Facility Design Guidelines**

**Design Summary**

Shared-use paths can provide a desirable facility particularly for novice riders, recreational trips, and cyclists of all skill levels preferring separation from traffic. Shared-use paths should generally provide new travel opportunities.

The Albuquerque Development Process Manual defines a shared-use path/trail as, “A shared use path is a bikeway physically separated from motorized vehicle traffic by an open space or barrier, and constructed within the street right-of-way or within an independent right-of-way including shared-use rights-of-way or utility or drainage easements.”

**Discussion**

Shared-use paths serve bicyclists and pedestrians and provide additional width over a standard sidewalk. Facilities may be constructed adjacent to roads, through parks, or along linear corridors such as active or abandoned railroad lines or waterways. Regardless of the type, paths constructed next to the road must have some type of vertical (e.g., curb or barrier) or horizontal (e.g., landscaped strip) buffer separating the path area from adjacent vehicle travel lanes.

Elements that enhance shared-use path design include:

- Providing frequent access points from the local road network; if access points are spaced too far apart, users will have to travel out of direction to enter or exit the path, which will discourage use.
- Placing directional signs to direct users to and from the path.
- Building to a standard high enough to allow heavy maintenance equipment to use the path without causing it to deteriorate.
- Limiting the number of at-grade crossings with streets or driveways.
- Terminating the path where it is easily accessible to and from the street system, preferably at a controlled intersection or at the beginning of a dead-end street. If poorly designed, the point where the path joins the street system can put pedestrians and cyclists in a position where motor vehicle drivers do not expect them.
- Identifying and addressing potential safety and security issues up front.
- Whenever possible, and especially where heavy use can be expected, separate bicycle and pedestrian ways should be provided to reduce conflicts.
- Providing accessible parking space(s) at trailheads and access points.

**Additional Guidance**

Shared-use paths should be constructed according to the AASHTO Guide for the Development of Bicycle Facilities. Where possible, shared-use paths should be designed according to ADA standards. Constructing trails may have limitations that make meeting ADA standards difficult and sometimes prohibitive. Prohibitive impacts include harm to significant cultural or natural resources, a significant change in the intended purpose of the trail, requirements of construction methods that are against federal, state or local regulations, or presence of terrain characteristics that prevent compliance.
3.1. Shared-Use Path Design

Design Summary

**Width (DPM standards)**
- 10’ is the minimum allowed for a two-way shared-use path and is only recommended for low traffic situations.
- 12’ or greater is recommended for high-use areas, as identified in the Long Range Bikeway System or in heavy use situations with high concentrations of multiple users such as joggers, bicyclists, rollerbladers and pedestrians.

**Lateral Clearance**
- A 2’ or greater shoulder on both sides.

**Overhead Clearance**
- Clearance to overhead obstructions should be 8’ minimum, with 10’ recommended.

**Design Speed**
- The maximum design speed for bike paths is 20 miles per hour. Speed bumps or other surface irregularities should never be used to slow bicycles.

**Grade**
- The recommended maximum gradient is 5%. Steeper grades can be tolerated for short distances (500 feet max).

**Discussion**
A hard surface should be used for multi-use trails. Concrete, while more expensive than asphalt, is the hardest of all trail surfaces and lasts the longest. However, joggers and runners prefer surfaces such as asphalt or decomposed granite due to its relative “softness”. While most asphalt is black, dyes (such as reddish pigments) can be added to increase the aesthetic value of the trail itself.

When concrete is used the trail should be designed and installed using the narrowest possible expansion joints to minimize the amount of ‘bumping’ cyclists experience on the trail.

**Guidance**
- FHWA. *Designing Sidewalks and Trails for Access.*
3.1.1. Shared-Use Equestrian Trail Design

Design Summary

**Width**
- 5’-6’ in low (rural) development
- 8’-12’ in moderate to high development

**Lateral Clearance**
- A 3’ or greater shoulder on both sides.

**Overhead Clearance**
- Clearance to overhead obstructions should be 10’ minimum, with 12’ recommended.

**Discussion**
Walkers, hikers, and cyclists often share trail corridors with equestrians. Pedestrians and riders are often compatible on the same tread as they both accept unpaved surfaces and move at relatively slow speeds. However, fast moving and quiet cyclists, approaching a horse from behind, are a valid concern for riders. In areas where conflicts seem likely, efforts are made to physically separate the different user groups.

For equestrian routes, trail tread or surface should be relatively stable. The trail surface should be solid, obstacle free and should stay in place. Appropriate trail surfaces include: compacted native soil, crusherfines, and decomposed granite. Hard surfaces, such as asphalt and concrete are not amenable to equestrians.

Trails that are comfortable for equestrians are ones that accommodate most trail users. While horses can easily negotiate grades up to 20% for short distances (up to 200’), steeper running grades result in faster water run-off and erosion problems. Following contours helps reduce erosion problems, minimize maintenance needs and increase comfort levels. A 2% cross slope or crowned tread and periodic grade reversals along running slopes will minimize standing surface water and will resolve most drainage issues on a multi-use path. An exception is cut sections where uphill water must be collected in a ditch and directed to a catch basin, where the water can be directed under the trail in a drainage pipe of suitable dimensions. Additionally, on running grades steeper than 5%, add 6 to 12 inches of extra tread width as a safety margin where possible.

**Guidance**
USDA/FHWA Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds.
3.1.2. Trail Accessibility

Design Summary

- 3’ minimum clear width, where less than 5’, passing space should be provided at least every 100’.  
- Cross slope should not exceed 5%.  
- Signs shall be provided indicating the length of the accessible trail segment.  
- Curb ramps shall be provided at roadway crossings and curbs. Tactile warning strips and auditory crossing signals are recommended.

Discussion

Slopes typically should not exceed 2%. However certain conditions may require the use of steeper slope. For conditions exceeding a 5% slope, the recommendations are as follows:

- Up to an 8.33% slope for a 200’ max run, landings or resting intervals must be provided at minimum of 20’.  
- Up to a 10% slope for a 30’ maximum run, resting intervals spaced at 30’ minimum.  
- Up to 12.5% slope for 10’ maximum run, with resting intervals spaced at 10’ minimum.

The trail surface shall be firm and stable. The Forest Service Accessibility Guidelines defines a firm surface as a trail surface that is not noticeably distorted or compressed by the passage of a device that simulates a person who uses a wheelchair. Where rights-of-way are available, paths can be made more accessible by creating side paths that meander away from a roadway that exceeds a 5% slope.

Accessibility guidelines note that the natural environment may prohibit ADA compliance. In addition, the standards may be waived where compliance would cause “substantial harm to cultural, historic, religious, or significant natural features or characteristics.”

Guidance

General guidelines have been created in response to the American with Disabilities Act (ADA) for accessible trails.

3.1.3. Managing Multiple Users

Design Summary

- Barrier separation – vegetated buffers or barriers, elevation changes, walls, fences, railings and bollards.
- Distance separation – differing surfaces.
- User behaviour guidance signage.

Discussion

Differing surfaces suitable to each user group foster visual separation and clarity of where each user group should be. When trail corridors are constrained, the approach is often to locate the two different trail surfaces side by side with no separation.

Informing trail users of acceptable trail etiquette is a common issue when multiple user types are anticipated. Yielding the right-of-way is a courtesy and yet a necessary part of a safe trail experience involving multiple trail users. Trail right-of-way information should be posted at trail access points and along the trail. The message must be clear and easy to understand. Where appropriate, trail etiquette systems should instruct trail users to the yielding of cyclists to pedestrians and equestrians and the yielding of pedestrians to equestrians.

Guidance

The 2009 MUTCD contains additional information about centerline striping on a trail.
3.1.4. Trail Opportunities

3.1.4.1. Rails-with-Trails

Rails-with-Trails projects typically consist of paths adjacent to active railroads. Offering the same benefits as rail-to-trail projects, these facilities could be developed within active rail corridors in Albuquerque. It should be noted that some constraints could impact the feasibility of rail-with-trail projects. In some cases, space needs to be preserved for future planned freight, transit or commuter rail service. In other cases, limited right-of-way width, inadequate setbacks, concerns about trespassing, and numerous mid-block crossings may affect a project’s feasibility.

3.1.4.2. Utility and Arroyo Corridor Trails

Several utility and arroyo corridors in Albuquerque offer excellent trail development and bikeway gap closure opportunities. Utility corridors typically include powerlines, sewer corridors, and irrigation ditches while waterway corridors include canals, drainage ditches, rivers, and beaches. These corridors offer excellent transportation and recreation opportunities for cyclists of all ages and skills.

Trails along waterways such as drainage ditches should consider design to minimize access to the water. Fences can deter trail users from attempting to access to the water or from inadvertently falling.
3.1.5. Trails Along Roadways

Design Summary

Where a shared-use path must be adjacent to a roadway, a five foot minimum buffer should separate the path from the edge of the roadway, or a physical barrier of sufficient height should be installed.

Shared use paths may be considered along roadways under the following conditions:

• The path will generally be separated from all motor vehicle traffic.
• Bicycle and pedestrian use is anticipated to be high.
• To provide continuity with an existing path through a roadway corridor.
• The path can be terminated at each end onto streets or trails with good bicycle and pedestrian facilities.
• There is adequate access to local cross-streets and other facilities along the route.
• Any needed grade separation structures do not add substantial out-of-direction travel.

Discussion

Concerns about shared use paths directly adjacent to roadways (e.g., with minimal or no separation) are:

• Half of bicycle traffic may ride against the flow of vehicle traffic, contrary to the rules of the road.
• When the path ends, cyclists riding against traffic tend to continue to travel on the wrong side of the street, as do cyclists who are accessing the path. Wrong-way bicycle travel is a major cause of crashes.
• At intersections, motorists crossing the path often do not notice bicyclists approaching from certain directions, especially where sight distances are poor.
• Bicyclists are required to stop or yield at cross-streets and driveways, unless otherwise posted.
• Stopped vehicles on a cross-street or driveway may block the path.
• Because of the closeness of vehicle traffic to opposing bicycle traffic, barriers are often necessary to separate motorists from cyclists. These barriers serve as obstructions, complicate facility maintenance and waste available right-of-way.
• Paths directly adjacent to high-volume roadways diminish users' experience by placing them in an uncomfortable environment.

As bicyclists gain experience and realize some of the advantages of riding on the roadway, some riders stop using paths adjacent to roadways. Bicyclists may also tend to prefer the roadway as pedestrian traffic on the shared use path increases due to its location next to an urban roadway. When designing a bikeway network, the presence of a nearby or parallel path should not be used as a reason to not provide adequate shoulder or bike lane width on the roadway, as the on-street bicycle facility will generally be superior to the “sidewalk” for experienced cyclists and those who are cycling for transportation purposes. Bike lanes should be provided as an alternate (more transportation-oriented) facility whenever possible.

Guidance

The AASHTO Guide for the Development of Bicycle Facilities generally recommends against the development of trails adjacent to roadways. The DPM similarly states that, “Bike Trails should be located to serve corridors not served by streets and highways or where wide rights-of-way exist, permitting such facilities to be constructed away from the influence of parallel streets.” The DPM also states, “The sidewalk may be designated as a legal trail for short distances of up to one-quarter mile to serve as a linkage within the bikeway network. Two-way bicycle traffic as well as pedestrian traffic should be expected on sidewalks under these conditions.”
3.2. Path/Roadway Crossings

Design Summary

At-grade path/roadway crossings generally will fit into one of four basic categories:

- **Type 1**: Marked/Unsignalized Unprotected crossings include trail crossings of residential, collector, and sometimes major arterial streets or railroad tracks.
- **Type 1+**: Marked/Enhanced – Unsignalized intersections can provide additional visibility with flashing beacons and other treatments.
- **Type 2**: Route Users to Existing Signalized Intersection - Trails that emerge near existing intersections may be routed to these locations, provided that sufficient protection is provided at the existing intersection.
- **Type 3**: Signalized/Controlled - Trail crossings that require signals or other control measures due to traffic volumes, speeds, and trail usage.
- **Type 4**: Grade-separated crossings - Bridges or under-crossings provide the maximum level of safety but also generally are the most expensive and have right-of-way, maintenance, and other public safety considerations.

Discussion

While at-grade crossings create a potentially high level of conflict between path users and motorists, well-designed crossings have not historically posed a safety problem for path users. This is evidenced by the thousands of successful paths around the United States with at-grade crossings. In most cases, at-grade path crossings can be properly designed to a reasonable degree of safety and can meet existing traffic and safety standards.

Evaluation of path crossings involves analysis of vehicular and anticipated path user traffic patterns, including:

- Vehicle speeds
- Street width
- Sight distance
- Traffic volumes (average daily traffic and peak hour traffic).
- Path user profile (age distribution, destinations served)

Crossing features for all roadways include warning signs both for vehicles and path users.

Consideration must be given for adequate warning distance based on vehicle speeds and line of sight, with visibility of any signing absolutely critical. Catching the attention of motorists jaded to roadway signs may require additional alerting devices such as a flashing light, roadway striping or changes in pavement texture. Signing for path users must include a “STOP” sign and pavement marking, sometimes combined with other features such as bollards.

Guidance

The proposed intersection approach that follows is based on established standards, published technical reports¹, and experiences from cities around the country.

---

¹ Federal Highway Administration (FHWA) Report, “Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations.”
### Guidance (continued)

#### Summary of Path/Roadway At-Grade Crossing Recommendations

<table>
<thead>
<tr>
<th>Roadway Type</th>
<th>Vehicle ADT ≤ 9,000 Speed Limit (mph)**</th>
<th>Vehicle ADT &gt; 9,000 to 12,000 Speed Limit (mph)**</th>
<th>Vehicle ADT &gt; 12,000 to 15,000 Speed Limit (mph)**</th>
<th>Vehicle ADT &gt; 15,000 Speed Limit (mph)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Lanes</td>
<td>30 35 40 30 35 40 30 35 40</td>
<td>30 35 40 30 35 40 30 35 40 30 35 40 30 35 40 30 35 40</td>
<td>30 35 40 30 35 40 30 35 40 30 35 40 30 35 40 30 35 40</td>
<td>30 35 40 30 35 40 30 35 40 30 35 40 30 35 40 30 35 40</td>
</tr>
<tr>
<td>3 Lanes</td>
<td>1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+</td>
<td>1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+</td>
<td>1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+</td>
<td>1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+ 1 1 1/1+</td>
</tr>
<tr>
<td>Multi-Lane (4 +) w/ raised median***</td>
<td>1 1 1/1+ 1 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+</td>
<td>1 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+</td>
<td>1 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+</td>
<td>1 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+ 1/1+</td>
</tr>
<tr>
<td>Multi-Lane (4 +) w/o raised median</td>
<td>1 1/1+ 1/3 1/1+ 1/1+ 1/3 1/1+ 1/1+ 1/3 1/1+ 1/3 1/1+ 1/3</td>
<td>1 1/1+ 1/1+ 1/1+ 1/1+ 1/3 1/1+ 1/1+ 1/3 1/1+ 1/3 1/1+ 1/3</td>
<td>1 1/1+ 1/1+ 1/1+ 1/1+ 1/3 1/1+ 1/1+ 1/3 1/1+ 1/3 1/1+ 1/3</td>
<td>1 1/1+ 1/1+ 1/1+ 1/1+ 1/3 1/1+ 1/1+ 1/3 1/1+ 1/3 1/1+ 1/3</td>
</tr>
</tbody>
</table>

*General Notes: Crosswalks should not be installed at locations that could present an increased risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding which treatment to use.

For each pathway-roadway crossing, an engineering study is needed to determine the proper location. For each engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites.

** Where the speed limit exceeds 40 mi/h marked crosswalks alone should not be used at unsignalized locations.

*** The raised median or crossing island must be at least 4 ft (1.2 m) wide and 6 ft (1.8 m) long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and AASHTO guidelines. A two-way center turn lane is not considered a median.

1= Type 1 Crossings. Ladder-style crosswalks with appropriate signage should be used.

1/1+ = With the higher volumes and speeds, enhanced treatments should be used, including marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

1+/3 = Carefully analyze signal warrants using a combination of Warrant 4, Pedestrian Volume or 5, School Crossing (depending on school presence) and Equivalent Adult Unit (EAU) factoring (see MUTCD, Chapter 4). Make sure to project pathway usage based on future potential demand. Consider Pelican, Puffin, or Hawk signals in lieu of full signals. For those intersections not meeting warrants or where engineering judgment or cost recommends against signalization, implement Type 1 enhanced crosswalk markings with marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

---

2 This table is based on information contained in the U.S. Department of Transportation Federal Highway Administration Study, “Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations,” February 2002.
3.2.1. **Type 1: Marked/Unsignalized Crossings**

A marked/unsignalized crossing (Type 1) consists of a crosswalk, signage, and often no other devices to slow or stop traffic. The approach to designing crossings at mid-block locations depends on an evaluation of vehicular traffic, line of sight, path traffic, use patterns, vehicle speed, road type and width, and other safety issues such as proximity to schools. The following thresholds recommend where unsignalized crossings may be acceptable:

**Maximum traffic volumes:**

- ≤9,000-12,000 Average Daily Traffic (ADT) volumes.
- Up to 15,000 ADT on two-lane roads, preferably with a median.
- Up to 12,000 ADT on four-lane roads with median.

**Maximum travel speed:**

- 35 MPH.

**Minimum line of sight:**

- 25 MPH zone: 155 feet.
- 35 MPH zone: 250 feet.
- 45 MPH zone: 360 feet.

**Discussion**

If well-designed, crossings of multi-lane higher-volume arterials over 15,000 ADT may be unsignalized with features such as a combination of some or all of the following: excellent sight distance, sufficient crossing gaps (more than 60 per hour), median refuges, and/or active warning devices like flashing beacons or in-pavement flashers. These are referred to as “Type 1 Enhanced” (Type 1+). Such crossings would not be appropriate; however, if a significant number of schoolchildren used the path. Furthermore, both existing and potential future path usage volume should be taken into consideration.

On two-lane residential and collector roads below 15,000 ADT with average vehicle speeds of 35 MPH or less, crosswalks and warning signs (“Path Xing”) should be provided to warn motorists, and stop signs and slowing techniques (bollards/geometry) should be used on the path approach. Curves in paths that orient the path user toward oncoming traffic are helpful in slowing path users and making them aware of oncoming vehicles. Care should be taken to keep vegetation and other obstacles out of the sight line for motorists and path users. Engineering judgment should be used to determine the appropriate level of traffic control and design.

On roadways with low to moderate traffic volumes (<12,000 ADT) and a need to control traffic speeds, a raised crosswalk may be the most appropriate crossing design to improve pedestrian visibility and safety. These crosswalks are raised 3 inches above the roadway pavement (similar to speed humps) to an elevation that matches the adjacent sidewalk. The top of the crosswalk is flat and typically made of asphalt, patterned concrete, or brick pavers. Brick or unit pavers should be discouraged because of potential problems related to pedestrians, bicycles, and ADA requirements for a continuous, smooth, vibration-free surface. Detectable warning strips are needed at the sidewalk/street boundary so that visually impaired pedestrians can identify the edge of the street.
3.2.2. **Type 2: Route Users to Existing Signalized Intersection**

Crossings within 250 feet of an existing signalized intersection with pedestrian crosswalks are typically diverted to the signalized intersection for safety purposes. For this option to be effective, barriers and signing may be needed to direct shared-use path users to the signalized crossings. In most cases, signal modifications would be made to add pedestrian detection and to comply with ADA.

3.2.3. **Type 3: Signalized/Controlled Crossings**

New signalized crossings may be recommended for crossings that meet pedestrian, school, or modified warrants, are located more than 250 feet from an existing signalized intersection and where 85th percentile travel speeds are 40 MPH and above and/or ADT exceeds 15,000 vehicles. Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity, and safety.
3.2.3.1. **Mid-block Crosswalk**
Mid-block crossings provide a crossing opportunity where there is no intersection. At controlled mid-block crossing locations, crosswalks are marked where there is a demand for crossing, and there are no nearby marked crosswalks. At uncontrolled crossing use FHWA report HRT-04-100 as guidance of when to mark a crosswalk. Mid-block crosswalks should always be accompanied with pavement markings and warning signs to inform drivers of the approaching crosswalk.

3.2.4. **Type 4: Grade-separated Crossings**
Grade-separated crossings may be needed where existing bicycle/pedestrian crossings do not exist, where ADT exceeds 25,000 vehicles, and 85th percentile speeds exceed 45 MPH. Safety is a major concern with both overcrossings and undercrossings. In both cases, shared-use path users may be temporarily out of sight from public view and may have poor visibility themselves. Undercrossings, like parking garages, have the reputation of being places where crimes occur. Most crime on shared-use paths, however, appears to have more in common with the general crime rate of the community and the overall usage of the shared-use path than any specific design feature.

Design and operation measures are available which can address shared-use path user concerns. For example, an undercrossing can be designed to be spacious, well-lit, equipped with emergency cell phones at each end and completely visible for its entire length prior to entering. Other potential problems with undercrossings include conflicts with utilities, drainage, flood control, and maintenance requirements. Overcrossings pose potential concerns about visual impact and functional appeal, as well as space requirements necessary to meet ADA guidelines for slope.
3.3. Amenities

A variety of amenities can make a path inviting to the user. The following table highlights some common items that make path systems complete facilities. Costs vary depending on the design and materials selected for each amenity. Amenities shall be designed and located so as not to impede accessibility.

3.3.1. Pedestrian-Scale Lighting

Pedestrian-scale lighting improves safety and enables the facility to be used year-round, particularly on winter afternoons. Minimizing glare, not lighting the night sky, and protecting the light from vandalism are the three main issues neighborhood trail lighting design should consider.

Albuquerque has a Night Sky Protection Act, which limits the use of lights in the area. The Act requires all outdoor lighting fixtures to be shielded. The Act also states that, “No outdoor recreational facility, whether public or private, shall be illuminated after 11:00 p.m.” The New Mexico Heritage Preservation Alliance has provided a comprehensive guide to acceptable lighting under this Act. [http://www.wetmtndarkskies.org/images/Lighting_Guide_NMHeritage.pdf](http://www.wetmtndarkskies.org/images/Lighting_Guide_NMHeritage.pdf)

Some neighborhood-scale lighting options include:

- In-ground lighting – dim lights which indicate the extent of the path.
- Bollards – low-level lighting, susceptible to vandalism.
- Solar lighting – best used in situations where running power to the trail would be costly or undesirable.

Pedestrian scale lighting can have screens to deter the glare from affecting neighbors. In addition, lights can be programmed to dim or turn off later in the night.

A guideline for a pedestrian way is illumination of between 0.5 foot-candle to 1 foot-candle.

3.3.2. Bollards

Bollards are posts that can be used to block vehicle access to the path and that can provide information such as mile markings, wayfinding for key destinations, or small area maps.

Where used, bollards should be high-visibility with reflective tape or paint, and should not be low enough to be unnoticed. Cyclists using the shared-use path can bump into a bollard, particularly in low light conditions. Bollards should be placed in the middle of the path, with sufficient space for path users of all abilities, using a variety of mobility devices, to pass. They can create bottlenecks with path users at intersections, and should be used with caution.

Bollards can also include small signs, mile markers, and path logos. This can reduce sign clutter and branding to the trail.

Guidelines for bollards can be found in MUTCD Figure 9C-8.
3.3.3. **Edge Treatments**

3.3.3.1. **Fencing**

Fencing is a means of assuring safety for both trail users and neighboring residents by preventing unwanted access onto or off of the trail. However, fencing both sides of the trail right of way can result in a “tunnel” effect with the perception of being trapped, resulting in a detrimental effect on the trail user experience. The narrow width of many corridors in compounds this tunnel effect. Additionally, fencing could inhibit community surveillance of the trail. Solid fencing that does not allow any visual access to the trail should therefore be discouraged.

Fencing should not be a barrier to wildlife passage across the corridor. For example, a small six inch gap between the bottom of the fence and the ground can allow wildlife passage while not allowing trail users to trespass on private property. Fencing that allows a balance between the need for privacy, while simultaneously allowing informal surveillance of the trail should be encouraged. If fencing is requested purely for privacy reasons, vegetative buffers should be considered.

3.3.3.2. **Dense Vegetation**

Dense vegetation can be used to define the trail corridor and increase privacy, particularly in locations with preexisting plants. The major expense of this option is maintenance and upkeep, which includes watering and trimming vegetation semi-regularly to maintain adequate path clearance.

3.3.3.3. **Open Boundary**

In locations without significant vegetation, it is an option to maintain an open boundary around the trail. Users will tend to walk through an open area, so this option is not practical for areas where privacy or trespassing is a concern of landowners.

3.3.4. **Landscaping**

Landscape features, including street trees or trees along paths, can enhance the visual environment and improve the path user experience. Trees can also provide shade from heat and also provide protection from rain.

Insert image: landscaping improves trail experience
3.4. Path Amenities

Design Summary

A variety of amenities can make a path inviting to the user. Costs vary depending on the design and materials selected for each amenity. Amenities shall be designed and located so as not to impede accessibility.

Discussion

Benches

Providing benches at key rest areas and viewpoints encourages people of all ages to use the trail by ensuring that they have a place to rest along the way. Benches can be simple (e.g., wood slates) or more ornate (e.g., stone, wrought iron, concrete).

Restrooms

Restrooms benefit path users, especially in more remote areas where other facilities do not exist. Restrooms can be sited at trailheads along the path system.

Water Fountains

Water fountains provide water for people (and pets, in some cases) and bicycle racks allow recreational users to safely park their bikes if they wish to stop along the way, particularly at parks and other desirable destinations.

Bicycle Parking

Bicycle parking allows trail users to store their bicycles safely for a short time. Bicycle parking should be provided if a trail transitions to an unpaved pedestrian-only area.

Trash Receptacles

Litter receptacles should be placed at access points. Litter should be picked up once a week and after any special events held on the trail, except where specially designed trash cans have been installed. If maintenance funds are not available to meet trash removal needs, it is best to remove trash receptacles.

Signage

Informational kiosks with maps at trailheads and signage for other destinations can provide information to trail users. They are beneficial for areas with high out-of-area visitation rates as well as the local citizens.

Art

Local artists can be commissioned to provide art for the pathway system, making it uniquely distinct. Many pathway art installations are functional as well as aesthetic, as they may provide places to sit and play on.

Guidance

• AASHTO *Guide for the Development of Bicycle Facilities*. 
3.5. Trail Safety and Security

3.5.1. Crime Prevention Through Environmental Design (CPTED)

Safety and security concerns on a trail can be addressed through Crime Prevention Through Environmental Design (CPTED) guidelines. The four principles of CPTED are:

- Natural surveillance – maintaining sight lines and visibility to deter criminal activities.
- Natural access control utilizes fences, lighting, signage and landscape to clearly define where people and vehicles are expected to be.
- Territorial reinforcement – use physical designs such as pavement treatments, landscaping, and signage to develop a sense of proprietorship over the trail.
- Maintenance - if graffiti or vandalism occurs and is not repaired replaced right away, it can send the message that no one is watching or that no one cares.

It is also recommended that law enforcement conduct a site visit of the proposed trail alignment during the planning and design phase to determine areas of concern, so that those areas can be addressed through the proposed design.

3.5.2. Trail Safety and Security Concerns

3.5.2.1. Privacy of adjacent property owners

- Encourage the use of neighborhood friendly fencing and also planting of landscape buffers.
- Clearly mark path access points.
- Post path rules that encourage respect for private property.
- Strategically placed lighting.

3.5.2.2. Unwanted vehicle access

- Utilize landscaping to define the corridor edge and path, including earth berms or boulders.
- Use bollards at intersections (see guidelines above)
- Pass a motorized vehicle prohibited ordinance and sign the path.
- Create a Path Watch Program and encourage citizens to photograph report illegal vehicle use of the corridor.
- Lay the shared-use path out with curves that allow bike/ped passage, but are uncomfortably tight for automobile passage.

3.5.2.3. Litter and dumping

- Post rules encouraging pack-it-out practices.
- Place garbage receptacles at trailheads.
- Strategically-placed lighting, utilizing light shields to minimize unwanted light in adjacent homes.
- Manage vegetation to allow visual surveillance of the path from adjacent properties and from roadway/path intersections.
- Encourage local residents to report incidents as soon as they occur.
- Remove dumpsites as soon as possible.

3.5.2.4. Trespassing

- Clearly distinguish public path right-of-way from private property through the use of vegetative buffers and the use of good neighbor type fencing.
- Post rules encouraging respect for property.
3.5.2.5. Local on-street parking

- Designate residential streets as parking for local residents only to discourage user parking.
- Place “no outlet” and “no parking” signs prior to path access points.
- Accessible parking should be provided when feasible.

3.5.2.6. Crime

- Manage vegetation to ensure visibility from adjacent streets and residences.
- Place lights strategically and as necessary.
- Place benches and other amenities at locations with good visual surveillance and high activity.
- Provide mileage markers every ¼ mile and clear directional signage for orientation.
- Create a “Path Watch Program” involving local residents.
- Proactive law enforcement on the trail, with regular bicycle patrols.

3.5.2.7. Vandalism

- Select benches, bollards, signage and other site amenities that are durable, low maintenance and vandal resistant.
- Respond through removal or replacement in rapid manner.
- Keep a photo record of all vandalism and turn over to local law enforcement.
- Encourage local residents to report vandalism.
- Create a Trail Watch Program; maintain good surveillance of the corridor.
- Involve neighbors in path projects to build a sense of ownership.
- Place amenities in well used and visible areas.

Rest stops should provide garbage receptacles to minimize littering.

Emergency call boxes improve users’ feelings of safety.

Surveillance from nearby buildings and pedestrian-scale lighting can increase shared-use path safety.
3.5.3. Community Involvement with Safety on the Trail

Creating a safe trail environment goes beyond design and law enforcement and should involve the entire community. The most effective and most visible deterrent to illegal activity on Albuquerque’s trail system will be the presence of legitimate path users. Getting as many “eyes on the corridor” as possible is a key deterrent to undesirable activity.

3.5.3.1. Good access to the path

Access ranges from providing conveniently located trailheads along the trail, to encouraging the construction of sidewalks to accommodate access from private developments adjacent to the trail. Access points should be inviting and signed so as to welcome the public onto the trail.

3.5.3.2. Good visibility from neighbors

Neighbors adjacent to the trail can potentially provide 24-hour surveillance of the trail and can become Albuquerque’s biggest ally. Though some screening and setback of the path is needed for privacy of adjacent neighbors, complete blocking out of the trail from neighborhood view should be discouraged. This eliminates the potential of neighbors’ “eyes on the trail,” and could result in a “tunnel effect” on the trail.

3.5.3.3. High level of maintenance

A well-maintained trail sends a message that the community cares about the public space. This message alone will discourage undesirable activity along the trail.

3.5.3.4. Programmed events

Community events along the trail will help increase public awareness and thereby attract more people to use the trail. Neighbors and residents can help organize numerous public events along the path which will increase support for the path. Events might include a day-long path clean up or a series of short interpretive walks led by long time residents or a park naturalist.

3.5.3.5. Adopt-a-Path Program

Nearby businesses, community institutions, and residential neighbors often see the benefit of their involvement in trail path development and maintenance. Businesses and developers may view the trail as an integral piece of their site planning and be willing to take on some level of responsibility for the trail.

3.5.3.6. Path Watch Program

Partnering with local and county law enforcement, a path watch program would provide an opportunity for local residents to become actively involved in crime prevention along Albuquerque’s path system. Similar to Neighborhood Watch programs, residents are brought together to get to know their neighbors, and are educated on how to recognize and report suspicious activity.
3.5.4. Trailheads

Design Summary

- Major trailheads should include automobile and bicycle parking, trail information (maps, user guidelines, wildlife information, etc.), garbage receptacles and restrooms.
- Minor trailheads can provide a subset of these amenities.

Discussion

Good access to a path system is a key element for its success. Trailheads (formalized parking areas) serve the local and regional population arriving to the path system by car, transit, bicycle or other modes. Trailheads provide essential access to the shared-use path system and include amenities like parking for vehicles and bicycles, restrooms (at major trailheads), and posted maps. All areas of newly designed or newly constructed and altered portions of existing trails connecting to designated trailheads or accessible trails to comply with Section 16.1 of the accessibility standards. However, the guidelines do recognize that often the natural environment will prevent full compliance with certain technical provisions.

Guidance

- Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas.
4. Wayfinding

Wayfinding needs of on-street and multi-use trail users are similar but the location identification infrastructure differs. On-street bikeways benefit from an existing street name, address and signing system, this type of system currently does not exist for the multi-use trail network. The City’s multi-use trails are named but a mile marker system means of location identification and signing needs to be established. This section will address the improvements for a wayfinding of the on-street and multi-use trail facilities.

The ability to navigate through a city is informed by landmarks, natural features, and other visual cues. Signs throughout the city can indicate to pedestrians and bicyclists their direction of travel, location of destinations, and travel time/distance to those destinations. Types of signage include:

- Regulatory signs indicate to cyclists the traffic regulations which apply at a specific time or place on a bikeway.
- Warning signs indicate in advance conditions on or adjacent to a road or bikeway that will normally require caution and may require a reduction in vehicle speed.
• Guide and information signs indicate information for route selection, for locating off-road facilities, or for identifying geographical features or points of interest.

Regulatory and warning signs are dictated by the Manual on Uniform Traffic Control Devices (MUTCD). The MUTCD also provides guidance for wayfinding signs for trails and on-street bikeways, but allows for more leeway in design and information.

4.1 On-Street

4.1.1. Bike Routes

Bike routes should be identified using the bike route sign D11-1. Placement should be at the beginning and end of the bike routes, using the M4-14 and M4-6 plaques (Figure 1). Where routes split or shift to an intersecting street, advanced turn arrows (M4 series) and directional arrows (M5 series) shall be used to indicate the change in direction. The D11-1 sign can be placed occasionally along the bike route to help in wayfinding. Other signs that provide addition route identity are the bicycle warning sign W11-1 with the Share-the-road plaque W16-1P (Figure 2) and bicycle may use full lane R4-11 (Figure 3). These signs can help remind motorists and cyclists of the presents of a bicycle facility.

Pavement markings can be used to provide awareness of the presence of the bicycle facility as well as wayfinding guidance.

Pavement markings Sharrows (Figure 4) and bike route “pavement direction indicators” or bike blazes (figure 5) can be effective and durable additions to help guide the cyclist along their route. The bike blaze can be used to indicate changes in direction of the bike route.

4.1.2. Bike Lanes

Bike lanes are separate travel lanes for use by bicycles. The bike lanes are marked using a lane edge stripe between the motor vehicle lane and the bike lane, and including bike lane symbols and bike lane signs (R3-17). Where bike lanes change direction or at the junction with another bike lane, directions arrow sign plaques (M4 and M5 series) should be included. These simple additions to the built environment can provide adequate guidance for the cyclist to aid in route identification.

Figure 9B-4 in chapter 9 of the MUTCD shows a selection of guide signs and plaques that can be used to inform bicyclists of bicycle route direction changes and to confirm route direction, distance, and destination.

4.1.3. Bicycle Boulevards

Bike Boulevards are roadways in which bicyclists share the pavement with motor vehicles, but the facility is optimized in favor of the bicycle. Bicycle boulevards are characteristically slower than residential streets to the extent that posted speed limits are non-typical (18 mph vs. 25 mph). The non-typical speed limit is intended to call attention to the bike boulevard’s posted speed being different from a normal roadway.

The City recently developed a series of signs and pavement markings to provide identification for the bicycle boulevards. The color and logo of these signs are unique to the Bicycle Boulevard.
Boulevard and provide identification, guidance and wayfinding for the cyclist alerting the motorist to the unique character and operations of the Bicycle Boulevard (Figure 6).

4.1.4. On-Street Signage Guidelines

Signage for on-street bikeways can serve both wayfinding and safety purposes including:

- Helping to familiarize users with the bicycle network.
- Helping users identify the best routes to destinations (Figure 7).
- Helping overcome a “barrier to entry” for people who are not frequent cyclists or pedestrians.
- Visually cue motorists that they are driving along a bicycle route and should use caution.
- Including mileage and travel time estimates minimize the tendency to overestimate the amount of time it takes to travel by bicycle (Figure 8).

Identifying Destinations for Signage

Destinations for on-street signage can include:

- On-street bikeways (regional or local)
- Commercial centers
- Regional or local parks and trails
- Public transit sites
- Civic or community destinations, such as hospitals and schools
- Area destinations (e.g., cities, downtowns, or neighborhoods)

Placement Standards and Techniques

Too many road signs clutter the right-of-way. Signs should be placed at key locations to and along bicycle routes, including:

- Confirmation signs designate bikeways to bicyclists and drivers.
- Turn signs indicate where a bikeway turns from one street onto another street.
- Decision signs mark the junction of two or more bikeways and include destinations and associated directional arrows.

Additional recommended guidelines include:

- Place the closest destination to each sign in the top slot, allowing the nearest destination to “fall off” the sign and subsequent destinations to move up as the bicyclist approaches.
- Use pavement markings to help reinforce routes and directional signage. Markings, such as those bicycle boulevard symbols (Figure 9), bike blaze and sharrow may be used in addition to signs along bike routes and can help cyclists navigate difficult turns in route.
4.2 **Multi-use Trails**

There are 175 miles of formalized multi-use trail in the city. Wayfinding can be a challenge for most trail users. A system needs to be established to provide effective wayfinding for the trail users and location identification for emergency responders.

4.2.1. **Trail identification**

Multi-use trails are typically identified by name, usually coinciding with the major feature which they parallel such as an arroyo, highway or geographical location. Examples of these are the Bear Canyon, I-40 trail and Paseo del Bosque multi-use trails. Knowing where you are on these trails can be difficult due to lack of an addressing system. A logical system needs to be established that provides the trail user with their location and direction of travel. Multi-use trails shall follow the following conventions with regards to direction and location.

1. **Trail direction and mile marker**
   a. Multi-use trails that have a predominantly south/north alignment shall have a mile marker designation that begins at mile zero at the southern terminus of the trail. If there are plans to extend the trail towards the south the mile marker shall begin at the future southerner terminus of the planned extension. The mile markers shall increase along the trails alignment in the northerly direction.
   b. Multi-use trail that have a predominantly west/east alignment shall have a mile marker designation that begins at mile zero the existing western terminus of the trail. If there are plans to extend the trail to the west the mile marker shall being at the future western terminus of the planned extension. The mile markers shall increase along the trails alignment in the easterly direction.
   c. When posting mile marking information shall be shown to the nearest 1/10th of a mile in decimal format. Whole number mile marks shall use a decimal point followed by a zero.

2. **Trail location**
   a. Locations on a trail shall be identified by the distance from the beginning terminus of the trail expressed in miles and tenths of miles.

It would be beneficial to the trail users to include on the City’s bike map multi-use trail mile markers at major locations such as trail heads, trail/trail intersections and trail/street intersections. Emergency responders should be aware of the multi-use trail identification system and incorporate it into their dispatching protocol.
4.2.2. Trail marking

Trail identification/location marking and wayfinding can be comprised of signs, trail heads, kiosks, maps and pavement markings. The type of location marking is dependent on the location and anticipated needs of the trail users.

Trail head

Trail head identification should be used to indicate the terminus of the trail, thus informing users approaching the trail from an intersecting trail and when users are leaving a specific trail to use another trail. The trail head can be as simple as a sign identifying the trail by name or more informative by including additional information, such as, the City's Bike Map, or a map emphasizing the trail and showing the trail length, major destinations and distances, and 911 emergency reporting instructions. A kiosk can provide a good location to display this information in addition to trail etiquette educational information and pet waste cleanup stations. Trail appurtenances near the kiosk may also improve user satisfaction and aid in alerting quick moving commuters to the congested quality, which maybe present near the kiosk as shown in the figure at the right.

Mid-trail marking

Mid-trail markings should be placed at 0.5 mile intervals starting at the southern or western trail terminus and shall include the trail name and mile marker. A combination of pavement marking and sign can be used or pavement marking solely. Pavement markings showing the trail name and mile marker shall be placed on and parallel to the trail centerline using retroreflective pavement marking utilizing a 4-inch high white letters and numbers. When a sign is used, a single, double-sided sign shall be placed on
the right side of the trail in the direction of increasing mileage. The sign shall be a flexible fiberglass composite extending 3 feet above ground displaying the mile marker and optionally the trail name. An example of the mid-trail pavement marking and sign is shown in figure 11.

Trail/street intersections
Where a multi-use trail intersects a street the trail name, trail mile marker and street name shall be displayed. In addition destination guide signs may be appropriate.

Intersection sign
A post mounted street name sign, similar to a D3-1 with 4-inch initial upper-case letters with 3-inch lower-case letters, shall be located on the right side of the trail near as particle to the edge of the street right-of-way. These signs shall display the trail name and street name. For trails with long names appropriate abbreviations can be used.

Intersection pavement marking
The street name shall be shown using retroreflective pavement marking in 6-inch high white letters placed perpendicular to the trails centerline approximately 10 feet from the intersection. The trail name and mile marker retroreflective pavement marking shall be placed on and parallel to the trail centerline using retroreflective pavement marking using 4-inch high white letters and numbers and should be placed approximately 25 feet before the intersection. Figure 12 shows the preferred layout for trail identification markings.

Trail/trail intersections
Where multi-use trails intersect the trail names and mile markers shall be shown using signs and pavement markings.

Intersection sign
Post mounted signs displaying both trail names, similar to a D3-1 sign with 4-inch initial upper-case letters with 3-inch lower-case letters, shall be located at the intersection. For trail with long names appropriate abbreviations can be used.

Intersection pavement marking
The trail name, for each trail, shall be shown using retroreflective pavement marking in 4-inch high white letters and numbers. The multi-use trail name and mile marker shall be placed on and parallel to the center line of the trail approximately 25 feet before the intersection. Figure 13 shows the preferred layout for trail identification markings.
5. Pedestrian and Cycling Supportive Site Design

The DPM requires that “All new roadways which are legal for bicycle use should be designed and constructed under the assumption that they will be used by bicyclists.”

The DPM provides the following guidance for accommodating bicycles on new streets:

a) Development of Bike Lanes on New or Reconstructed Roadways

Bike lanes should be provided on all new or reconstructed arterial and collector roadways. Recommended minimum widths for bicycle lanes are as follows:

- 5 feet, measured from painted edgeline to edge of gutter, on roadways with posted speed limits of 40 mph or greater.
- 4 feet, measured from painted edgeline to edge of gutter, on roadways with posted speed limits of 35 mph or less.

Bike lanes shall be flush with roadside gutters and should be marked in accordance with the MUTCD and AASHTO guidelines.

Future roadway improvements should retain existing bike lanes, including intersection approaches where additional turn-lanes may be constructed.

The DPM also states that, “In new residential or commercial developments adjacent to bikeways, contiguous walls or fences should provide breaks for paved bicycle access which link the development to the bikeway system. Access(es) should be delineated on the sketch plat, preliminary plat, and/or site development plan as appropriate.”

5.1.1. Bicycle Routes to Transit

Safe and easy access to bicycle parking facilities is necessary to encourage commuters to access transit via bicycle. Bicycling to transit reduces the need to provide expensive car parking spaces, mitigates peak-hour congestion, and promotes active, healthy lifestyles.

Providing bicycle routes to transit helps combine the long-distance coverage of bus travel with the door-to-door service of bicycle riding. Transit use can overcome large obstacles to bicycling, including distance, hills, riding on busy streets, night riding, inclement weather, and breakdowns. Providing bicycle access to transit and space for bicycles on buses can increase the feasibility of transit in lower-density suburban areas, where transit stops are beyond walking distance of many residences. People are often willing to walk only a quarter- to half-a-mile to a bus stop, while they might bike as much as two or more miles to reach the bus station. As the majority of bus stops do not provide long-term, secure parking options for bicycles, most people who ride to a bus stop will want to bring their bicycle with them on the transit portion of their trip.

The local bicycle network should connect to transit stations, particularly higher-volume hubs that provide bicycle parking. The TCRP report, Bicycle and Transit Integration also recommends bicycle paths from neighboring communities that are shorter in length than roadways, which is particularly important in areas with a disconnected street pattern. Signage on these routes should be clearly visible, using the bicycle symbol for bicycle routes and parking facilities.

High-visibility crosswalks and mid-block crossings are often appropriate treatments to provide safer bicycle and pedestrian access to bus stops, particularly at high-usage transit stops. If a bus stop is located mid-block, adequate crossing treatments should be provided, based on level of traffic on the roadway. All transit riders will need to cross the street to access or leave the bus stop.
6. Bicycle Parking

Bicycle parking can be broadly defined as either short-term or long-term parking:

- Short-term parking: parking meant to accommodate visitors, customers, messengers and others expected to depart within two hours; requires approved standard rack, appropriate location and placement, and weather protection.
- Long-term parking: parking meant to accommodate employees, students, residents, commuters, and others expected to park more than two hours. This parking is to be provided in a secure, weather-protected manner and location.

6.1. Short-Term Bicycle Parking

Design Summary

Location
- 50’ maximum distance from main building entrance.
- 2’ minimum from the curb face to avoid ‘dooring.’
- Avoid fire zones, loading zones, bus zones, etc.
- Location should be highly visible from adjacent bicycle routes and pedestrian traffic.

Additional Considerations
- To allow ample pedestrian movement, a minimum clear distance of 6’ should be provided between the bicycle rack and the property line. A clear distance of 5’ is the minimum standard.
- If two racks are to be installed parallel to each other, a minimum of 2.5’ should be provided between the racks.

Discussion

Bicycle racks are generally appropriate for commercial and retail areas, office buildings, healthcare and recreational facilities, and institutional developments such as libraries and universities. On-sidewalk racks should be placed adjacent to the curb in the utility strip, where other street furniture, utility poles, and trees are located. Racks should be oriented so that bicycles are positioned parallel to the curb, where neither the rack nor the bicycle in it impedes pedestrian traffic. Where a clear right-of-way for pedestrians cannot be maintained by installing the rack on the sidewalk, place bicycle racks in curb extensions or on-street (see next page). A certain number of bicycle racks should be weather protected. This may be achieved by simply locating the racks under overhangs.

Custom racks using creative designs can double as public artwork or advertising space for local businesses. The “post and ring” style rack is an attractive alternative to the standard inverted-U, which requires only a single mounting point and can be customized to have the City’s name or emblem stamped into the rings. Where older-style parking meters have been replaced with newer models but have not been removed, it is possible to retrofit them to provide short-term parking. The meter head is removed, and the post remains. A loop may be attached to the pole, in order to accommodate cable locks and to formalize the meter as bicycle parking.
### Guidance

#### Hitching Post or Staple Racks

![Image of Hitching Post or Staple Racks](image)

#### Ribbon, Spiral, or Freestanding Racks (with access from only one side)

![Image of Ribbon, Spiral, or Freestanding Racks](image)

#### Bicycle Rack Placement Guidelines

<table>
<thead>
<tr>
<th>Design Issue</th>
<th>Recommended Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum Rack Height</strong></td>
<td>To increase visibility to pedestrians, racks should have a minimum height of 33 inches or be indicated or cordoned off by visible markers.</td>
</tr>
<tr>
<td><strong>Signing</strong></td>
<td>Where bicycle parking areas are not clearly visible to approaching cyclists, signs at least 12 inches square should direct them to the facility. The sign should include the name, phone number, and location of the person in charge of the facility, where applicable.</td>
</tr>
<tr>
<td><strong>Lighting</strong></td>
<td>Lighting of not less than one foot-candle illumination at ground level should be provided in all bicycle parking areas.</td>
</tr>
<tr>
<td><strong>Frequency of Racks on Streets</strong></td>
<td>In popular retail areas, two or more racks should be installed on each side of each block. This does not eliminate the inclusion of requests from the public which do not fall in these areas. Areas officially designated or used as bicycle routes may warrant the consideration of more racks.</td>
</tr>
<tr>
<td><strong>Location and Access</strong></td>
<td>Access to facilities should be convenient; where access is by sidewalk or walkway, ADA-compliant curb ramps should be provided where appropriate. Parking facilities intended for employees should be located near the employee entrance, and those for customers or visitors near main public entrances. (Convenience should be balanced against the need for security if the employee entrance is not in a well-traveled area). Bicycle parking should be clustered in lots not to exceed 16 spaces each. Large expanses of bicycle parking make it easier for thieves to be undetected.</td>
</tr>
<tr>
<td><strong>Locations within Buildings</strong></td>
<td>Provide bike racks within 50 feet of the entrance. Where a security guard is present, provide racks behind or within view of a security guard. The location should be outside the normal flow of pedestrian traffic.</td>
</tr>
<tr>
<td><strong>Locations near Transit Stops</strong></td>
<td>To prevent bicyclists from locking bikes to bus stop poles - which can create access problems for transit users, particularly those who are disabled - racks should be placed in close proximity to transit stops where there is a demand for short-term bike parking.</td>
</tr>
<tr>
<td><strong>Locations within a Campus-Type Setting</strong></td>
<td>Racks are useful in a campus-type setting at locations where the user is likely to spend less than two hours, such as classroom buildings. Racks should be located near the entrance to each building. Where racks are clustered in a single location, they should be surrounded by a fence and watched by an attendant. The attendant can often share this duty with other duties to reduce or eliminate the cost of labor being applied to bike parking duties; a cheaper alternative to an attendant may be to site the fenced bicycle compound in a highly visible location on the campus. For long-term parking needs of employees and students, attendant parking and/or bike lockers are recommended.</td>
</tr>
<tr>
<td><strong>Retrofit Program</strong></td>
<td>In established locations, such as schools, employment centers, and shopping centers, the City should conduct bicycle audits to assess bicycle parking availability and access, and add additional bicycle racks where necessary.</td>
</tr>
</tbody>
</table>
6.1.1. On-Street Corrals

Design Summary

- See guidelines for sidewalk bicycle rack placement and clear zones.
- Can be used with parallel or angled parking.
- Each motor vehicle parking space can be replaced with approximately 6-10 bicycle parking spaces.
- Protect bicycles from motor vehicles with physical barriers such as curbs, bollards, or fences or through the application of other unique surface treatments.
- Establish maintenance responsibility when facility is built, particularly street sweeping and snow removal.
- Parking stalls adjacent to curb extensions are good candidates for bicycle corrals since the concrete extension serves as delimitation on one side.
- Cyclists should be able to access the corral from both the sidewalk and the roadway.
- Cyclists should have an entrance width from roadway of 5 – 6'.

Discussion

Bicycle corrals (also known as “in-street” bicycle parking) consist of bicycle racks grouped together in a common area within the public right-of-way traditionally used for automobile parking. Bicycle corrals are reserved exclusively for bicycle parking and provide a relatively inexpensive solution to providing high-volume bicycle parking. Bicycle corrals can be implemented by converting one or two on-street motor vehicle parking spaces into on-street bicycle parking.

Bicycle corrals move bicycles off the sidewalks, leaving more space for pedestrians, sidewalk café tables, etc. Because bicycle parking does not block sightlines (as large motor vehicles would do), it may be possible to locate bicycle parking in ‘no-parking’ zones near intersections and crosswalks.

Bicycle corrals can be considered instead of other on-street bicycle parking facilities where:

- High pedestrian activity results in limited space for providing bicycle racks on sidewalks.
- There is a moderate to high demand for short-term bicycle parking.
- Sufficient on-street vehicular parking is provided
- The business community is interested in sponsoring the bicycle corral.

In many communities, including Portland, the installation of bicycle corrals is driven by requests from adjacent businesses, and is not a city-driven initiative. In such cases, the City does not remove motor vehicle parking unless it is explicitly requested. In other areas, the City provides the facility and business associations take responsibility for the maintenance of the facility. Many communities, including the City of Portland, establish maintenance agreements with the requesting business.

The bicycle corral can be visually enhanced through the use of attractive planters and vegetation to act as buffers from the motor vehicle parking area as well as the use of creative demarcation elements to separate the corral for motor vehicle traffic.
6.1.2. Shelters

Design Summary

- See guidelines for sidewalk bicycle rack placement and clear zones.
- To be located on-street or off-street, in areas of high potential demand, such as areas in close proximity to major employment areas, schools, or community and recreational facilities.
- Recommended height: 8-12’ m.
- Roof area: 12-15’.
- If the bicycle racks are located perpendicular to a wall, 2’ minimum clearance (single-side access); and 2.5 m (double-sided access).
- If the bicycle rack is located parallel to a wall, 8’ minimum clearance should be provided.
- A clear width of 3’ should be provided between rack ends to balance the maximization of bicycle parking capacity with the need for adequate bicycle manoeuvrability.

Discussion

Bicycle shelters consist of bicycle racks grouped together within structures with a roof that provides weather protection. Bicycle shelters provide convenient short-term and long-term bicycle parking. They also offer extra protection against accidental damages by providing greater separation between the bicycles and the sidewalk or parking lane. Information boards and advertising space can also be incorporated onto the bicycle shelter which is often used to post cycling or bicycle related information. Bicycle shelters provide a high level of aesthetic adaptation as each of its components (shelter, racks, roof) may be enhanced with different shapes, colours and materials.

Bicycle shelters are warranted anywhere that bicycle racks may be located, particularly:

- Major commercial and retail areas, particularly in the major commercial nodes.
- Areas with sufficient space on sidewalks, promenades or public plazas, or curb extensions, so that adequate sidewalk width can be maintained.
- Demand for bicycle parking is oriented more towards long-term parking.

The location chosen for the bicycle shelter should be central to all surrounding activities so cyclists can park and walk conveniently to their final destination.

Bicycle parking area signage should be provide to indicate to cyclists and pedestrians that the bicycle shelter is intended exclusively for bicycle use and to alert pedestrians and motorists that they can expect higher bicycle volumes in the area.

6.2. Long-Term Parking

Long-term facilities protect the entire bicycle, its components and accessories against theft and against inclement weather, including snow and wind-driven rain. Long-term parking facilities are more expensive to provide than short-term facilities, but are also significantly more secure. Potential locations for long-term bicycle parking include transit stations, large employers and institutions where people use their bikes for commuting, and not consistently throughout the day.
6.2.1. Bike Lockers

Design Summary

- Place in close proximity to building entrances or transit exchanges, or on the first level of a parking garage.
- Provide door locking mechanisms and systems.
- A flat, level site is needed; concrete surfaces preferred.
- Enclosure must be rigid.
- Transparent panels are available on some models to allow surveillance of locker contents.
- Integrated solar panels have been added to certain models for re-charging electric bicycles.
- Minimum dimensions: width (opening) 2.5’; height 6’; depth 4’.
- Stackable models can double bicycle parking capacity.

Discussion

Although bicycle lockers may be more expensive to install, they can make the difference for commuters who are deciding whether or not to cycle. Bicycle lockers are large metal or plastic stand-alone boxes and offer the highest level of bicycle parking security available.

Some lockers allow access to two users - a partition separating the two bicycles can help ensure users feel their bike is secure. Lockers can also be stacked, reducing the footprint of the area, although that makes them more difficult to use. Security requirements may require that locker contents be visible, introducing a tradeoff between security and perceived safety. Though these measures are designed to increase station security, bicyclists may perceive the contents of their locker to be less safe if they are visible and will be more reluctant to use them. Providing visibility into the locker also reduces unintended uses, such as use as homeless shelters, trash receptacles, or storage areas. Requiring that users procure a key or code to use the locker also reduces these unintended uses.

Traditionally, bicycle lockers have been available on a sign-up basis, whereby cyclists are given a key or a code to access a particular locker. Computerized on-demand systems allow users to check for available lockers or sign up online. Models from eLocker and CycleSafe allow keyless access to the locker with the use of a SmartCard or cell phone. With an internet connection, centralized computerized administration allows the transit agency to monitor and respond to demand for one-time use as well as reserved lockers.

Lockers available for one-time use have the advantage of serving multiple users a week. Monthly rentals, by contrast, ensure renters that their own personal locker will always be available. Bicycle lockers are most appropriate:

- Where demand is generally oriented towards long-term parking.
- At transit exchanges and park-and-rides to help encourage multi-modal travel.
- Medium-high density employment and commercial areas and universities.
- Where additional security is required and other forms of covered storage are not possible.
6.2.2. Bicycle Compounds/Cages

Design Summary

- See guidelines for bicycle rack placement and clear zones.
- A cage of 18’ by 18’ can accommodate up to 20 bicycles and uses the space of approximately two automobile parking spots.
- Improve surveillance through public lighting and video cameras.
- Bicycle compounds shall have an exterior structure consisting of expanded metal mesh from floor to ceiling.
- In an attended parking facility, locate within 100’ of an attendant or security guard or must be visible by other users of the parking facility.
- Entry doors must be steel and at least 2.5’ in width, with “tamper proof” hinges. A window may be provided in the door to provide permanent visual access.
- Accommodate a maximum of 40 bicycles, or 120 if the room is compartmentalized with expanded metal mesh with lockable industrial-grade doors into enclosures containing a maximum of 40 bicycles.

Discussion

Bicycle compounds are fully enclosed, stand-alone bicycle parking structures. Compounds should not only have a locked gate but should also allow for the frame and both wheels to be locked to a rail, as other users also have access to the enclosure. Bicycle compounds are recommended for employment or residential bicycle parking areas, or for all-day parking at transit exchanges, workplaces and schools. They can be located at street level or in parking garages.

Bicycle Secure Parking Areas (SPAs) are a new concept implemented for TriMet (Portland, Oregon’s transit agency). They provide high capacity, secure parking areas for 80-100 bicycles at light rail and bus transit centres. The Bicycle SPAs are semi-enclosed covered areas that are accessed by key cards and monitored by security cameras. The increased security measures provide an additional transportation option for those who may not be comfortable leaving their bicycle in an outdoor transit station exposed to weather and the threats of vandalism. They also include amenities that make the Bicycle SPA more attractive and inviting for users such as benches, bicycle repair stations, bicycle tube and maintenance item vending machines, as well as hitching posts which allow people to leave their locks at the SPA.
6.2.3. Bicycle Rooms

Design Summary

- See guidelines for bicycle rack placement and clear zones.
- Improve surveillance through public lighting and video cameras.
- Walls should be solid and opaque from floor to ceiling.
- Install a panic button so as to provide a direct line of security in the event of an emergency.
- Accommodate a maximum of 40 bicycles, or 120 if the room is compartmentalized with expanded metal mesh with lockable industrial-grade doors into enclosures containing a maximum of 40 bicycles.

Discussion

Bicycle rooms are locked rooms or cages which are accessible only to cyclists, and which may contain bicycle racks to provide extra security against theft. Bicycle rooms are used where there is a moderate to high demand for parking, and where cyclists who would use the bicycle parking are from a defined group, such as a group of employees. Bicycle rooms are also popular for apartment buildings, particularly smaller ones in which residents are familiar with one another.

The bicycle parking facilities shall be no further from the elevators or entrances than the closest motor vehicle parking space, and no more than 150’ from an elevator or building entrance. Buildings with more than one entrance should consider providing bicycle parking close to each entrance, and particularly near entrances that are accessible through the bicycle network. Whenever possible, bicycle parking facilities should allow 24-hour secure access.

Dedicated bicycle-only secure access points shall be provided through the use of security cards, non-duplicable keys, or passcode access. The downside is that bicyclists must have a key or know a code prior to using the parking facilities, which is a barrier to incidental use.