2024 CITY OF ALBUQUERQUE BIKEWAY AND TRAIL FACILITIES PLAN

APPENDIX H: ADDITIONAL CONSIDERATIONS FOR MULTI-USE TRAILS (FROM 2015 PLAN)

BIKEWAY & TRAIL FACILITIES PLAN
CITY OF ALBUQUERQUE

ONE ALBUQUERQUE municipal development

ONE ALBUQUERQUE parks & recreation

Overview and Note on Contents

The material in this appendix is taken directly from the 2015 Bikeways and Trails Facilities Plan and is meant to preserve content that was not updated as part of the 2024 Plan.

Interagency Coordination Processes

Shared Use of Irrigation Ditches

Any trail proposal for an MRGCD-owned or managed facility has to be reviewed and approved by use for the adequate right of way, current management and maintenance of that facility, landownership, and the ability for another local entity to manage and maintain the trail through a license agreement. The size of the facility and available right-of-way are strong determinants in the feasibility of a multi-use trail that can be separated from the MRGCD's required maintenance access. Other than at road crossings, rails and fences are generally not installed along ditch banks as they prevent or impede our access and maintenance.

Albuquerque has significant opportunities to develop trails along drainage ditches.

Equestrians use unimproved maintenance roads and trails on our facilities and generally keep their distance from bicycles and other fast-moving users. Our ditches and drains are used by and very important to equestrians in the valley and we try to provide or maintain access wherever feasible/desirable.

Wherever possible, multi-use trails should meet ADA standards for design and access. It's helpful to make them higher in elevation than the maintenance road for drainage so less material migrates onto the trail. The opinion about bollards is that they can cause some hazards on a trail but we are increasingly using them rather than the horse log step-overs to provide better access for those who have more mobility issues, bicycles, strollers, etc. while excluding vehicles and four and three-wheelers (ATVs).

The trail corridors proposed for the Corrales Main Canal and Alameda Drain will need more study for feasibility. Some funding has been allocated for the Alameda Drain from Matthew Ave. north to Alameda Blvd. and reconnaissance and coordination efforts have commenced.

It would be good for the MRGCD, City, and County to develop maintenance and management standards and signage/information more specific to trails on MRGCD facilities as the concerns, management, opportunities and purposes are unique.

Shared Use of Utility Corridors

PNM transmission rights-of-way or easements are identified as the location for several proposed bike routes or trails. As the easement holder, PNM has the legal right to use and maintain the easement including ensuring vehicular access to the lines, maintaining adequate clearances, and other safety measures. If the bike lanes and/or trails become guest uses at these locations, an encroachment agreement will be necessary. The City also needs to directly contact the underlying property owner. In addition, it will be the City of Albuquerque's responsibility to ensure that PNM's uses of the easement are not affected or interfered with in any way by the inclusion of the bike lane or trail. Four proposed bike lane and/or trail

locations are identified within PNM's 115kV transmission rights-of-way and easements. The four locations are:

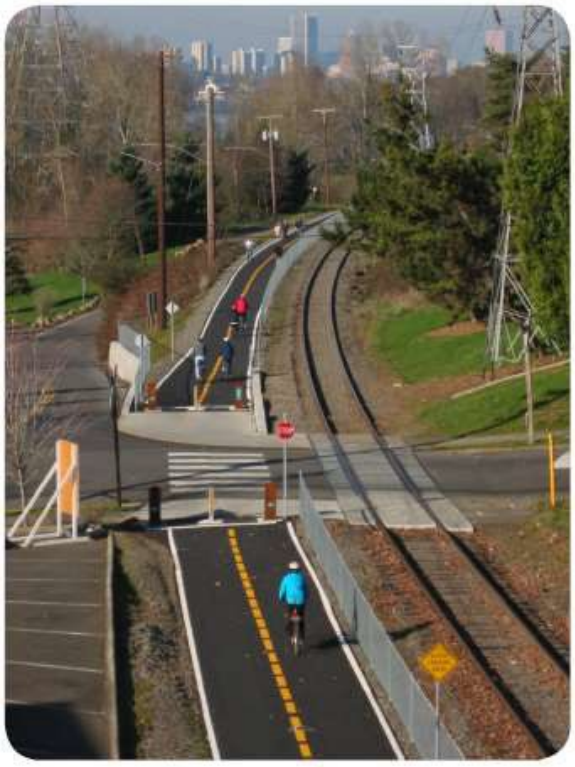
- Along the PNM CE 115kV transmission line from Irving Blvd. NW heading north toward McMahon Blvd. NW
- Along the PNM BW 115kV transmission line north of Interstate 40 east of Atrisco Vista Blvd NW
- Along the PNM SE 115kV transmission line/ID 46kV transmission line corridor in Tijeras Arroyo
- Along the PNM RE/ER 115kV transmission line corridor on San Antonio Drive NE just west of Tramway Blvd NE

Based on PNM's experience constructing and maintaining facilities at these locations, the terrain is difficult and is not conducive for bike trails. Coordination with PNM will be necessary as trails are developed at any of these four locations.

PNM does not support the development of trails within PNM existing 345kV transmission line rights-of- way or easements. The higher voltage lines can potentially result in electrical nuisance shocks. Nuisance shocks may occur when a person touches an ungrounded metal object, in this case, such as bicycle handlebars. A nuisance shock does not harm the recipient but can be startling. PNM will not grant an encroachment easement in 345kV transmission corridors.

New Mexico Department of Transportation (NMDOT)

Any trail, lane, and route proposal for a NMDOT roadway facility will require review and approval by NMDOT for the following, but not limited to, adequate right-of-way, accessibility, connectivity, maintenance of the facility and need for license agreement. As we had discussed, bringing some of the other agency coordination text referring to ADA compliance, design, feasibility, etc. to the introductory section would cover these items for all affected agencies.



The Springwater Corridor in Portland, Oregon runs next to an active rail line.

Trail Design

Background Information

In 1981, the American Association of State Highway and Transportation Officials (AASHTO) first attempted to create a comprehensive set of guidelines for accommodating bicyclists in various riding environments. Although it was not intended to set forth strict standards, the AASHTO Guide for the Development of Bicycle Facilities (revised in 1991, 1999, and the current 2012 fourth edition) has been the predominant source of information in this area although no enforceable Federal standards exist.

While most states have deferred to AASHTO's guidelines as de-facto design standards since 1981, some state and local governments are leading the way in the production of their own standards and guidelines in order to address local issues and meet the current needs of pedestrians, bicyclists, equestrians, and other user groups. In 1992, the U.S. Department of Transportation and the Federal Highway Administration conducted a national bicycling and walking survey entitled Case Study No. 24, Current Planning Guidelines

and Design Standards Being Used by State and Local Agencies for Bicycle and Pedestrian Facilities. That study was followed in 1999 by a similar, but broader effort entitled Designing Sidewalks and Trails, Part 1: Review of Existing Guidelines and Practices. By compiling and listing a number of examples of state and local guidelines, these documents identified models to which other communities could refer when developing their own bicycle and pedestrian plans, as guides to the state of the practice. (Part 2 of the 1999 FHWA study summarizes the earlier findings in a "best practices" guide, described more fully below.)

Until recently, bicycle-related protection measures (such as appropriate widths, turning radii, sight distances, and avoiding conflicts with vehicular traffic) have been the dominant trail design concerns. While these remain vital concerns, the presence of accepted standards such as the AASHTO guidelines have led to a shift in focus toward providing more "inclusive" and accessible outdoor recreational settings, especially in the urban environment. Rather than focusing solely on the cyclist and/or pedestrian, our collective awareness has been broadened to include all types of users, including children, parents with strollers, equestrians, people in wheelchairs, vision impairments, and those with other impairments or physical challenges. It is relatively easy to design for one or two user groups; however, it is extremely challenging to design multi-use trails that will be perfect for every user group.

ADA Guidelines

The Americans with Disabilities Act of 1990 (ADA) prohibits discrimination and ensures equal opportunity for persons with disabilities in employment, State and local government services, public accommodations, commercial facilities, and transportation. It also mandates the establishment of TDD/telephone relay services. The current text of the ADA includes changes made by the ADA Amendments Act of 2008 (P.L. 110-325), which became effective on January 1, 2009 and is now accompanied by the 2010 ADA Standards for Accessible Design. Together they provide national accessibility regulations for buildings and related urban environments. However, when designing outdoor recreational facilities or multi-use trails (with the exception of facilities built on Federal Land), the application of strict ADA standards often proves impractical and currently lacks any Federal ruling or legal requirement. There is practical design and smart practices that can and should be followed when building multi-use trail and trailhead facilities. These will be followed until the Federal government adopts a ruling for requirements that shall be followed. The following is some history on how practical design and smart practice came to be.

In 1993, the nonprofit organization Project Play and Learning in Adaptable Environments, Inc., (PLAE), in partnership with the USDA Forest Service and a number of other agencies and organizations, took the initiative to develop guidelines and published Universal Access to Outdoor Recreation: A Design Guide. By acknowledging a desire for various levels of recreational challenge and related facility development in settings ranging from highly-developed urban to primitive, natural landscapes, this book pioneered the way for designers to address the needs of people of all abilities in outdoor recreation and provides a universal approach to outdoor design in the spirit of ADA regulations. However, as comprehensive as it is, the PLAE design guide does not yet enjoy the support of law, such as ADAAG.

To address this, the U.S. Architectural and Transportation Barriers Compliance Board (a.k.a. the "Access Board" – the agency which administers and develops accessibility design guidelines) formed the Recreation Access Advisory Committee (RAAC) to study the issues and develop federal standards for outdoor recreational facilities. Based in part on the research and recommendations of the PLAE partnership in Universal Access to Outdoor Recreation, the RAAC published draft Recommendations for Accessibility Guidelines: Recreational Facilities and Outdoor Developed Areas in 1994 but could not reach consensus on many issues. Public comment also demonstrated a lack of consensus, especially regarding trails accessibility. In 1997 the Access Board created the Outdoor Developed Areas Regulatory Negotiation Committee (RNC), with representation by people with disabilities, state, federal and local land management

agencies, trails groups, designers, and owners/operators of various “outdoor developed areas.” After careful examination of the previous work done by RAAC, and the solicitation of input from the public, a final report was submitted by the RNC to the Access Board in September of 2013 (available at http://www.access-board.gov/guidelines-and-standards/recreation-facilities/outdoor- developed-areas/final-guidelines-for-outdoor-developed-areas). The report gives recommendations on accessibility issues related to outdoor recreation access routes, beach access, picnic elements, and camping facilities.

The 2000 Census shows that 20% or approximately 54 million U.S. Citizens over the age of 15 have a disability. Also, 17 million Americans have serious hearing disabilities (2000 Census).There are three times more people with severe vision impairments than there are wheelchair users and information is a barrier for people with vision disabilities.

The newest and most comprehensive guidelines that can and should be used when designing multi-use trails is called Public Rights of Way Accessibility Guidelines (PROWAG). These guidelines were originally intended to supplement the ADAAG to provide standards specific to public rights-of-way. Applicable to new construction and alterations of existing facilities within the public right-of-way excluding shared-use paths or multi-use trails. As an enforceable standard, PROWAG provides the best guidelines for multi-use trail design and should be followed until there is specific guidelines enforceable for multi-use trails.

When designing multi-use trails for ADA, the two main barriers of people with disabilities should be remembered. Movement and information are two major barriers for people with disabilities. People with mobility disabilities may have limited agility, speed, endurance and may benefit from designers implementing firm level surfaces, curb ramps where needed, and limited cross slopes. People with vision impairments from complete blindness to partial vision tend to benefit from sounds, textures, and contrasts such as audible/vibrotactile crossing information, tactile indication of boundary between pedestrian and vehicular roadways, clearly defined pathways, and high color contrasts. People with hearing disabilities rely on vision and benefit from good sight lines for assessing street crossing conditions, information in the visual, and information in a visual or vibrotactile format. Persons with cognitive disabilities have different processing and decision-making skills and benefit from straightforward, and direct environments, uncomplicated street crossings, and easy to understand symbols. Therefore, the design of multi-use trails should try and accommodate a broad spectrum of users and enable users to travel independently as much as possible.

FHWA Best Practices Guidelines

In 2001 the FHWA issued the latest in its series of technical guides intended to help designers at the state level more easily integrate bicycle and pedestrian projects into mainstream transportation projects. Designing Sidewalks and Trails for Access, Part 2: Best Practices Design Guide followed their earlier compendium of existing guidelines and practices (described above). According to the transmittal letter which accompanied the initial distribution of the Best Practices Design Guide, “its aim was to develop tools to help the FHWA, and State and local governments meet their responsibilities under Title II [of the Americans with Disabilities Act of 1990] and Section 504 [of the Rehabilitation Act of 1973], while reducing their vulnerability to complaints filed under the ADA. The guide reflects recognized “best practices” in effect at the time of publication, and also incorporates recommendations from the Access Board’s 1999 final report from the Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Area (described above).

State and Local Efforts

The City of Albuquerque’s efforts to address trail implementation date back to 1973, when an advisory committee began research for The Bikeway Study, which was published the following year. That document

marked Albuquerque's first bicycle network plan, which evolved into the Long Range Bikeway System maps currently published by the Mid-Region Council of Governments (MRCOG). In the early '80s, the Albuquerque/Bernalillo County Comprehensive Plan reaffirmed the City's dedication to implementing a multi-purpose trails network. Other local documents created in the mid-1980s to the early '90s began to address trail design issues specific to Albuquerque. The 1986 Facility Plan for Arroyos, for example, promotes the use of the city's numerous drainage features for urban recreational purposes. Several Arroyo Corridor Plans further carry out the multi-use trail goals stated in the Facility Plan. The Bear Canyon Arroyo Corridor Plan, San Antonio Arroyo Corridor Plan, Amole Arroyo Corridor Plan, and Pajarito Arroyo Corridor Plan have been adopted by the City and contain varying levels of design guidelines for implementing specific types of trails. Several other corridors, including the City's two largest arroyos, the Calabacillas and Tijeras, have been the subjects of similar studies, which have not yet been adopted.

In 1989, the City Council adopted Bill No. 0-133 establishing a Greater Albuquerque Recreational Trails Committee (GARTC), which serves as the off-road counterpart to the Greater Albuquerque Bicycling Advisory Committee (GABAC) now GAATC, providing a voice for the trail-user and cycling communities in City government. In conjunction with the City's Planning Department, GARTC began research for a "Master Recreational Trails Plan" shortly after its formation. This process resulted in the 1993 Trails & Bikeways Facility Plan, which represents the city's most comprehensive trails planning document to date (plan maps updated in 1996).

In 1996, the New Mexico State Highway and Transportation Department (NMSHTD – now NMDOT) produced the first state-wide New Mexico Bicycle-Pedestrian-Equestrian (BPE) Transportation Plan. Developed partially in fulfillment of federal mandates under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the plan provides general guidance in the development of bikeways, walkways, and equestrian trails. Three appendices include some design standards, applicable state laws, and trail-related signing and striping excerpts from the Manual on Uniform Traffic Control Devices (MUTCD). The recommendations in the plan are "loosely categorized" according to an emerging national convention called the "4-E" approach, which emphasizes the four functional areas of engineering, education, enforcement, and encouragement in promoting and implementing successful BPE programs. The state plan was revised in 1999, 2001, and 2003. Currently, the NMDOT has begun a comprehensive and collaborative process to develop a 2040 Statewide Long-Range Multimodal Transportation Plan (SLRP). The plan will provide a vision for how New Mexico's transportation system can support the well-being of our residents and visitors now and in the future.

Current Directions

The various local documents concerning Albuquerque trails have provided the first stages in trail design guidance based on the needs of individual user groups. However, they fall short in providing adequate guidelines for implementing a multi-purpose network that will accommodate all potential users. Many were oriented primarily toward bicycles, while those that addressed multiple users tended to focus on separate single-use facilities.

In the greater Albuquerque area, as is true throughout the nation, finding solutions to the wants and needs of multiple user groups is increasingly challenging. It is simply not feasible in most cases to provide separate facilities for each of the various use types. Acquiring sufficient right-of-way to provide adequate widths and necessary separations for multiple, parallel trails is cost-prohibitive, at best, and is often not even possible within developed portions of the city. The City of Albuquerque has adopted the strategy of accommodating multiple user groups with the design and construction of multi-use trails.

Designing for Multiple-Use

The concept of combining user groups on single trail facilities is not without its difficulties. Multi-purpose trail design is faced with the challenge of allowing for the freedom of choice essential to a satisfactory outdoor recreation experience, on one hand, while at the same time minimizing conflicts between different trail users. In order for multi-use trails to function effectively, the various user groups need to be cognizant and respectful of the needs of other users. Public education is an important element in reducing conflicts often associated with multi-use trails.

Several studies have been undertaken at various levels to try to understand the underlying causes of trail conflicts. In 1994 the Federal Highway Administration and the National Recreational Trails Advisory Committee sought to summarize this information and "establish a baseline of the current state of knowledge and practice and to serve as a guide for trail managers and researchers." Their resulting report, Conflict on Multiple-Use Trails, offers a useful summary of possible management strategies that adhere to the "minimum tool rule," which advocates using the least intrusive measures possible. Some of their suggestions include:

- Build trails wide enough to accommodate expected levels of use
- Provide adequate trail mileage and a variety of trail opportunities
- Provide appropriate signage and/or educational material
- Design in adequate sight distances and provide pullout areas
- Paint a yellow center stripe and two white side stripes on all multi-purpose trails within the City of Albuquerque Right of Way.
- Have an effective maintenance program appropriate to trail type and use.

Trail Difficulty Rating System

In most instances, individuals intentionally choose a specific environmental setting when exploring the outdoors. These choices are made with distinct expectations for recreational experiences, especially with regard to the level of accessibility of a given area or facility. Because of the close relationship between the expectation and the resultant outdoor experience, successful design and management strategies should include an understanding of this cause and effect. A key to this success lies in the provision of adequate information to enable trail users to make informed decisions about a given facility.

Trail users can more easily gauge the level of effort required for a given segment of trail through the implementation of a difficulty rating system. Although no national standard format has yet been established, five key attributes have emerged for assessing the navigability of a trail facility. Referred to as the Universal Trail Assessment Process (UTAP), this system quantifies each of the following elements:

- Grade/Running Slope/Inclination (average and maximum)
- Cross Slope (average and maximum)
- Trail Width (average and minimum)
- Surface Type/Condition (firmness)
- Obstacles (type and magnitude)

Both PLAE and RAAC recommend the additional measure of summarizing the above information into a rating hierarchy similar to ski run designations – Easy, Moderate, Difficult, and Most Difficult, with accompanying "Universal Design" symbols which graphically reinforce the text designation (discussed further under "Signage" later in this report). However, it should be emphasized that without the UTAP

attributes, the simple designation of “Easy” or “Moderate” becomes very subjective and may not provide adequate information to some trail users to assess their ability to negotiate a particular facility.

Of course, other factors also influence ease of use, including overall length of a given trail facility, as well as the relative distances between specific facilities, use areas, and access points. Awareness of those factors is key to determining a trail user’s ability to complete a trail segment, given their own abilities or the amount of time available. And while more difficult to quantify in terms of the above system, these factors can be conveyed via trail maps and/or mileage signs.

Local Applicability

Trail design and construction have increased dramatically in Albuquerque since 1991 and the passage of the first federal Intermodal Surface Transportation Enhancement Act (ISTEA), which set aside unprecedented levels of funding for alternative transportation facilities, including trails. And, given the passage of its successor bills, TEA-21 and the current SAFETEA-LU (2005-2009), this trend is not likely to end soon. In short, trail planners are not waiting for a uniform federal standard for trail development.

However, in the absence of any comprehensive local standards, there is a great deal of variability in the configuration of those facilities. Until the Access Board issues its “final rule” and codifies it as law, an interim standard is needed to guide trail development in the greater Albuquerque area.

Since the underlying goal is to make Albuquerque’s trails accessible to as many people as possible, regardless of ability, the trail community and the larger transportation system as a whole would best be served by striving for the highest level of accessibility that can reasonably be attained within the realms of the underlying natural landscape and physical geography. Therefore, to the extent practicable, paved trails within the City’s jurisdiction should be in substantial compliance with the current PROWAG as stated in the sections above. At such time as new federal regulations for shared-use paths are ruled and enacted, the ADAAG and PROWAG standards should still take precedence. Any trails within Federally owned and managed lands are subject to the Access Board’s ruling for outdoor developed areas.

General Trail Information

While not intending to stifle creativity or variation among projects, this document is intended to provide a basic set of design guidelines which sets forth minimum acceptable parameters for various types of trail facilities constructed within the greater Albuquerque area. The guidelines are organized into a number of categories, each of which may have up to three levels of information: **Design Standards,** which represent minimum required design criteria; **Design Considerations & Guidelines** provide background information and issues that may influence facility design; and **Design Guidance** offers suggested criteria or other information which may guide the design process.

The AASHTO Guide for the Development of Bicycle Facilities (2012 edition) has an extensive section of design guidelines for Shared Use Paths, covering the following categories:

- Separation between Shared Use Paths and Roadways
- Width and Clearance
- Design Speed
- Horizontal Alignment

- Grade
- Sight Distance
- Path-Roadway Intersections
- Signing and Marking
- Other issues, such as Lighting; Restriction of Motor Vehicles; Railroad Crossings; etc.

Shared-use paths (also referred to as "trails" and "multi-use paths") are often viewed as recreational facilities, but they are also important corridors for utilitarian trips.

Rather than duplicating that information here, this document will instead focus on issues and criteria specific to Albuquerque's multi-use trail system. The remainder of the material from the AASHTO Guide is incorporated herein by reference. In the event of a conflict with this or future versions of the AASHTO Guide, the more stringent criteria will apply.

The Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD), Part 9: Traffic Control for Bicycles is the accepted reference for most matters relating to signage, signalization, and striping of bicycle trails. The MUTCD offers three levels of information: Standards, which should be followed; Guidance, which is recommended, but not required; and Options, which are permitted, and may or may not be followed, at the discretion of the local authority. The guidelines presented in the MUTCD should be followed in the design of Albuquerque's multi-use trails.

Multi-use trails, shared-use paths, or simply "trails," provide a desirable facility for cyclists, pedestrians, equestrians, and other trail users. They allow for travel and recreational use that is separated from traffic. Multi-use trails should generally provide new travel opportunities while accommodating all types of trail users.

The Albuquerque Development Process Manual defines a multi-use trail as:

> *Paved trails, also called multi-use trails or shared-use paths, are facilities that are dedicated for pedestrians and cyclists and are designed for use by people of all abilities for transportation and recreational purposes. 2. Trails are physically separated from vehicular traffic and are either within the roadway right-of-way or within an easement.*

Sidepaths are physically separated from motor vehicle traffic by an open space or barrier and are either within the public street right-of-way or within an independent (private) right-of-way."

Trail Types

Albuquerque's multi-use trails can be grouped into two broad categories: paved and unpaved multi-use trails. **Paved trails** are intended to accommodate all types of non-motorized users that include but not limited to bicycles (and other types of cycles), in-line skates and ski trainers, all types of skateboards, strollers, wheelchairs, equestrians, and many types of pedestrians preferring a hard, all-weather surface. **Unpaved trails** typically accommodate but are not limited to (unless posted and signed) equestrians, mountain bikers, hikers, and pedestrians preferring a soft walking surface (stabilized unpaved trails may also be suitable for wheelchair users depending on their ability). In any given corridor, these two basic trail types may be categorized in one of three ways:

- **Single Track, Limited Use** – although this runs counter to the concept of "multiple-use," there may be instances where only single use types are allowed or, more frequently, certain uses may be prohibited in order to minimize potential conflicts or impacts. This situation would most likely occur in specific management areas such as Wilderness areas or designated Open Space facilities, such as the Pino Trail at Elena Gallegos. Site specific signage will define the appropriate usage of trails in Open Space. The Open Space Division is responsible for defining appropriate uses based on topography, environmental conditions, and to avoid potential user conflicts.
- **Single Track, Multiple Use** – either of the trail types (paved or unpaved) within a corridor by itself, but open to any non-motorized users. This category comprises the vast majority of Albuquerque trails.
- **Multiple Track, Multiple Use** – in some cases, it may be possible and appropriate to provide parallel hard and soft-surfaced trails within the same corridor. Some separation between the two types is desirable.

Trail Location

As noted in the AASHTO Guide, multi-use trails ("shared use paths") should serve as an off-road transportation system which augments a community's roadway network. "Shared-use paths should not be used to preclude on-road bicycle facilities, but rather to supplement a system of on-road bike lanes, wide outside lanes, paved shoulders, and bike routes" [AASHTO, 1999, p.33]. This is because even though off-street facilities may parallel a roadway, the presence of other, usually slower, users may make the trail a less efficient (and in fact more dangerous) route for commuters or other "serious" cyclists.

Multi-use trails may be located in separate, designated corridors (purchased, donated, negotiated, or dedicated during the development process), or shared rights-of-way, utilizing corridors along arroyos, power lines, and even roadways (assuming minimal driveway and other intersection crossings). All trails built within the City of Albuquerque right-of-way should be built to the guidelines proposed in this design manual whether it is a private developer building out a section of road or an entire subdivision. If a developer constructs a trail and it is intended to be maintained by a Homeowner's Association, Neighborhood Association, or any means other than a public governmental agency such as the City of Albuquerque, the trail shall be built to the standards of this design manual in consultation with the Parks and Recreation Department's Trails Planner or other City official. If a trail is to be built within a private right-of-way, it is not required to be built to City standards or specifications however, it is highly recommended. Trails built to City standards ensure longevity and high quality resulting in less maintenance costs to the entity maintaining the trail. Trails built within a private right-of-way shall never be maintained by the City of Albuquerque or other governmental or quasi-governmental entity unless there is a trail maintenance agreement or other legal agreement that is signed and accepted by the City or another agency.

The City of Albuquerque may require a *"trail maintenance agreement"* when a trail is built within the City right-of-way to ensure there is sufficient documentation of who will retain maintenance responsibility after the project is constructed. The City requires developers to help build out trail sections when they go through the development process when the trail is a proposed link on the Bikeways and Trails Facility Plan map. All trails within the public right-of-way are open to use by the public. Trails built within an independent or private right-of-way do not have to be open to the public but can be.

Design Considerations & Guidelines

The maps that are associated with the Bikeways and Trails Facility Plan show locations of many proposed facilities as well as existing facilities. The updated map is based on the Mid-Region Council of Governments

(MRCOG) Long Range Bikeway System map, as well as many Sector and Facility Plans prepared by or for the City of Albuquerque. Specific locations should be coordinated with the City's Trails Planner when developments are going through the design, planning, and construction process.

Trail Design Criteria

Trail design criteria are outlined below, however, design must follow the DPM.

Trail Cross Section for Typical Paved Multi-use Trail

Design Standards

Width (same as the DPM standards)

- 10 feet is the minimum allowed for a two-way shared-use path (trails less than 10 feet wide need an exception by the City and may need a separate legal "trail maintenance agreement").
- 12 feet or 14 feet or greater is recommended for high-use areas and regional corridors, or in heavy-use situations with high concentrations of multiple users, such as joggers, bicyclists, skaters, equestrians, and pedestrians.

Lateral Clearance

- A 2-foot or greater compacted shoulder on both sides.
- 3' or more from walls, fences, posts, signs, and other structures.

Overhead Clearance

- Clearance to overhead obstructions should be a minimum of 10 feet.

Design Speed

- The maximum design speed for bike paths is 18-20 mph. Speed bumps or other surface irregularities should never be used to slow bicycles.

Grade

- The recommended running grade is 5% or less. Steeper grades can be tolerated for shorter distances. The cross slope shall be no greater than 2%. It is recommended cross slope is designed at 1.5%.

Design Considerations & Guidelines

Trails should be constructed according to this design manual. Further guidance can be found in the books and publications listed in the beginning of the manual. Constructing trails may have limitations in regards to PROWAG or any ADA document issued in the future for. 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.

Surfacing

According to the ADA, an accessible surface must be "stable, firm, and slip-resistant" [28 CFR Part 36, Appendix A, Section 4.5.1; 1994, p. 513]. Trail or path surfaces which meet these criteria can accommodate

bicyclists, in-line skaters, individuals using wheelchairs, and other trail users who need or prefer the security of a firm surface. Any pavement design should be prepared or approved by a geotechnical engineer, based on site-specific soil conditions. Nonetheless, some general design parameters apply specifically to trail construction, as outlined below.

Concrete

In general, concrete trail surfacing should follow The City's Standard Specifications for sidewalk construction. The major difference between a concrete trail and a sidewalk is that a sidewalk is typically not wider than 6 feet. The minimum trail width is 10 feet and 8 feet with a written exception or legal maintenance agreement with the City. Also, trails have separation between back of curb and sidewalks do not. Thickness typically should typically be four inches (4") minimum, but should be thickened to at least six inches where frequent vehicular traffic is expected (such as at curb access ramps and maintenance vehicle crossings). Addition of color may enhance the visual character of a concrete trail surface, but texturing should be kept to a minimum. Control joints should be saw cut, rather than tooled, in order to maintain a smoother, more even rolling surface.

Asphalt

Asphalt is much less expensive to install than concrete and is used more often than concrete for trail applications. Asphalt is aggregate mixed with oil. It is actually meant to be driven over as the movement of a vehicle over the asphalt literally "kneads" the asphalt keeping it smooth. Therefore, it is recommended and shall be required to use a smaller aggregate for trail applications due to the lack of vehicles "kneading" the asphalt. Parks and Recreation requires "Type C" asphalt which has been typically used since 2010. In lieu of Type C, a super pave IV (SP IV) can also be used however "Type C" is recommended for paved trails. The aggregate is small which helps to keep the trail surface smooth for cyclists and pedestrians. Another concern with asphalt trail surfaces in New Mexico is oxidation (loss of asphalt binder) due to sun exposure, and cracking over time. Both of these problems can be minimized to a small extent through modification of the pavement mix to increase the amount of asphalt binder in relation to the aggregate, as compared to a standard roadway mix. Care should be taken, though, not to increase the binder content to the point that the surface becomes difficult to finish.

Surface thickness also affects the durability of asphalt. Since the design of asphalt surfacing is generally based upon vehicular loads, two inches is usually considered more than adequate to support bicycle and foot traffic. However, since bicycles are not heavy enough to provide the "kneading action" of automobile traffic (which helps hold asphalt roadways together), surface integrity relies solely on the tensile strength of the asphalt binder. Current thinking generally holds that increasing the thickness of the asphalt surface will in turn increase durability and help reduce cracking. Therefore, although the typical trail section in the City's Standard Specifications for Public Works Construction shows 2" of asphalt over 8" of compacted subgrade, the recommended design thickness for trail surfacing when maintenance vehicles will be utilizing the trail consists of 3" of asphalt over 12" of compacted subgrade. In areas with soft (sandy or high clay content) subgrade material, the addition of 4" of engineered base course is recommended. Final determination of subgrade and base course treatment should be made by a qualified civil or geotechnical engineer and it is recommended that 12" of subgrade preparation at 95% compaction rather than 8" of subgrade be used on all new and rehabilitated paved trails. Unless otherwise determined by a civil or geotechnical engineer, aggregate base course should have an "R- Value" >/=76 and subgrade should have an "R-Value" >/=50.

Figure 1: Typical Paved Multi-Use Trail Cross Section

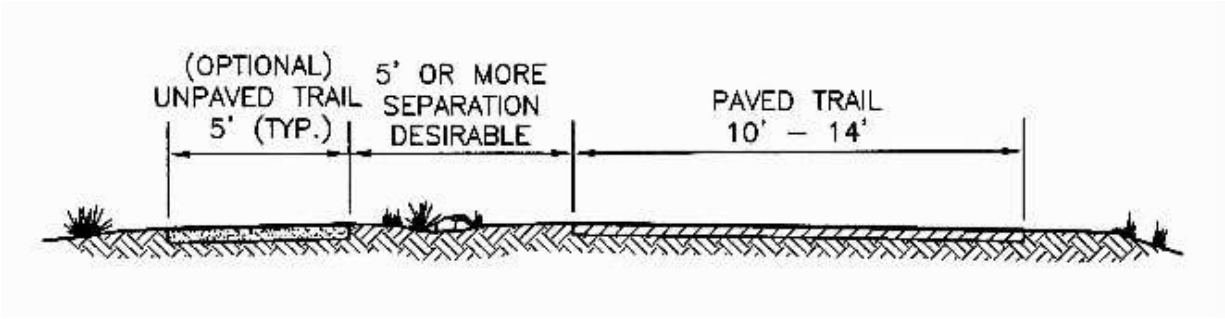
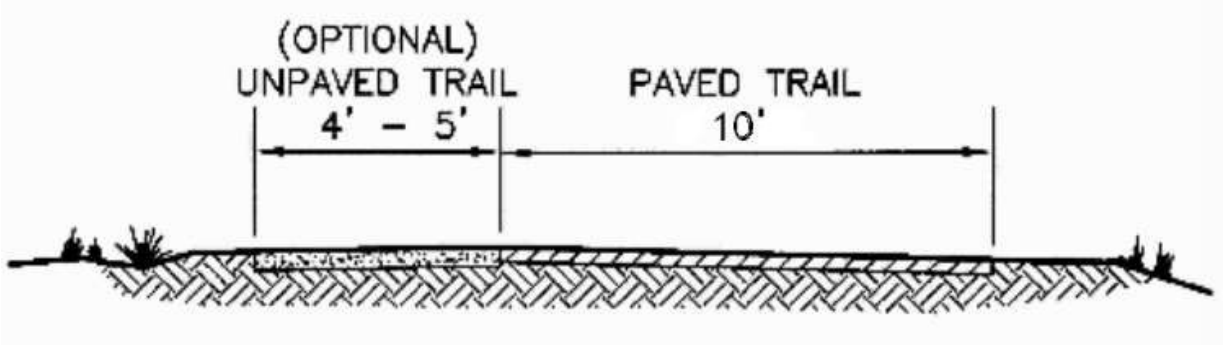


Figure 2: Typical Paved Multi-Use Trail Cross Section (no separation)



Unpaved Trails

Unpaved (non-stabilized) trails within the urban/rural area are sometimes provided as an alternative to parallel paved facilities, primarily for use by equestrians or joggers. However, Major Public Open Space has over a hundred miles of unpaved natural surface multi-use trails throughout all quadrants of the City and in Bernalillo and Sandoval County. In many cases, the existing native soil is suitable for surfacing such trails, especially in Major Public Open Space (unless a stabilized crusher fine ADA type trail is desired). These could include 3/8" or smaller angular gravel, crusher fines, decomposed granite, or other suitable soils (e.g. sandy loams) which remain firm underfoot in both wet and dry conditions. A 3”- 4” layer of these imported materials should be adequate in most instances if subgrade soils provide adequate support (greater depth may be required over loose sand or silt). Unpaved trails should be separated from paved trails within the same corridor as far as possible, given right-of-way constraints.

Unpaved trails are typically classified as “singletrack” trails. These are primarily found in Major Public Open Space areas. However, The City Open Space Division also maintains and manages a few paved trails as well. Actually, when looking at the trail system as a network City Major Public Open Space maintains a large majority of trails within the regional Albuquerque area and beyond. Most of these “MPOS” trails differ in design and construction from the paved trail network with exception of the MPOS paved trails but they are just as important and need to be addressed in this design manual as they are considered part of the overall trail network. Some basic MPOS trail designs are listed below for MPOS trails. For more detailed information on MPOS trail standards, trailhead design, signage, etc. please refer to the draft MPOS trail standards. These can found by contacting the Open Space Division directly. Major Public Open Space trails’ typical cross sections differ from the paved trail cross sections as seen in the figures above. Each MPOS property is different and trails are designed to accommodate specific environmental terrains and conditions. However, the natural surface trails designed and constructed by the Open Space Division typically follow the

International Mountain Bicycling Association publication entitled “Trail Solutions; IMBA’s Guide to Building Sweet Singletrack” 2004 edition. The figures below are typical examples used by the Open Space Division for design and construction of MPOS trails. Unless noted as either Major Public Open Space, MPOS, or Open Space in this design manual, all other material is referring to trails that are not MPOS with the exceptions of any paved and maintained by MPOS trail sections such as the northern section of the Paseo del Bosque Trail.

Figure 3: Typical MPOS Singletrack Full Bench Trail

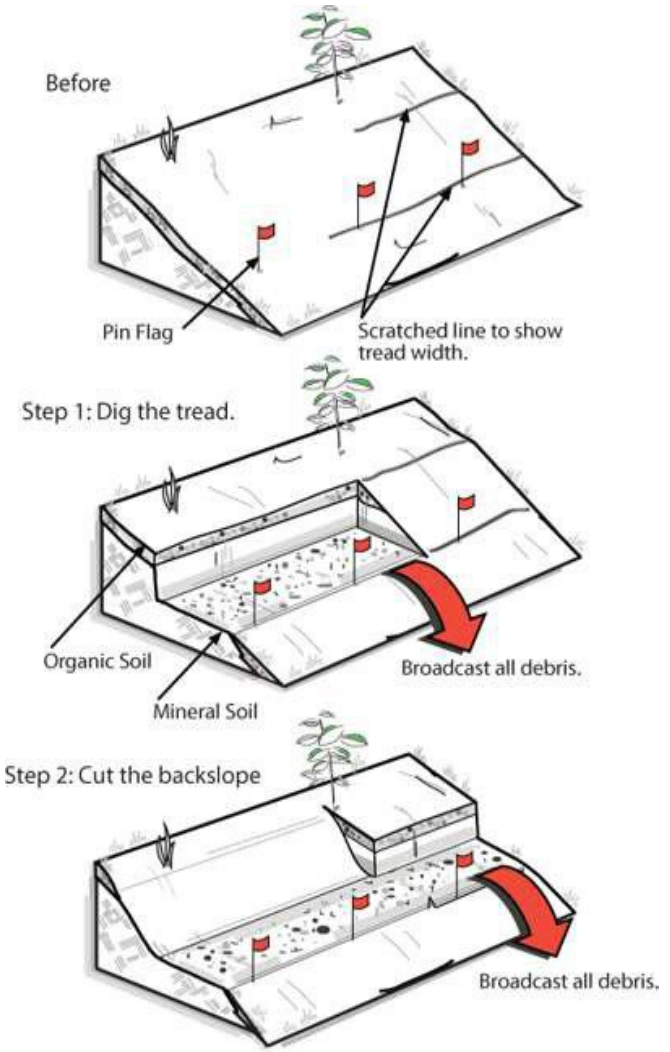
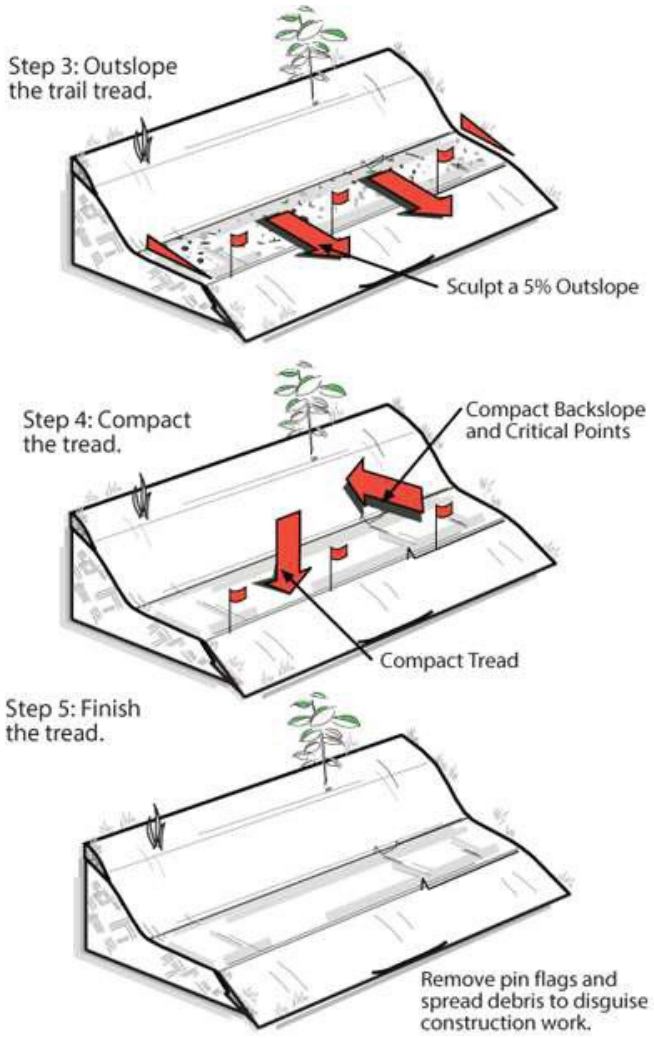
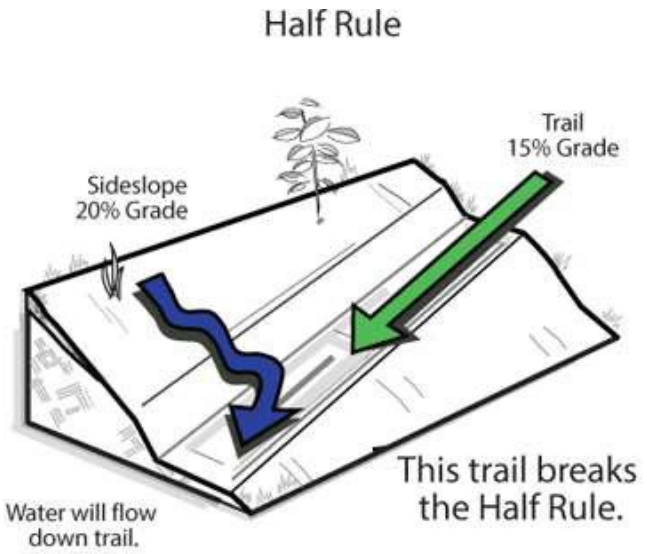


Figure 4: Typical MPOS Singletrack Full Bench Trail (cont.)



Source: Trail Solutions: IMBA

Figure 5: Sustainable Trail Design using the Half Rule



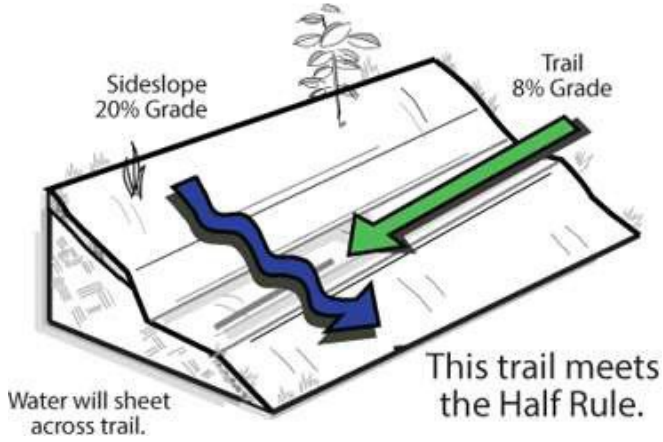
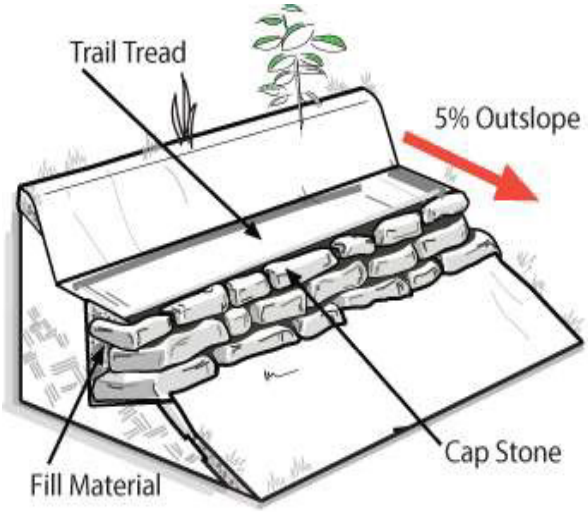
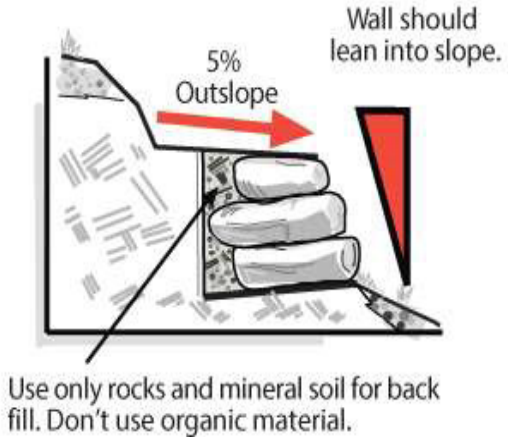


Figure 6: Typical MPOS Design for Natural Retaining Walls





Source: Trail Solutions: IMBA

Design Considerations & Guidelines

Asphalt is the most widely used surfacing for paved trails in the Albuquerque area, due primarily to its lower cost, and ease of installation and maintenance. It also offers a smooth surface, if installed correctly, and holds up relatively well over time, since it is not subject to the degree of frost heave or other environmental degradation often encountered in harsher climates.

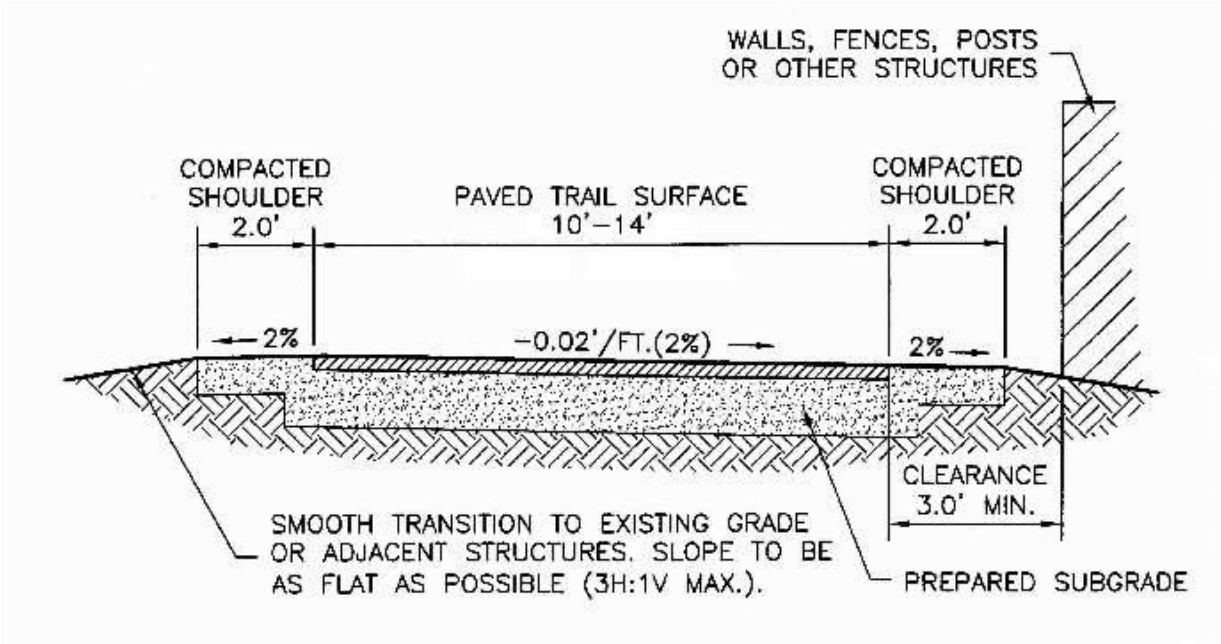
Concrete is also commonly used for trail surfacing, although less so in Albuquerque than other locations. The primary benefit of concrete is its longevity and smoothness, resulting in reduced maintenance requirements and associated long-term costs. However, its initial installation cost often outweighs the long-term benefit of a concrete surface; especially here in Albuquerque where geographically it is vastly sprawled out and hundreds of miles of trail are needed to adequately connect the City together. Other perceived problems with concrete include the rigidity of the surface (runners usually prefer the flexibility of asphalt) and the somewhat large spacing of the required construction and crack-control joints (esp. for skateboards). These complaints can often be overcome by providing an adjacent soft- surfaced trail for runners, and using saw-cut control joints, rather than tooled joints, in concrete that create a tighter gap.

Environmentally-friendly variations on traditional pavement are also becoming more readily accepted and available. One such variation involves the use of recycled materials (such as shredded tires, plastic, or even crushed glass) in place of a portion of the normal stone aggregate in asphalt or concrete. Another removes the “fines”(smallest components) from the mix aggregate to create a porous pavement, which enables water to pass directly through the pavement and infiltrate into the ground below, thus minimizing runoff. Other alternatives which are gaining acceptance as naturalistic, yet stable trail surfaces involve the use of organic or synthetic binders to form pavements using native soils or other decorative materials; and even the use of brick or concrete pavers. While the use of alternative surfacing may be appropriate in certain circumstances, some of these materials may have limited application for urban trails, due to potential deterioration and/or unevenness of the surface. In any case, sound engineering judgment should be used in determining suitability of materials for trail use on any given project.

Trail Dimensions

Trails should be of sufficient width to accommodate expected numbers of users without excessive interference. Side slopes and clearances from adjacent obstacles should be designed to minimize danger to cyclists who may inadvertently stray from the paved surfacing. Shoulders should provide a stable recovery surface in those instances. Railings (addressed later) may also be used to keep trail users from leaving the paved path, and may be placed within the 2’-3’ clear (recovery) zone illustrated below. Refer to the AASHTO Guide for additional information not addressed here.

Figure 7: Paved Trail Dimensions and Clearances



Shared-use paths should be constructed according to this design manual and to the AASHTO Guide for the Development of Bicycle Facilities when and where feasible. Shared-use paths will be designed according to American with Disabilities Act (ADA) standards when a Federal ruling is adopted by the Access Board. In the meantime, trails (paths) will be constructed using the best ADA practices as adopted through the "Public Rights of Way Accessibility Guidelines" (PROWAG) when and where possible. 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. Parks and Recreation is currently (started in 2013) auditing all paved trails for ADA compliance. Once the audit is completed, the report will show how many miles of trail and which trails can be utilized by people with disabilities.

Design Considerations & Guidelines

Shared-use paths serve cyclists and pedestrians and provide additional width over a standard sidewalk. Facilities may be constructed adjacent to roads (side paths), 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 should 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. However, sometimes right of way restrictions hinder the possibility for a vertical or horizontal barrier. It will be determined the engineers, designers, and planners if the benefits of having a trail outweigh the risks when the ROW is constrained.

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 and way finding signage 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.
- Providing, where possible, a soft surface shoulder adjacent to paved surfaces for use by joggers and equestrians.

Trails should be of sufficient width to accommodate expected numbers of users without excessive interference. Side slopes and clearances from adjacent obstacles should be designed to minimize danger to cyclists who may inadvertently stray from the paved surfacing. Shoulders known as the "recovery zone" should provide a 2-3' stable recovery surface in those instances. Compacted base course, subgrade, or crusher fines are recommended and gravel should not be used unless the aggregate is finer than 3/8". Railings (addressed later) may also be used to keep trail users from leaving the paved path, and may be placed within the 2-3' clear zone illustrated below. Refer to the AASHTO Guide for additional information not addressed here.

Trail Alignment

Although multi-use trails are, by definition, intended for many modes of use, the design of those trails is effectively determined by only a few user groups – those with the most stringent requirements. In the case of paved trails, this presents something of a conundrum, in that the design must accommodate two sometimes-conflicting extremes. Bicycles, on the one hand, are a very efficient means of transportation, capable of fairly high speeds and long distances. Wheelchairs, on the other, are relatively inefficient and slow. While both have wheels, and therefore share some basic requirements in terms of surfacing, most other design requirements for the two are quite different. In order to accommodate wheelchairs which typically have shorter travel distances and may need frequent rest stops on as many multi-use paths as possible, shared-use paths will need to meet the requirements of the Americans with Disabilities Act (ADA) once a proposed ruling by the Access Board is adopted by the Department of Justice as an "enforceable standard", which currently does not exist for shared-use paths.

In contrast, AASHTO guidelines for bicycle design focus on higher travel speeds and efficiency of movement. Nonetheless, the two are not mutually exclusive. Trail designers must find the common ground between the two seemingly contradictory sets of criteria, and work within those parameters. In the simplest of terms, while the overall design of a trail facility should consider both modes, bicycles tend to dictate horizontal alignment criteria, while wheelchair requirements drive vertical alignment.

The information that follows is a summary of trail design criteria that should satisfy both ADA and AASHTO for use in the design of Albuquerque's urban multi-use trails.

Design Standards

Table 1: Maximum Recommended Running Grade Lengths

Max. Running Grade	For Distances Up To:
5% or less	Unlimited
8.33%	200 ft. with resting intervals
10%	30 ft. with resting intervals
12.5%	10 ft. with resting intervals

Defined under ADA accessibility guidelines for outdoor areas

Table 2: Minimum Recommended Curve Radii for Paved Trails

Grade	Design Speed	Min. Centerline Radius*
less than 3%	20 mph (30 km/hr)	95 ft. (29 m)
3% - 5%	25 mph (40 km/hr)	160 ft. (49 m)
greater than 5%	30 mph (50 km/hr)	265 ft. (81 m)

Assumes 2% superelevation (cross slope in direction of curve)

Table 3: Recommended Vertical Curve Radii for Paved Trails

Grade Change (Algebraic Difference)	Minimum Length for Crest Curve	Minimum Length for Sag Curve
less than 2%	None Required	None Required
2% - 4%	10 ft. (3 m)	60 ft. (18 m)
>4% - 6%	60 ft. (18 m)	160 ft. (49 m)
>6% - 8%	100 ft. (30 m)	300 ft. (91 m)
greater than 8%	160 ft. (49 m)	500 ft. (152 m)

Design Considerations & Guidelines

Grade

Trails in the urban area should be designed to provide running grades of 5% (20H:1V) or less wherever possible. If necessary, due to existing terrain or right-of-way constraints, grades up to 12.5% (8H:1V) are permissible, provided that a rest area be provided every 10 feet (77 cm) of vertical rise. See the table above for running grades and recommended resting intervals. Such rest areas may be integral to the trail (i.e. a landing with a maximum grade of 2.03% at least 5 feet in all directions of the landing pad), or, with approval of the City's project manager, may be offset alongside the trail, to provide a more even surface for bicycles

and other faster-moving uses. The table above lists recommended maximum distances for various trail grades under the current most stringent ADA guidelines for outdoor recreation areas. It should be noted that the natural environment terrain and grade may prohibit ADA compliance. This is allowed as long as the entire system or trail network has a certain amount of ADA-accessible trails located throughout the City. In addition, the standards may be waived where compliance would cause "substantial harm to cultural, historic, religious or significant natural features or characteristics."

Horizontal Curves

Many factors, including design speed, tire friction, lean angles, sight distances, and braking capabilities, are involved in determining minimum acceptable dimensions for horizontal alignments of bicycle facilities. These are covered in detail in the AASHTO Guide [pp. 37-46]. By default, facilities that are designed to facilitate the turning movements of two-way bicycle traffic would easily accommodate the spatial requirements of wheelchairs and other slower modes of travel. However, the same is not true for vertical alignment. It is, in fact, difficult to separate horizontal and vertical alignment criteria, so the designer should carefully weigh the impact that any changes to one might have on the other. As can be seen in the tables in the Design Standards below, the grade selected for a vertical alignment affects design speed, which in turn affects the minimum turning radius.

Curves sharper than those in the tables above may be necessary in circumstances of limited right-of-way or other physical constraints. If so, such curves should be identified by solid centerline striping and warning signs per the MUTCD.

Vertical Curves

Vertical curves are used to make a smooth transition at changes in trail grade. This issue comes most sharply into focus in the design of ramps that meet the letter of ADA requirements, but also must serve bicycles. The typical alternating 30-foot, 12:1 (8.33%) ramp and 5- to 10-foot level landing configuration (often seen on bridge approaches and other areas of significant grade change) makes for abrupt transitions and runs contradictory to the 30 mph design speed recommended in the AASHTO Guide for such grades. Adding at least a short vertical curve at each change in grade will provide a much smoother travel surface, and lessen the potential for accidents by minimizing the chance of bicycles (and even some other modes of wheeled use) becoming airborne.

The most recent AASHTO Guide provides tables listing minimum lengths of Crest Vertical Curves (e.g. over the top of a hill) but no longer provides that information for sag curves (e.g. at the bottom of a valley), stating only that the minimum length of a vertical curve should be one meter (3 ft.). The previous (1991) AASHTO publication did not differentiate between the two types, offering a single graph [p. 29] that presented minimum lengths for any vertical curve based upon grade differential and design speed. The current differentiation is due to the fact that crest and sag curves are governed by different criteria. While crest curves can occur either at the top of a hill or in the middle of a slope, in both cases approach speeds are generally slower than exit speeds. Nonetheless, stopping sight distance (the distance that the trail surface is visible ahead) is usually the primary concern, since the slope is breaking away from the user. Sag curves represent the opposite conditions, and usually see the highest speeds on the approach to the grade change. Visibility is rarely an issue; instead, user comfort and ease of negotiation (due to resultant "G" forces) are the main criteria. So while the AASHTO guide has relaxed its recommendations for vertical sag curves, the resultant abrupt change in some instances might make for uncomfortable riding conditions for cyclists. In lieu of the 3' minimum requirement, the table above suggests vertical curves which will make for a more pleasant trail experience.

In general, vertical curve grade transitions should be designed to provide as gentle a transition as possible, given the physical constraints of a site. The table above provides suggested lengths of vertical curves for various conditions, based on 2% increments in grade change. These numbers are generalized and should provide acceptable results in most cases; however, if more detailed information is required; please refer to the current AASHTO Guide.

As with horizontal curves described above, there will undoubtedly be instances when such lengths cannot be achieved in designing vertical curves. In the case of the accessible ramp design described above, provision of even a short vertical curve at each grade transition will permit easier negotiation by bicycles.

Figure 8: Crest Curve

Figure 9: Sag Curve

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 "sidepath" 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.

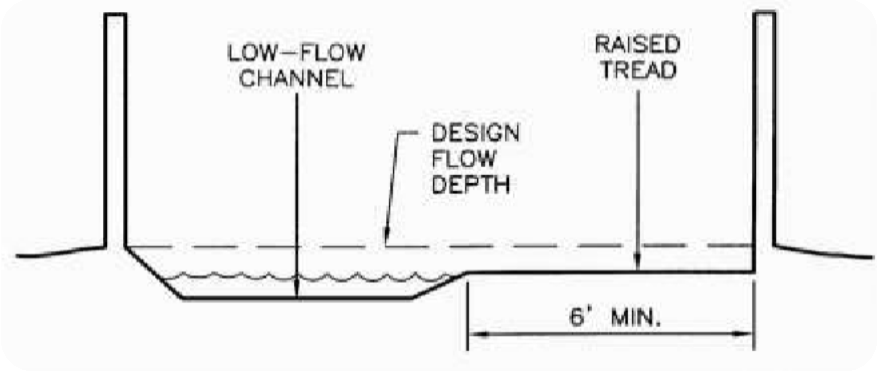
Guidance

Please see the DPM and the discussion on "Sidepaths" for further guidance.

Drainage

Since many trails follow drainage features (e.g. arroyos or ditches), they often must address not only drainage issues related to the trails themselves, but also accommodate runoff originating elsewhere. In fact, "neighborhood access" to a trail is often provided via wide rundowns which carry storm water from adjacent streets into shared arroyo/trail corridors. This is not a desirable configuration. Both the water itself, and the silt and debris which invariably accompany it, make for potentially hazardous trail conditions. Instead, parallel facilities should be provided which keep the trail access separate from the drainage way, or the trail access tread can be elevated six to eight inches above a low-flow channel within the rundown. Likewise, when trails cross drainage rundowns along the edge of a channel, the drainage flow should be routed under the trail, rather than across it.

Figure 10: Neighborhood Trail Access via Shared Drainage Rundown



Design Considerations & Guidelines

In general, drainage design for trails does not differ greatly from drainage design for roadways. Nonetheless, a few key principles should be highlighted here:

- Trail surfaces should have a 1% to 2% cross slope, and uniform surface planarity (no depressions or "bird baths") in order to prevent water ponding on thetrail;
- Interception ditches should be provided on the uphill side of trails which traverse slopes or hillsides, to prevent runoff from washing sediment onto the trail;
- Drainage grates or other structures should be sized and/or located so as not to interfere with trail traffic (narrow bicycle tires in particular).
- Culverts should be sized adequately to passexpected flows and allow for easy maintenance, including removal of debris. Minimum culvert size should be 12" diameter; 18" diameter is preferred for maintenance purposes.

Shared Use of Drainage Facilities

In recent years, the shared use of drainage channels for underpasses beneath major roadways has become more commonplace in the Albuquerque area. Trails are most often accommodated through such crossing by creating a notch in the side of the channel, with ramps leading in and out of the crossing.

Albuquerque has significant opportunities to develop trails along drainage ditches.

Less frequently, suspended platforms have been mounted on the side of the channel where adequate flow capacity exists. The notched configuration, while significantly more expensive, is generally preferred by drainage authorities because it does not impede the flow of water in the channel, and, in fact, increases the channel cross section (and carrying capacity) at the bridge crossing. The figures below show possible configurations of such a crossing, based upon the depth and capacity of the channel at the crossing.

Figure 11: Trail Underpass Notched Into Side of Channel

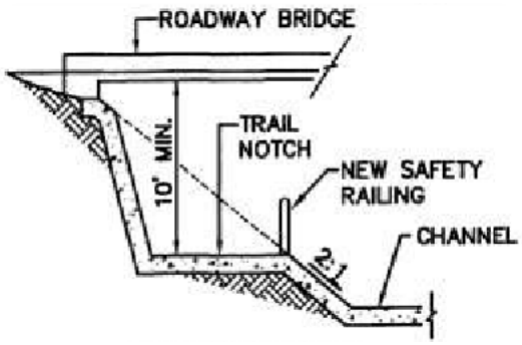


Figure 12: Depressed Underpass for Low Bridge Clearance Condition

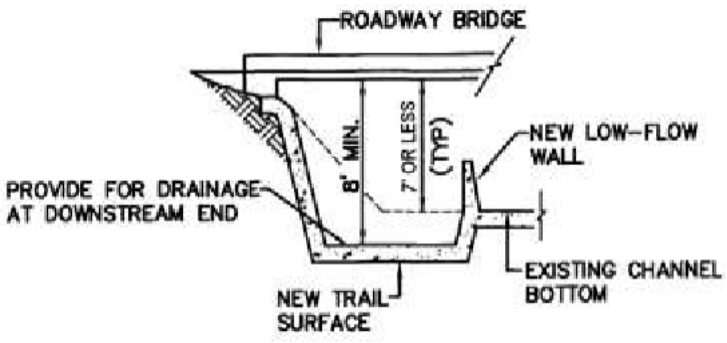
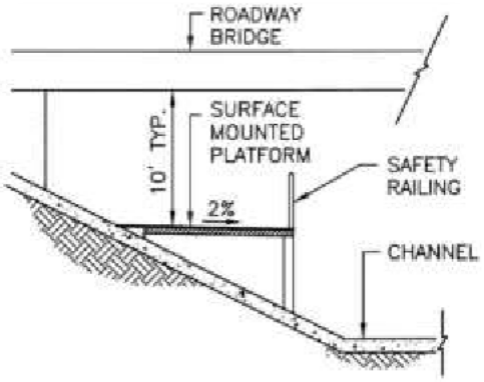


Figure 13: Trail Underpass Attached to Channel Surface



One of the primary concerns about placing trail crossings within major drainage channels lies in the fact that users are essentially directed into a potentially dangerous situation, where storm runoff may inundate the trail. Although the probability of such an occurrence would be quite low at any given time, it is nonetheless a valid concern. The potential hazard of such a crossing can be greatly decreased through the following actions:

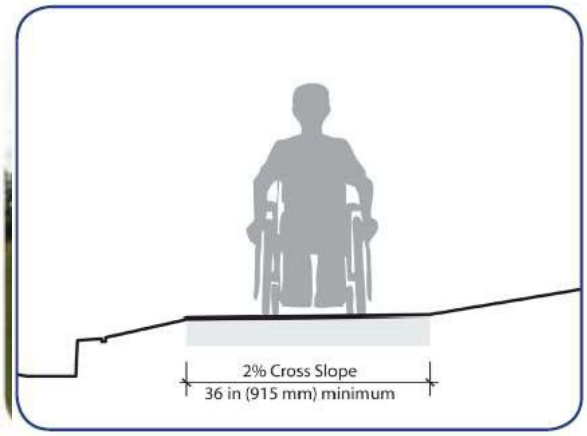
- Provide hand railings at the edge of the trail surface, in accordance with the Access Control section below.
- Post signs at either end of the crossing warning users not to enter the underpass if water is present or flowing across the trail surface.
- Provide alternate, at-grade crossing opportunities for times when the trail crossing may be flooded.
- Design notch configurations to keep the trail surface above the nominal “10-year design flow” depth, and such that inundation of the trail would be minimal for a “100-year” flood event.

If trail users heed the second guideline above, the last one would not be much of an issue. However, the fact remains that common sense does not always prevail, or that a trail user might unintentionally end up in such a situation (e.g. brake failure or other unforeseen mishap). While no national standard exists for acceptable flow depth across a trail, depths of greater than one-foot should be viewed as the maximum allowable condition. Any deeper, and stormwater flows begin to obscure the railing at the trail edge, limiting or eliminating the benefit it should provide.

Trail Accessibility

Design Standards

- 3 feet minimum clear width, where less than 5 feet, passing space should be provided at least every 100 feet.
- Cross slope should not exceed 2 percent where and when possible.
- Curb ramps shall be provided at roadway crossings and curbs. Tactile warning strips and auditory crossing signals are recommended along with any other mandated ADA street crossing criteria.



ADA clearance requirement.

Running slopes typically should not exceed 5%. However, certain conditions may require the use of steeper slopes for grade separated crossings.

- 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.

Bo tra Shared-use paths surfacing materials affects which types of users can benefit from the facility.

Design Considerations & Guidelines

- General guidelines have been created inresponse to the ADA for accessible trails.
- FHWA. (2001). Designing Sidewalks and Trails for Access, Chapter 14: Shared Use Path Design, Section 14.5.1: Grade. www.fhwa.dot.gov/environment/sidewalk2/sidewa lks212.htm#tra2
- Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas Final Report, (1999). www.access- board.gov/outdoor/outdoor-rec-rpt.htm

Access Control

Access control devices are intended to minimize the potential for trail user conflicts by restricting vehicular access to trails or serving as barriers from dangerous conditions. Access control measures can include, but are not limited to, railings, fences, gates, and bollards or guard posts. Landscaping and/or natural features can also be used effectively for access control in some settings. Each type of access control has its place, as indicated in the Design Guidance below.

Design Standards

Bollards/Guide Posts

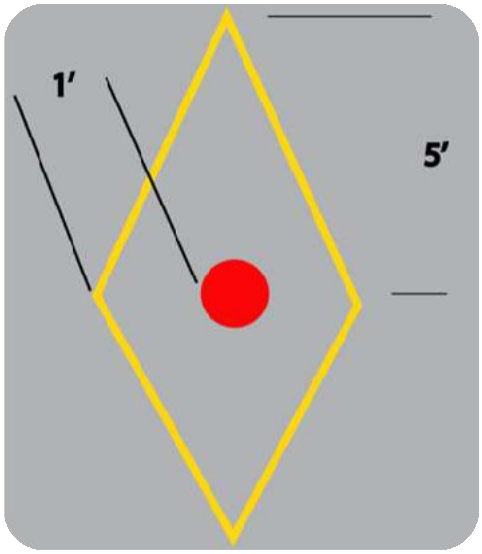
Bollards should only be used or installed in areas where it is likely a vehicle will mistake the trail for a possible vehicular road or where there have been documented claims that vehicles have been driving on the

trail. Bollards have become more of a hazard to trail users than users being run over or into by illegal vehicle trespass on multi-use trails.

Therefore, bollards should be installed on an as needed basis rather than adding them to every project and crossing of streets. When determined they are needed, access control bollards may be made of any number of materials, including but not limited to: wood, concrete, plastic (PVC), or steel, as appropriate to a particular setting. Sizing should be appropriate for both maximum visibility and as a visual deterrent to motor vehicles. Surfaces of the bollard should be relatively smooth, with no protruding objects to snag on clothing or appendages of passersby. Selection of bollard materials is less important than their placement. If deemed necessary for a particular trail access point, bollards should be placed only in the center of the trail and (if additional protection is necessary), at either edge. For a typical ten- foot trail, this would result in two five-foot-wide accessible openings on either side of the trail centerline. In specific situations where ATV access must be addressed such as within AMAFCA facilities, bollard spacing may be reduced to provide a minimum 36”-wide clear opening on either side of the trail centerline. This will permit wheelchair access, but exclude all but the smallest ATVs (and motorcycles). Bollards should be brightly painted and reflectorized for greater visibility, especially in low light conditions.

A specific diamond shaped stripe shall be placed around center bollards per AASHTO. If maintenance and emergency vehicles are expected to gain access via the trail itself, access control bollards should be designed for easy removal or collapse. Otherwise, gates should be provided in adjacent fences or railings to permit such access. Consultation with local authorities is advised in such situations. Although AMAFCA currently requires 36-inch maximum spacing on bollards, the proposed PROWAG standards will require 48-inch spacing. A minimum of 48-inch spacing is required to pass certain types of cycles for ADA use such as those that have parallel seating and are over 36 inches wide.

Figure 14: Typical Striping around Bollard



Following is a list of best practices that should be consistent when installing bollards at any trail facility by the City of Albuquerque:

- Only apply bollards if the need is demonstrated, or if the trail entrance cannot be designed or modified to discourage use by unauthorized motor vehicles. Bollard use should be reserved for problematic locations.
    - Bollards should not be installed on trail facilities that parallel a roadway unless it is identified as a problematic location.
    - Bollards should be considered along obscured facilities that are not readily visible and at other problematic locations.
- All bollards should be made of a retro-reflectorized material or have retro-reflectorized tape affixed to them for easy visibility from both approaches to the bollard.
    - Where possible, retractable bollards should be implemented. Appropriate usage ensures that the bollards will remain in place and cannot be removed from the site and when retracted, the bollard will not be a hazard as there is no "collar" that sticks up when the bollard is removed due to this type of bollard retracting into the ground rather than coming off.
- Bollards should be 40 inches in height (minimum) and 4 inches (minimum) in diameter to ensure visibility but short enough to not interfere with handlebars on cycles.
    - In most instances, a single bollard should be placed at the centerline of the trail, where adequate sight distance is available.
- An even number of bollards shall never be used as they typically will be placed in the center of the travel way for each travel direction and they tend to direct users into each other causing confusion.
- If it is necessary to restrict access adjacent to the multi-use trail to restrict motorized traffic, bollards should be placed a minimum of 2-feet off of the edge of the trail.
- A minimum clear width of 5 feet should be provided between the edge of trail and the edge of the bollard.
- A striped envelope (4 inch wide, retro-reflective yellow "diamond") should be striped around the bollard to provide guidance to divert users around the bollard. A striped yellow centerline should also be provided along the trail for 25-feet on either side of the bollard.
- Bollards should be set back 30-feet from the roadway to separate the conflict point for users between the roadway and bollards, or as far back as is practical based on site conditions.

These recommendations are consistent with what the Parks and Recreation Trails Planner drafted in 2012 and a draft paper developed by the Greater Albuquerque Recreational Trails Committee (GARTC) as well as ideas coming from a coordination meeting held July 22, 2013. Standards to ensure consistent application should be implemented by all departments of the City of Albuquerque. Every trail and entrance are unique and special consideration will need to be given to each site to determine how best to place bollards, if the need for bollards is demonstrated.

Design Considerations & Guidelines

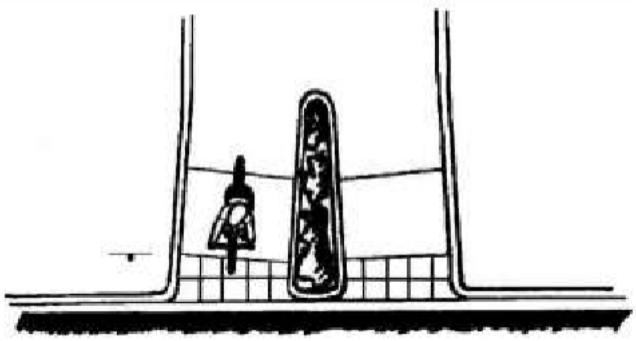
In recent years, the use of bollards as trailhead access control has become the subject of some debate. Posts or bollards have commonly been used to restrict vehicular access at roadway intersections. In addition, they serve a secondary purpose of warning trail users of the upcoming intersection. On the other hand, bollards also present obstacles for trail users to negotiate, and therefore become potential hazards, particularly in times of low visibility. While there is not yet consensus on the issue, it is increasingly held that in older, established areas of the city, where people are familiar with the existence of non-vehicular trails, bollards may no longer be necessary.

Trailhead access control can also take other forms beyond the use of posts or bollards. An attractive alternative might involve dividing the trail into two one-way paths, half the width of the total trail, with a

landscaped median or other central barrier (**Figure 51**). The resultant one-way paths are generally narrow enough to discourage vehicular access, while better defining trail movements. The trail could also be divided around power poles or other existing features in order to eliminate the need for adding bollards. This configuration works particularly well with traffic signal poles that incorporate user- activated crosswalk signals.

At the same time, it should be acknowledged that bollards or medians by themselves do not serve as effective deterrents to trail access by motorcycles and smaller all-terrain vehicles (ATVs), which can be a significant nuisance in some areas, while also being illegal per City Ordinance. Some years ago, a common solution involved the placement of specially-designed bicycle gates or wheelchair-accessible chicanes across trails to exclude such vehicles. Today, however, the consensus seems to be that such measures are more of a nuisance for legitimate users; especially bicyclists. Instead, enforcement and user vigilance seem to be fairly effective at keeping unauthorized uses to a minimum, at least on more heavily-used trails.

Figure 15: Divided Trail Access with Median



Fencing & Railings

Design Standards

The figure below provides criteria for appropriate application of various railing types.

Figure 16: Railing Warrants

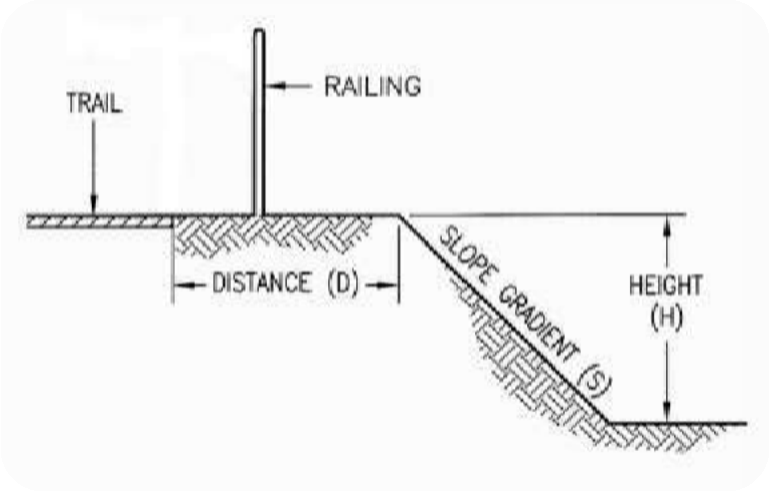


Table 4: Slope Gradient by Distance

DISTANCE (D)	SLOPE GRADIENT (S)	HEIGHT (H)	RAILING TYPE
10' or further	any	any	**None**
5'-10'	3H:1V or flatter	any	**None**
5'-10'	3H:1V to 1H:1V	12' or more	**2-Bar**
5'-10'	1H:1V to vertical	6' or more	**2-Bar**
5' or closer	3H:1V to 2H:1V	6' or more	**2-Bar**
5' or closer	2H:1V to 1H:1V	4' or more	**2-Bar**
3'-5'	1H:1V to vertical	1.5' – 4'	**4-Bar / 6-Bar**
3'-5'	1H:1V to vertical	4' or more	**Barrier**
3' or closer	**1H:1V to vertical**	**1.5' or more**	**Barrier**

Design Considerations & Guidelines

Railings

Protection railings should be used in situations where trails cross, or are adjacent to, drop-offs, steep slopes, hazardous drainage facilities, or other conditions where the trail user would be ill advised to leave the trail.

Railings usually take the form of two-, four-, or six-bar steel pipe railings, depending on the severity of the conditions behind the railing. In cases where extremely hazardous conditions exist along a trail a barrier railing should be used. Barrier railings are those with spaces of six inches or less (or three inch, maximum, openings to comply with U.S. Consumer Product Safety Commission (CPSC) guidelines near playgrounds or other areas frequented by small children). Railings are preferred over fencing in such situations because steel pipe is inherently stronger than most fencing. Railings also present a smoother surface than fencing, which often facilitates recovery if a cyclist wanders off the trail (i.e. brushing against a railing would typically be less catastrophic than catching a handlebar end in a fence mesh).

Post and wire fence.

Open boundaries can be used where users may be entering or existing the trail.

Fencing

Fencing along trails serves two purposes: access control and/or screening. Access control fencing usually consists of wire mesh (e.g. field fence), multiple individual wire strands (high-tensile fencing), or simply a single strand of cable suspended between posts (the aptly named "post-and-cable

barrier"). Screen fencing, on the other hand, can be comprised of a wide range of materials, but should conform to three main criteria:

- Screen fencing should not be totally opaque; rather it should provide for limited or indirect visibility to and fromthe trail corridor (e.g. offset "shadow-box" pickets).
- Materials should be strong enough to withstand impacts from trail users in the event of unintentional contact (for instance, vinyl fencing, while decorative, may not be capable of supporting a horse, or even a cyclist, if the fence is hit with any force).
- Fencing along trails should not contain any sharp edges or corners which could serve as snag points or otherwise cause injury to trail users.

Managing Multiple Users

Trails that experience high levels of use, particularly by a variety of user types, may become overcrowded and undesirable for some users. The City should consider widening a high-use trail where feasible; otherwise, treatments such as separating bicycle and pedestrian areas, pavement markings and etiquette signs can improve sharing the trail.

Centerline striping encourages trail users to provide space for other users to pass.

Design Standards

- Stripe a centerline. See guidelines below for specifics.
- Separate bicycle and pedestrian areas where feasible.
- Barrier separation – vegetated buffers or barriers, elevation changes, walls, fences, railings and bollards.
- Distance separation – differing surfaces.
- Install Park & Recreation Department typical trail etiquette signage, the "yield to" sign.
- In Major Public Open Space areas, trailheads should have regulation signage as well as the Open Space Division's trail etiquette or "yield to" signage.

Albuquerque uses guidance signage to encourage multiple users to share trail facilities.

Design Considerations & Guidelines

Centerline striping shall be used to encourage users to stay on a particular side of the trail. Use of thermoplastic material shall be used. The line shall be colored yellow and dashed using 3 foot long skips and 9 foot spacing between dashes. Refer to AASHTO for recommendations when solid center stripes should be used such as on turns or curves. Centerline striping is particularly beneficial in the following circumstances:

- For heavy volumes of bicycles and/or other users,
- On curves with restricted sight distance, and
- On unlighted paths where nighttime riding is expected.
- Differing surfaces suitable to each user group foster visual separation and clarity of where each user group should be. A dirt track can draw runners, equestrians,

and walkers to reduce conflicts with cyclists. When trail corridors are constrained, the approach is often to locate the two different trail surfaces side by side with no separation.

The MUTCD contains information about centerline striping.

Equestrian Facilities

Design Standards

Width

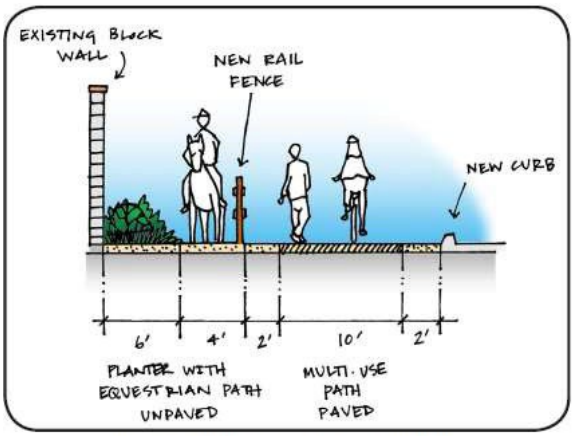
- 5-6 feet in low (rural) development
- 8-12 feet in moderate to high development

Lateral Clearance

- A 3 foot or greater shoulder on both sides.

Overhead Clearance

- Clearance to overhead obstructions should be 10 foot minimum, with 12 feet recommended.



Recommended design for a multi-use path that accommodates equestrians.

Design Considerations & Guidelines

With a multi-use trail system, planners and designers should always work to incorporate facilities that will accommodate all trail users whenever possible and feasible. Equestrians often are not thought about when designing in more urban trail areas. With an ever growing and interconnected trail system that extends from rural to urban, equestrian design should always be incorporated. Specifically, a bridge or tunnel should be expected to be used by equestrians and additional criteria should be taken into consideration:

Example multi-use equestrian trail.

- Overhead clearance is particularly important to accommodate both horse and rider. Ten-foot clearance is a minimum (twelve feet is preferred) without requiring the rider to dismount or duck.
- Horses may be frightened by the sound and motion of traffic beneath them, which could, in turn, result in injury to the rider. Therefore, equestrians tend to prefer underpasses to bridges. (However, adequate sight distances are critical. Poorly designed underpasses can also be dangerous, if, for example, a fast-moving bicycle suddenly appears within the confines of a narrow tunnel.) If a bridge is the only alternative for an equestrian crossing, solid side walls or other screening should be provided for at least three feet up from the bridge deck to minimize visibility of traffic below.
- Trail etiquette signs are triangular and look like yield signs and should be placed throughout the trail system/network. These signs help to educate trail users understand who has the right of way when approaching and passing each other. The sign is typically made to be 24 x 24 inches in size.

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, crusher fines 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 percent for short distances (up to 200 feet), 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 percent 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 to 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 percent, add 6-12 inches of extra tread width to help enhance safety and user comfort where possible.

- USDA/FHWA Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds.

Signage

Development of a consistent signage system is an important element in the creation of a unified and recognizable trail system in metropolitan Albuquerque. Signage can be grouped broadly into two categories: regulatory and informational. Regulatory signage includes warnings, regulations, and directives applicable to trail use in general (Stop, No Motor Vehicles, Trail Etiquette, etc.), while informational signage would refer to a signage package specific to a particular trail and location, providing information such as the trail name (especially at designated trailheads), connections to other trails or facilities (through maps or directional arrows), and distances to key destinations. In an effort to expand trail accessibility, these signs also often include information such as trail length, grades, cross slopes, and obstacles which may be encountered (see Trail Difficulty Rating System).

Figure 10b - Bike Facilities map

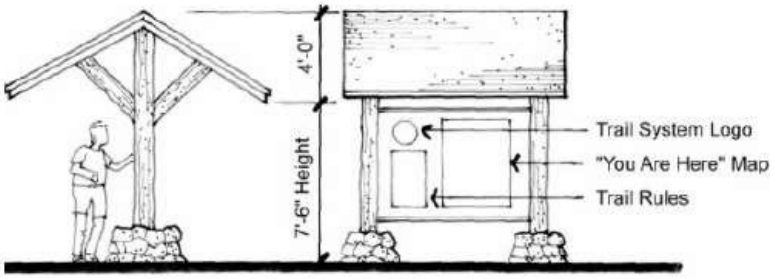


Figure 10 c- Example of a trail information kiosk

Design Considerations & Guidelines

Regulatory signage should be placed where most visible and effective, and should be grouped, where practical and appropriate, to minimize the number of posts (potential obstacles). In some cases, free-standing signs may be replaced by pavement markings, for the same reasons. (A specific example

would be to replace “Stop Ahead” signs with the same message painted on the trail surface. See Pavement Markings discussion below.) Sizing and placement should be in accordance with the most recent version of the Federal Highway Administration’s Manual on Uniform Traffic Control Devices (MUTCD) Part 9, Bicycle Facilities. However, the City Parks and Recreation Department has developed a few signs that will give Albuquerque’s paved multi-use trail network its own sense of community and style.

Trail signage has been designed with a standardized mounting system and graphic medium which can be easily modified or replaced as the trail system grows. Using the same design scheme throughout the entire Trail Network will help users understand that the network is a large system. For example, if you are on a trail on the west side of the City and see the specific green/blue general regulatory/informational sign, you will also see this same sign on a trail that is part of the network on the east side of the City. However, creativity and customization of trail-specific information signage is encouraged in addition to having the “network specific” regulatory signage in order to develop individual identities for each trail facility.

Pavement Markings

In general, pavement markings supplement or reinforce the regulatory signage, and are comprised of striping, text, and/or stenciled figures. Centerline striping shall be used to help define directions of travel or separate different user groups on multi-purpose trails and be yellow per AASHTO’s recommendations, while solid white edge striping gives trail users visual reinforcement of the limits of the trail surface, which is particularly valuable in low light conditions (especially if a potentially hazardous condition exists beyond the edge of the trail). Text is generally intended to convey warnings of changing conditions ahead, although it is sometimes used in place of or in addition to vertical regulatory signage (such as “Yield” signs). Figures usually take the form of arrows or other symbols, or may be used to designate portions of the trail for different modes of travel.

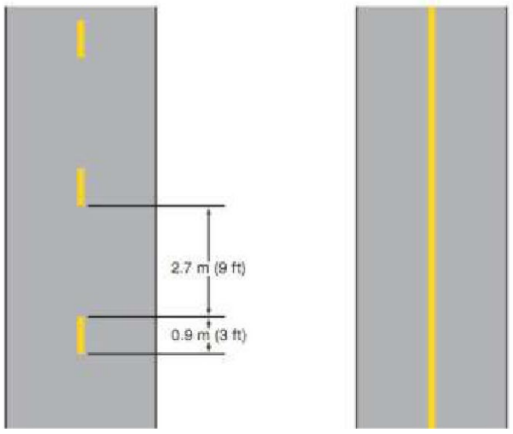
Design Considerations & Guidelines

Striping along a trail should be consistent, as any change in color, thickness or width can be perceived as an indication of an expected change. An example of this would be changing from dashed to solid striping on sharp curves which require cyclists to slow down (as described in the Trail Alignment section above).

Placement of text on the pavement, rather than on post-mounted signs, can reduce potential vandalism and/or graffiti targets; however, they are more easily overlooked, and are easily obscured by snow or wind-blown debris. Therefore, critical signage such as “Stop” signs should still be provided on posts alongside the trail.

Both AASHTO and MUTCD provide additional guidance on striping trail facilities.

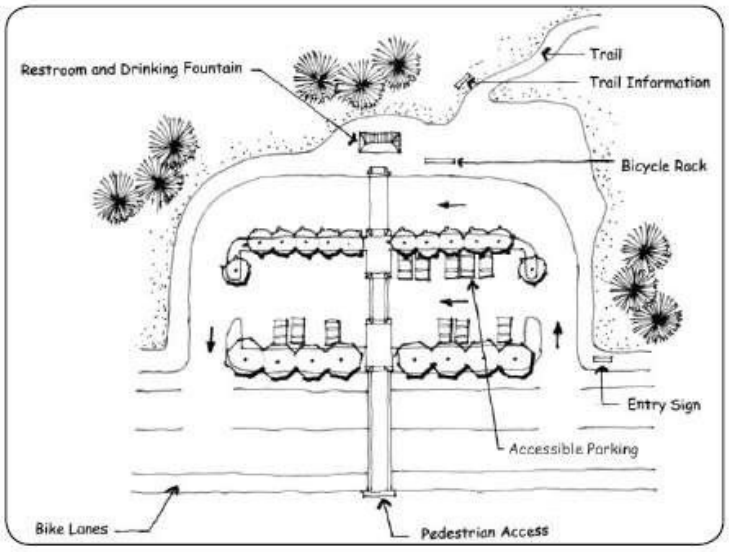
Figure 17: Examples of Centerline Markings for Trails



Trail Heads & Amenities

Trailheads

Major trailheads should include automobile and bicycle parking, trail information (kiosks including maps, user guidelines and regulations, wildlife information, etc.), garbage receptacles and if possible on a location by location basis; restrooms and water fountains. Minor trailheads can provide a subset of these amenities.



Example major trailhead.

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.

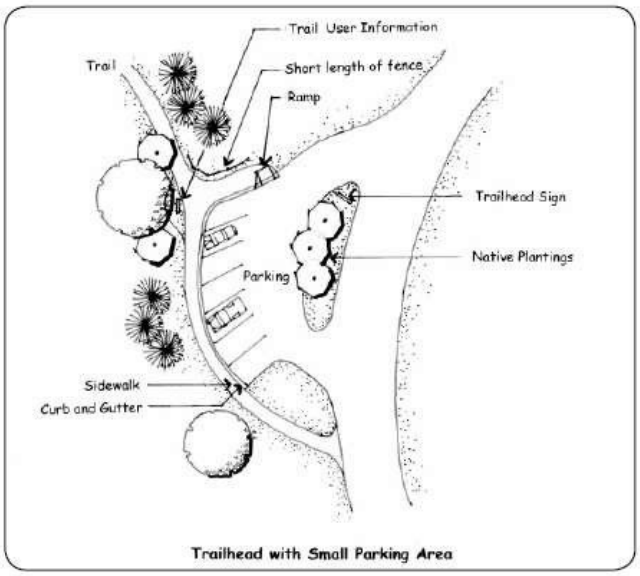
All areas of newly designed or newly constructed and altered portions of existing trails connecting to designated trailheads or accessible trails should comply with the most recent and stringent ADA regulations. However, the guidelines do recognize that often the natural environment will prevent full compliance with certain technical provisions. The accessibility audits that the Parks and Recreation Department is working on that started in 2013 will provide an idea of what needs to or can be done to help make trail heads more accessible if and when possible.

Design Considerations & Guidelines

- AASHTO Guide for the Development of Bicycle Facilities. Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas.

Trailhead Parking

One of the City's goals is to provide a trail network which offers ready access to and from all parts of the city, thereby enabling a reduction in automobile usage. Nonetheless, due to gaps in that developing system, as well as simple human nature, the fact remains that many people do, and will continue to use vehicles to get to the trails. As a result, it is necessary to provide parking wherever possible at trailheads and other major access points along the City's trail network.



Example minor trailhead.

Design Considerations & Guidelines

At a minimum, parking should be provided for cars, with additional spaces provided for horse trailers at trails likely to see equestrian usage. The size/capacity of each parking area should be determined in consultation with the Parks and Recreation Department, and should be based upon projected usage of the trail. Design of the lots should follow parking guidelines set forth in the Development Process Manual (DPM). Parking lots serving accessible trails should have be designed to current ADA standards for parking lots.

Amenities

The provision of amenities such as benches and/or tables, trash receptacles, lighting, water fountains, shade structures, industrial type vandal resistant bicycle pumps, and even restrooms tends to make trail use more enjoyable, especially on longer trails. Trail-related amenities can range from minor to major, both in terms of initial installation costs and long term maintenance issues. A major trail improvement might include a restroom facility with a water fountain, as well as benches, bicycle rack, and a trash receptacle. These major amenities should typically be provided in areas with high traffic and, preferably, overlapping uses (e.g. where a trail passes through a park or other public gathering area) in order to maximize return on the investment. Minor improvements, on the other hand, might include benches (or even sitting- height boulder groupings) or trash receptacles, alone or in combination, situated at intervals along the trail. Shade structures – always welcome in the Southwest climate – and directional signage packages fall in the mid-range of the amenity scale.

Lighting may be used for visual accent, as well as providing additional security in areas of concern, such as tunnels or other isolated locations. Fixtures should be vandal resistant and should be placed where they most effectively illuminate the trail (or key features within the corridor), without shining in trail users' eyes. They should also be designed and/or located in such a way as to shield nuisance light and minimize impact on adjacent properties. AASHTO provides additional recommendations for lighting in its Guide for the Development of Bicycle Facilities. For the 50 Mile Activity Loop amenities and other information, please refer to that specific Plan.

Design Considerations & Guidelines

Development of trail amenities should follow a conscious plan whereby major amenities are grouped in nodes at key locations, while minor amenities are consistently found along the length of each trail.

Styles of amenities should be compatible with adjacent development or closely allied with other amenities found along the length of the trail, in a thematic arrangement. Materials for benches, trash receptacles, tables, and such, must be of durable materials and should be designed (or coated) for easy graffiti removal. Introduction of bicycle pumps used to inflate soft or flat tires will start in 2014. Use of recycled materials is encouraged wherever possible. Coordination with the City's Park Management Division is also encouraged during the material selection process, in order to ensure that maintenance issues are adequately addressed.

Landscaping

Design Considerations & Guidelines

Landscaping along trails typically will fall into one of two categories: revegetation or enhancement. At a minimum, disturbed land within trail corridors should be re-seeded with native grasses (and wildflowers, where appropriate) according to Section 1012 of the City Standard Specifications. Those specifications list two generic seed mixes (for sand or clay soils) which may be used city- wide, with the condition that the shrub component (four- wing saltbush, etc.) be eliminated from seeding alongside recreational trails unless more than 5 feet away from edge of trail (however, the inclusion of xeric shrubs in the seed mix may be desirable for slope stabilization in areas of significant cut or fill). As an alternative to those generic mixes, trail developers may use a more site-specific mix, specified by the project landscape architect, Planner, or in consultation with the City Open Space Division. The addition of wildflower seed to a revegetation mix will provide color and seasonal interest to the trailside, and is particularly effective where the seeding can take advantage of any available supplemental water (e.g. sprinkler overspray from adjacent properties, collected storm water, etc.). Specifically where goat heads (puncture vine) are present or a nuisance, native plants that can out-compete the goat heads should be considered.

Landscaping improves the walking and bicycling experience, and can deter vandalism.

More intensive "enhancement" landscaping may be appropriate for high use areas; perhaps at an important trailhead, through a neighborhood development, or in conjunction with a major trail amenity/improvement as identified above. The viability of such landscaping is dependent upon the availability of water and electricity (or alternative power) for an irrigation system, and the establishment of a maintenance agreement with the City Parks Department or a private entity, prior to implementation.

Regardless of the type of landscaping considered, shoulder and clear-zone requirements (as identified earlier in the Trail Dimensions section) shall be followed. Native seeding should be kept back two feet from the edge of the trail (unless it is strictly grasses), in most cases, to allow for the graded, compacted shoulders. Trees are encouraged along trails for the shade that they provide; however, they should be planted at least 6-10 feet back from the edge of trail (to maintain the three-foot clear zone at maturity), and further, if possible, to minimize root damage to the trail surface. Likewise, shrubs should be located such that their branches do not interfere with the trail as they mature. Plant materials in general should be selected for people- and trail-friendly characteristics: thorny plants, trees which tend to drop messy fruit/seeds/pods (which could affect surface traction), and heavy pollen-producers

Vancouver, B.C. has a program where neighbors adopt a traffic circle, and an annual reward is given to the most beautiful one.

should not be used alongside trails. Native, non-invasive, low water use trees whose roots go downward rather than outward are highly recommended and encouraged next to shared-use paths.

Safety & Visibility

In addition to design factors such as stopping sight distances and trail widths, trail design must also take into consideration geographical and environmental factors such as local weather conditions, location (surroundings), and visibility. There is usually a strong correlation between a trail user's sense of security and the level of visibility, both into and out from the trail. Therefore, trail designers should strive to maintain a balance between the privacy of adjacent landowners, and security concerns of trail users. Security concerns on a trail can be addressed through Crime Prevention through Environmental Design (CPTED) guidelines.

Neighborhood-friendly fencing deters trail users from disturbing private property.

Crime Prevention through Environmental Design (CPTED) 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.

Bollards and pavement change prevent motor vehicles from using the trail.

Design Considerations & Guidelines

Design considerations for maximizing visibility include location, height, and type of fencing (see Access Control section below); clear lines of sight into and through tunnels, underpasses, and bridges; elimination of blind corners at intersections and other locations; and the addition of lighting in appropriate areas.

Weather-related design consists primarily of maximizing solar orientation to minimize dangers from ice and snow accumulation. In some cases, protection from potentially gusty winds may be appropriate for open, exposed stretches of trail. Discussion of potential hazardous conditions related to storm water runoff is contained in the Drainage section below.

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.

Unwanted vehicle access

- Utilize landscaping to define the corridor edge and path, including earth berms or boulders.
- Use bollards at intersections as needed and as outlined in various bollard assessments, future policies, and AASHTO.
- Pass a motorized vehicle prohibited ordinance and sign the path.
- Create a Trail Watch Program and encourage citizens to photograph and report illegal vehicle use of the corridor. Authorized vehicles are not considered "illegal" vehicle trespass.
- Lay the shared-use path out with curves that allow bike/pedestrian passage but are uncomfortably tight for automobile passage

Rest stops should provide garbage receptacles to minimize littering.

Litter and dumping

- Post rules encouraging pack it in/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.

Emergency call boxes improve users' feelings of safety.

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.

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.

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 1/4 mile and clear directional signage for orientation.

- Create a “Trail Watch Program” involving local residents.
- Encourage proactive law enforcement on the trail.

Vandalism

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

Trails should provide frequent access points into neighborhoods.

Visibility

There is usually a strong correlation between a trail user’s sense of security and the level of visibility, both into and out from the trail. Therefore, trail designers should strive to maintain a balance between the privacy of adjacent landowners, and security concerns of trail users.

Design considerations for maximizing visibility include:

- the location, height, and type of fencing (see Access Control section);
- clear lines of sight into and through tunnels, underpasses, and bridges;
- elimination of blind corners at intersections and other locations; and
- addition of lighting in appropriate areas.

Community Involvement to Make Trails a Better Place

Creating a secure 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.

- **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.
- **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.
- **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.

- **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.
- **Adopt-a-trail Program** - Nearby businesses, community institutions and residential neighbors often see the benefit of their involvement in trail 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.
- **Trail Watch Program** - Partnering with local and county law enforcement, a trail watch program would provide an opportunity for local residents to become actively involved in crime prevention along Albuquerque's trail 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. Although this section is related to better awareness, trail watch programs do not solely need to be tied to crime prevention. Many people can report fun items in trail watch reports such as different wildlife and bird sightings and other nature specific items such as interesting native vegetation as well as where noxious weeds are located.

Multi-use Trails

Development of a consistent signage system is an important element in the creation of a unified and recognizable trail system in metropolitan Albuquerque. Signage can be grouped broadly into two categories: regulatory and informational. Regulatory signage includes warnings, regulations, and directives applicable to trail use in general (Stop, No Motor Vehicles, Trail Etiquette, etc.), while informational signage would refer to a signage package specific to a particular trail and location, providing information such as the trail name (especially at designated trailheads), connections to other trails or facilities (through maps or directional arrows), and distances to key destinations. In an effort to expand trail accessibility, these signs also often include information such as trail length, grades, cross slopes, and obstacles which may be encountered (see **Trail Difficulty Rating System**).

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.

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.

Trail Name

- Officially recognized trails should all have names. Trail names should be memorable, informative, and linked to specific trail sections.
- Names are more useful when easier to recall. In general, words are more memorable than numbers. More specific names are better than generic ones ("Sandia Crest Trail" rather than "Long Trail"). Sets of trail names should be easy to distinguish (avoid sets like "Tramway Trail", "Tramway Hills Trail,"

"Tramway Heights Trail" etc.). Using both Spanish ("Paseo de las Montañas") and English ("North Diversion Channel Trail") adds to distinctiveness and honors New Mexico's multilingual heritage (in part).

- Trail names can be useful when they provide information on trail location, trail connections and character or function of the trail. Many of the paved trails in the Albuquerque area are named for the roads or watercourses that they parallel. This helps locate where they are, but can be problematic when trails or trail sections only follow a part of a road or watercourse that runs a long distance. Names like "Mariposa Linear Park" and "Emery Trail" show links to Mariposa Basin, and the Michial Emery trailhead respectively.
- Separate trail sections should receive distinct names, even if along same road or watercourse. Sections can be distinguished by suffixes such as "east, central, west" or other appropriate divisions. Foothills trail 365 should be divided into "North" and "South" sections.

Trail direction and mile marker

- The trail names shall be posted on trail signage at street and trail intersections. Stencils on paved trails offer a defacement-resistant alternative to traditional post-mounted, eye-level signage.
- 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.
- 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.
- 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.

Trail location

- 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.

Guidance

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.

Regulatory Signs

Design Considerations & Guidelines

Regulatory signage should be placed where most visible and effective, and should be grouped, where practical and appropriate, to minimize the number of posts (potential obstacles). In some cases, free-standing signs may be replaced by pavement markings, for the same reasons. (A specific example would be to replace "Stop Ahead" signs with the same message painted on the trail surface. See Pavement Markings discussion below.) Sizing and placement should be in accordance with the most recent version of the Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD) Part 9, Bicycle Facilities. However, the City Parks and Recreation Department has developed a few signs that will give Albuquerque's paved multi-use trail network its own sense of community and style. The following are examples of what the Parks and Recreation Department has implemented since 2013.

Figure 18: Trail Etiquette Signs

Informational signage should be dealt with on a trail-by-trail basis, developing a logo or theme for each trail, and developing a signage package which reflects that theme. This package has been designed with a standardized mounting system and graphic medium which can be easily modified or replaced as the trail system grows. However, creativity and customization of the trail-specific informational package, post (or alternative mounting) configuration and thematic colors are encouraged, in order to develop individual identities for each trail facility.

Pavement Markings

In general, pavement markings supplement or reinforce the regulatory signage, and are comprised of striping, text, and/or stenciled figures. Centerline striping shall be used to help define directions of travel or separate different user groups on multi-purpose trails and be yellow per AASHTO's recommendations, while solid white edge striping gives trail users visual reinforcement of the limits of the trail surface, which is particularly valuable in low light conditions (especially if a potentially hazardous condition exists beyond the edge of the trail). Text is generally intended to convey warnings of changing conditions ahead, although it is sometimes used in place of vertical regulatory signage (such as "Yield" signs). Figures usually take the form of arrows or other symbols, or may be used to designate portions of the trail for different modes of travel.

Design Considerations & Guidelines

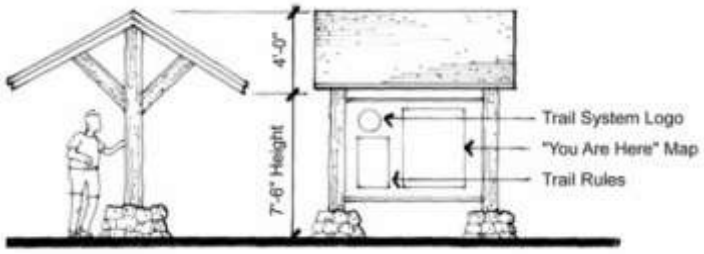
Striping along a trail should be consistent, as any change in color, thickness or width can be perceived as an indication of an expected change. An example of this would be changing from dashed to solid striping on sharp curves which require cyclists to slow down (as described in the Trail Alignment section above).

Placement of text on the pavement, rather than on post-mounted signs, can reduce potential vandalism and/or graffiti targets; however, they are more easily overlooked, and are easily obscured by snow or wind-blown debris. Therefore, critical signage such as “Stop” signs should still be provided on posts alongside the trail.

Guidance

Both AASHTO and MUTCD provide additional guidance on striping trail facilities.

Figure 19: Trail Information Kiosk



Signage Location

Trail head

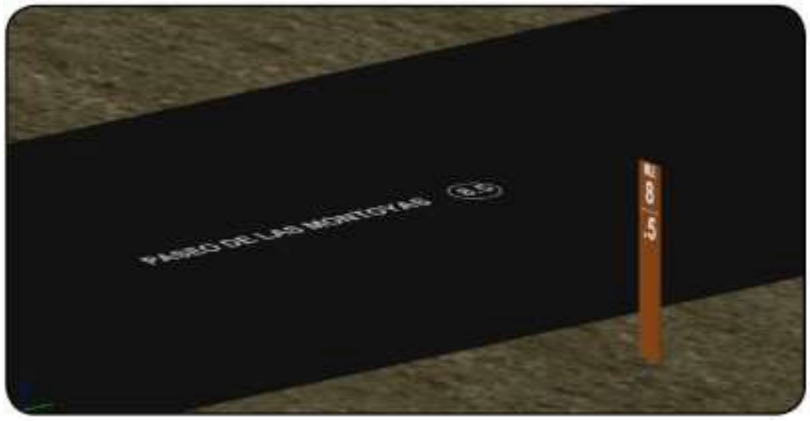
Trail head identification should be used to indicate the terminus of the trail, thus informing users approaching the trail from an intersecting trail and when users are leaving a specific trail to use another trail. The trail head can be as simple as a sign identifying the trail by name or more informative 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.

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 a 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 retro-reflective 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 the figure below.

Figure 20: Mid-trail Pavement Marking and Sign



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.

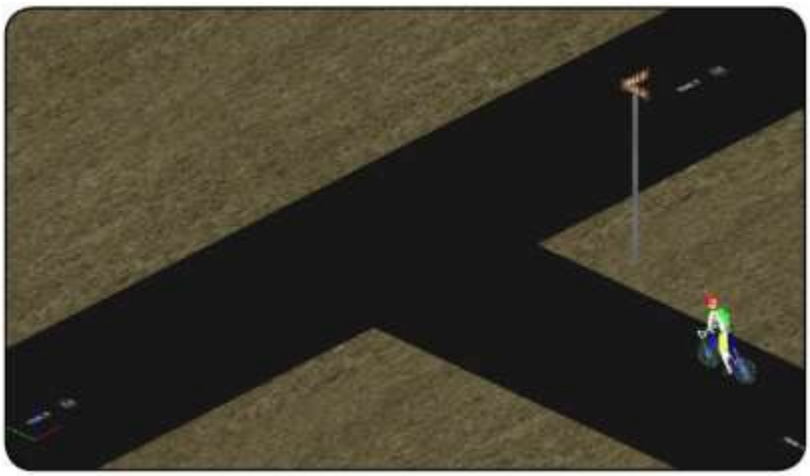
Intersection pavement marking
The street name shall be shown using retro-reflective pavement marking in 6-inch high white letters placed perpendicular to the trails centerline approximately 10 feet from the intersection. The trail name and mile marker retro-reflective pavement marking shall be placed on and parallel to the trail centerline using retro-reflective pavement marking using 4- inch high white letters and numbers and should be placed approximately 25 feet before the intersection.

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 retro-reflective 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 21: Trail/Trail Intersection Signage



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