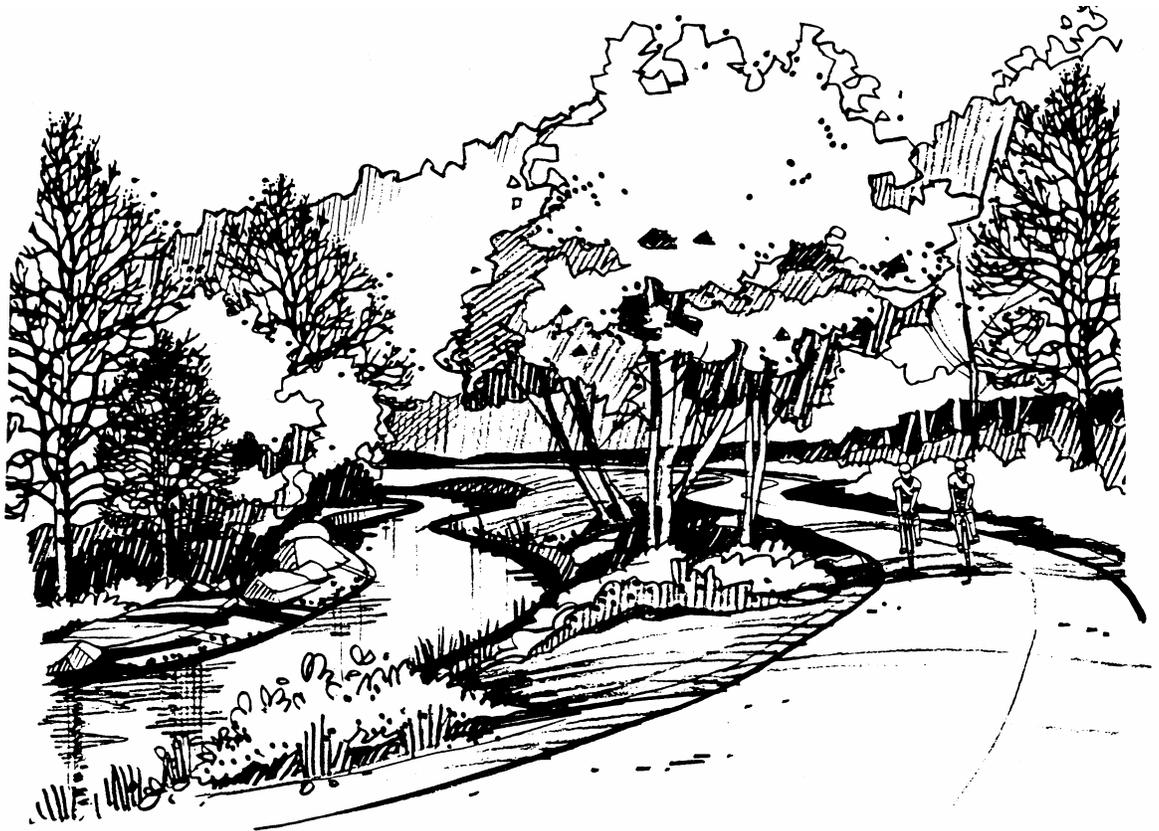


**City of Frisco
Hike and Bicycle Trail Master Plan**

Frisco, Texas



Department of Parks and Recreation

**City of Frisco
Hike and Bicycle Trail Master Plan
Frisco, Texas**

**Prepared for the City of Frisco
Department of Parks and Recreation**

Rick Wieland, Director

**Prepared by
Newman, Jackson, Bieberstein, Inc.
Dallas, Texas
15 January 2002**

***Updated by
HNTB Corporation
22 September 2008***

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SECTION I THE TRAILS PLAN

INTRODUCTION

The City of Frisco has undertaken the development of a comprehensive Hike and Bike Trail Master Plan to facilitate the movement of pedestrians and cyclists in a safe and efficient manner within the City transportation network of thoroughfares, collector streets, and open spaces. The principal goal of the planning effort was to make Frisco a bicycle and pedestrian friendly community by determining how and where to provide safe trail linkages to schools, businesses, parks and open space. The Trails Master Plan shows the potential development of a citywide, hierarchical system of trails that will achieve the goal of making Frisco a leader in the Metroplex for providing Frisco residents with safe and efficient recreational and commuter hiking and biking trails.

Executive Summary

The Master Plan document consists of the written guidelines and the trail maps. The Trail Master Plan maps show three levels of trails: Open Space Trails, On-Street Bike Routes, Off-Street Trails and walks. All Frisco Hike and Bike Trail maps included in this study are based on the City's 2006 *Comprehensive Plan*.

Plan Update

This Master Plan was updated in April of 2008 to accommodate the rapid growth occurring in Frisco and to add modifications to the Trail Plan, and to address at grade street crossings, below grade street crossings and on-street bike routes. Master plan modifications are noted in italics.

Open Space Trail System

The primary trail type or the "backbone" of the

system is the 12' wide or wider-Open Space Trail. These trails will be built in the major creek corridors identified in the City of Frisco 2006 *Comprehensive Plan*. These trails will be separated from vehicular traffic as much as possible using bridges and underpasses where the trails and streets intersect thereby reducing at-grade street crossings and facilitating the free flow of pedestrian and bicycle traffic.

The open space or greenway trails will be primarily an east-west trail system following the natural drainage pattern of the city's topography. Open Space Trails will be constructed in the corridors of:

- Panther Creek,
- Parvin Branch,
- Cottonwood Branch,
- Rowlett Creek,
- Stewart Creek, *and*
- *White Rock Creek.*

The City will be able to use land protected and set aside for open space use by the City's Subdivision Ordinance, the Major Creek Protection Ordinance (99-09-25-or as amended) and the Tributary Ordinance (01-03-25-or as amended) to route and build these trails. The Open Space Trail system will also include those trails developed by the private sector. It will be the responsibility of the City of Frisco Planning & Development Services and Park Departments to coordinate and ensure that the private sector plans have trails that connect private development to the public trail system described in the Master Plan maps.



On-Street Bike Routes

The second level of trails in the system is the On-Street bike route. Bike routes are planned on the north-south and east-west collector *and arterial* street system. Streets that are designated “**Bike Routes**” will be signed accordingly to let drivers know that they *will share the roadway with* cyclists while driving these streets.

Off-Street Trails and Walks

The third level of trails will be parallel to specific major and minor arterial streets identified on the Master Plan Map. These trails are *typically 8’ wide with a minimum width of 6’*. These “**Off-Street**” trails and walks will be within the street right-of-way or path easements and will intersect streets at the intersections requiring at-grade crossings with marked crosswalks. Off-Street trails will be, in most circumstances, separated from the traffic by a *minimum 6’ landscape or lawn area, if sufficient ROW is available*.

Off-Street trails are provided for pedestrians but will be designed to accommodate recreational cyclists. These trails are often links between the major Open Space Trails and specific destinations such as schools, offices, commercial uses and parks. These trails will tend to be more linear in layout and less serpentine than the Open Space Trails. In many instances these walks will be constructed by developers as part of their projects. Therefore, it may take several years to develop a continuous Off-Street trail system in some areas of the city. There are approximately 220 miles of Off-Street and Open Space Trails shown on the plan.



Typical Greenwalk Section

The third level of trails also includes those trails built within private commercial or residential areas. These trails usually are not dedicated to or maintained by the City, but are under the jurisdiction of the property managers, owners or neighborhood Home Owners Associations (HOA’s.) These trails are typically narrower than 10’ and serve as neighborhood connections and links to elementary schools, community centers and the City-wide trail system. Typically these trails are perceived as wide sidewalks and are not signed but are designated as hike and bike trails by the developers and recognized by the City as part of the City’s trail system. Procedures are in place in the City of Frisco Planning & Development Services and Park Departments’ approval process to facilitate the development and connection of these private trails to augment the overall hike and bike trail system.

Optimally, trails built to link schools, retail and commercial areas with residential neighborhoods should be planned so that they are part of the neighborhood’s open space system rather than wider walks adjacent to streets.

Commercial and retail development shall not treat trails as back door elements, but as amenities. Where commercial or retail development backs to a trail, or any other neighborhood amenity, there shall be adequate landscape and landform buffers and architectural screening of “back-of-house” uses such as trash and delivery areas. To minimize criminal acts along trails CPTED standards shall be followed to eliminate blind spots and focus more “eyes” on the trails. Trails shall always be considered part of the park and transportation system, not a utility, and treated accordingly.

System Identification and Recognition

One of the recommendations of this Master Plan is to have the City of Frisco become certified as a **“Bicycle Friendly Community.”** The League of American Bicyclists provides certification, public recognition and highway signs to municipalities that actively support better, safer bicycling environments within their communities.

A key part of the Hike and Bike Trail Master Plan is the graphics and sign program to educate the public regarding multiple use trails and On-Street bike routes. The Master Plan identifies the type and locations for the appropriate directional, warning and control signs and graphics for each type of trail. The recommendation of the advisory committee, the consultants and staff is that the On-Street bike routes be signed but not striped or delineated in any way on the pavement surface. Open Space Trails will be signed as shared use (multiple-use) trails for use by in-line skaters, runners, walkers, and cyclists.

Insert

POINTS OF INTEREST

- 1 FUTURE MALL LOCATION
- 2 PIZZA HUT PARK
- 3 CITY HALL
- 4 GRAND PARK
- 5 COLLIN COUNTY COMMUNITY COLLEGE
- 6 FRISCO RECREATION CENTER
- 7 DR PEPPER/ SEVEN UP PARK
- 8 STONEBRIAR MALL

LEGEND

- EXISTING TRAIL 6'-0" AND GREATER
- EXISTING SIDEWALK MAX. 6'-0"
- PROPOSED OFF-STREET TRAIL
- PROPOSED GREENWAY TRAIL
- PROPOSED ON-STREET BIKE ROUTE
- IN DESIGN OR UNDER CONSTRUCTION
- PROPOSED DART RAIL-TRAIL
- PROPOSED ADJACENT COMMUNITY TRAIL
- STREAMS
- EXISTING FISD SCHOOLS
- PROPOSED FISD SCHOOLS
- EXISTING ROADS
- PROPOSED ROADS
- PARKS
- PROPOSED BELOW GRADE TRAIL CROSSINGS
- ADJACENT COMMUNITY TRAIL CONNECTION



SECTION II

PLANNING PROCESS

The City of Frisco and Newman, Jackson, Bieberstein, Inc. began the Trails Master Plan Study in the late fall of 2000. The City invited interested citizens to participate in the planning process by serving on the Master Plan Task Force. A series of four Task Force meetings were planned to allow attendees to review path criteria and make recommendations regarding recreational needs of Frisco residents. An extensive on site visual assessment of the City was conducted, documenting the opportunities and constraints associated with the open space and street systems. The key components of the assessment included:



- Origins and destinations within the City limits of Frisco;
- Regional Destinations/Lakes, Parks, Employment Centers;
- Regional Trails-DALHOMA, Rowlett and White Rock Creek;
- Condition and design of existing thoroughfares (collector streets);
- Current and proposed land uses;
- Existing and proposed school sites;
- Existing and proposed park sites.

Following the assessment phase a conceptual routing plan was prepared and presented at three public Trail Task Force meetings that were held at the Frisco Velodrome. Information, suggestions and comments made by citizens and staff in these meetings *was* incorporated into the “Draft Plan” presented to the Park Board and City Council for their approval.

Goals and Objectives of the Trails Plan

- Provide a trail system that will enhance and provide access to the linear (greenway) park system along the major creek corridors and tributaries.
- Provide a trail system that links existing trails, uses utility corridors and future *commuter* rail corridors to complete the trail system.
- Provide a trail system that connects to adjacent cities’ trail systems as described in the “Six Cities” Trail Master Plan document and the North Central Texas-COG All-ways Trail System as well as conforming to the Mobility 2025 Plan.
- Provide access to the Rowlett Creek and White Rock Creek Greenway trails.
- Provide a system that encourages and promotes pedestrian and bicycle activities in addition to promoting cycling as a viable alternate mode of transportation in a balanced City of Frisco transportation system.
- Provide a system of trails that links existing and future schools, parks and other public facilities to the residential and employment areas within the City.
- Increase safety for both pedestrians and cyclists through the implementation of an educational and informational process to inform motorists, pedestrians and cyclists about the City of Frisco Trail System.

- Provide a barrier free environment that is accessible to all potential users including those that are physically challenged.

SIX CITIES TRAIL PLAN

The Six Cities Trail Plan (Figure 2-1) has been included in this planning document so that the adoption of this Master Plan by the City could also commit to connect and participate in the development of the Frisco portion of the trail system proposed in the Six Cities plan. City staff has reviewed the plan and provided information to ensure that the Six Cities plan included Frisco's section of the Rowlett Creek corridor trail.

PURPOSE OF THE SIX CITIES TRAIL PLAN

Park Department staff members from the participating cities first conceived the Six Cities Trail Plan in 1999. Those staff members saw the need for area cities to work together to establish a joint plan that would link the trail systems created in each individual city. The plan was created with the following purposes in mind:

- Foster inter-jurisdictional planning between the area cities.
- To further emphasize the regional transportation goals established by the governing regional planning entity, the North Central Texas Council of Governments.
- Establish key corridors as a "spine" system between the participating cities.

- Maximize the efficiency of planning funding by collaborating on an inter-jurisdictional planning effort.
- Through planning effort, establish uniform standards for trail segments so that a sense of consistency is maintained as one travels from City to City.
- Create an additional regional emphasis on trails that would allow the participating Cities to compete for regional recreational grant opportunities.

SPECIAL GOALS OF THE PLAN

Throughout the planning process, specific goals for the Six Cities Trail Plan were identified. These are as follows:

- To define specific high priority corridors that connect two or more of the participating Cities, so that these could be planned in an inter-jurisdictional manner;
- To identify and consider key crossing points between cities, so that uniform interconnecting points can be established, and so that points of intersection can be determined and built by each City;
- Where feasible, to establish uniform design materials and trail widths for trails that cross two or more cities; and
- To produce a regional trail guidance plan that is endorsed and ratified by all participating Cities, and that can serve to guide long range trail planning throughout the six cities and Collin and Dallas Counties.

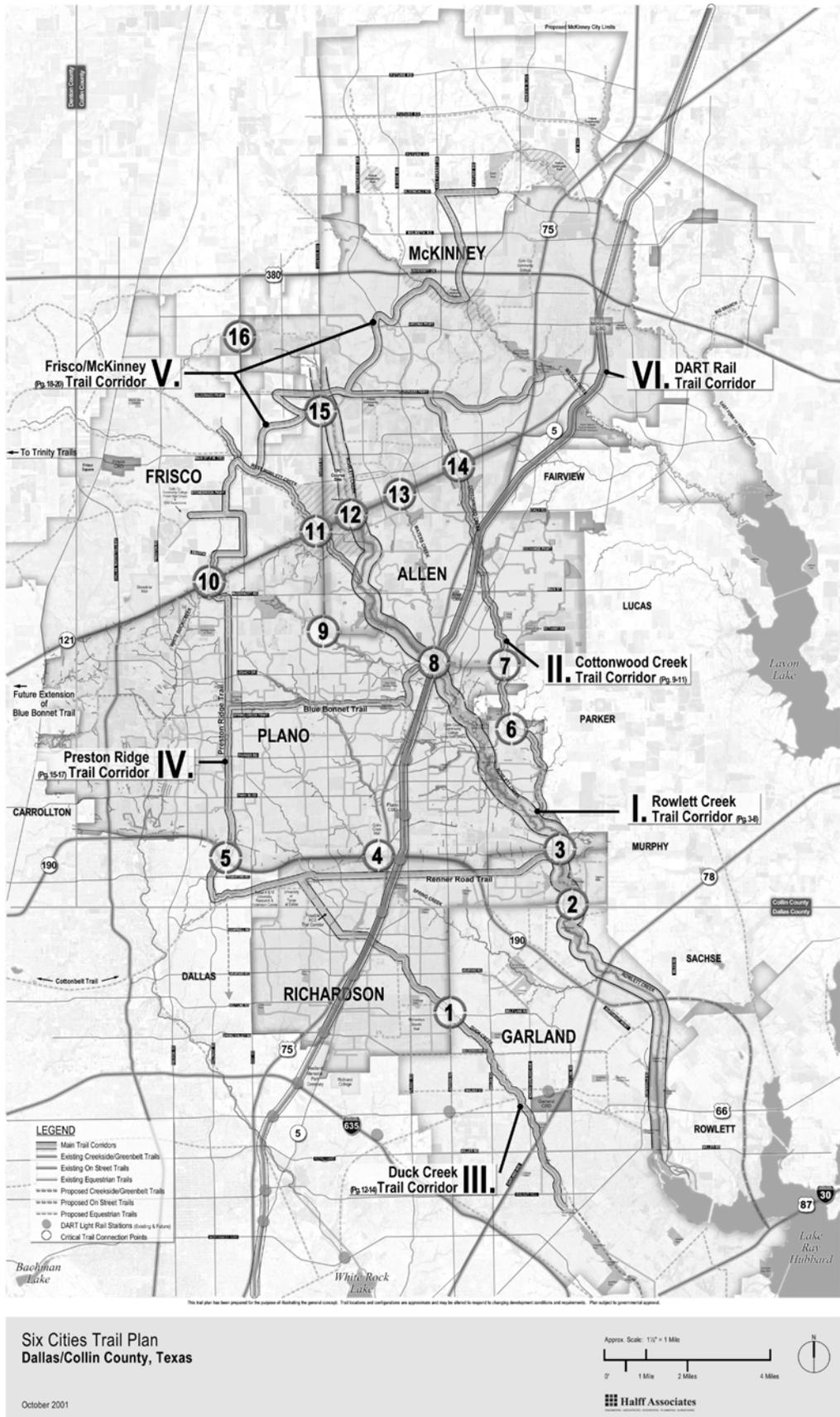


Figure 2-1 Six Cities Trail Plan

MASTER PLAN UPDATE SCOPE & OBJECTIVES

Hike & Bicycle Trail

- *A Master Plan update was requested by the City of Frisco in response to the rapid growth occurring in Frisco.*
- *The Hike & Bike Trail Master Plan Update was prepared by the HNTB Corporation.*
- *A kickoff meeting was held with representatives of the City of Frisco Park and Recreation Department and the Transportation Department. Items discussed at this meeting included the following:*
 - *Review with City staff the current Hike and Bike Trail Master Plan.*
 - *Discuss priorities of the Hike and Bike Trail Master Plan Update.*
 - *Identify trail construction by the City and private developers since the current master was completed.*
 - *Identify anticipated trail extensions that differ from the current Trail Plan.*
 - *Establish updated goals and objectives.*
- *A tour of the entire City was taken by members of the HNTB consultant team and representatives of the City to verify trail construction that has occurred since the current plan was completed. The tour was also used to identify critical needs and issues to be addressed in the plan update.*
- *HNTB met with representatives of the adjacent cities of Little Elm, The Colony and Prosper to discuss their Hike and Bike Trail Master Plans and to identify points of trail connections between their communities and Frisco.*
- *HNTB met with members of the Frisco Bicycle Community to gather their input on the On-Street Bike Routes within City. The Frisco Bicycle Community provided HNTB consultant team with their recommended on-street bike route system and their suggestions for implementation of this system.*
- *The HNTB consultant team made multiple progress presentations to the Park Board Bicycle Advisory Committee.*
- *The final recommendations of the Hike and Bike Trail Master Plan Update have been added to this report and the revised Bike Plan has been included as well.*

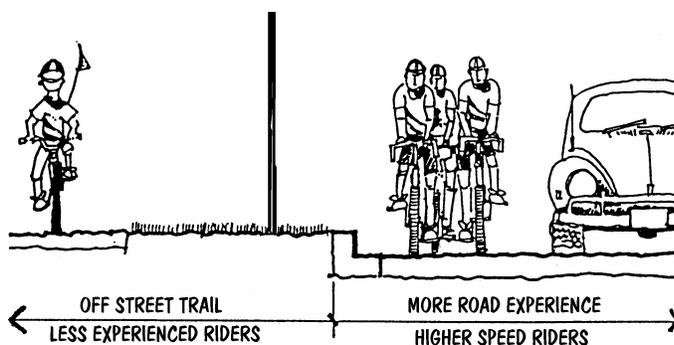
BICYCLIST TYPES

From a trail design and engineering point of view, cyclists fall into two broad categories. Recreational or occasional cyclists form the **first category of cyclists who tend to ride at slower speeds**. Generally, they have less road experience and avoid automobile traffic because of a fear of being hit by a car. Slower speed riders prefer residential streets and Off-Street trails.

The **second category of cyclists is typically the higher speed riders**. They generally have more road experience and thus, are more willing to ride on most streets in heavier vehicular traffic. The higher speed riders, like the first group, choose the roads less traveled when they have a choice, but will use the major roads when necessary to get where they want to go. (**Figure 2-2 Bicyclists Types.**)

Using the needs of the generally more experienced bicycle riders, standards for roads and bicycle facilities that meet the criteria of **all** cyclists were developed. Trails for the faster riders require stricter design criteria that also meet the needs of the slower riders.

The City of Frisco's goal is to improve the riding and trail conditions for **all** cyclists. Using the more experienced cyclists as the prototypical rider for the design guidelines accomplishes this objective. One can see that the opposite is **not** true by picturing a high-speed rider on an Off-Street trail which, at least when compared to roads, is relatively narrow and winding. Riders traveling at higher speeds under these conditions could increase the trail's accident potential.



Bicyclists Types

TRAIL TYPES

Open Space Hike and Bike Trails

An Off-Street pedestrian and bicycle network or system is a beneficial amenity to any City. Off-Street trails provide a different experience than do narrow sidewalks adjacent to streets or On-Street bike routes. These trails require different surfaces and a different set of design standards. The Off-Street trails are designed for both the commuter and the recreational user.

Using the *2006 Comprehensive Plan* and *Park Plan* as a basis, Open Space Trail routes were selected on the following criteria:

- Location of existing and future schools and libraries
- Location of Collin County Community College
- Location of Neighborhood Centers
- Location of existing and proposed Amenity Centers
- Location of existing and future Community and Regional parks
- Location of future Recreation Centers
- The location and configuration of 100 year flood plain areas and areas protected by the City's Subdivision Ordinance *94-08-19* (or as amended)
- The design of future thoroughfares and their locations
- Avoiding dead end routes, optimizing connections
- Connections to Regional Greenway Trails, lakes creeks and other linear park systems

The first type of “Off-Street” trail is typically located in greenways or linear parks that are developed along creeks in the undeveloped 100-year flood plains and adjacent areas. Often referred to as Open Space Trails, or greenway trails, these trails are typically the most heavily used in a city’s trail system. The White Rock Trail system in Dallas is a good example of an Off-Street, greenway trail.

Frisco’s trail system will be linked to two of these greenway trails: White Rock Creek and Rowlett Creek Trails. Frisco is located in a unique geographic location. The headwaters of these two key Dallas-area drainages are located in Frisco.

The major Open Space Trails in Frisco will be the:

- **Panther Creek Trail-19.0 Miles**
- **Parvin Branch Trail-6.0 Miles**
- **Cottonwood Branch Trail-8.0 Miles**
- **Stewart Creek Trail-17.5 Miles**
- **Rowlett Creek Trail-7.5 Miles**
- **White Rock Creek Trail-1.5 Miles**

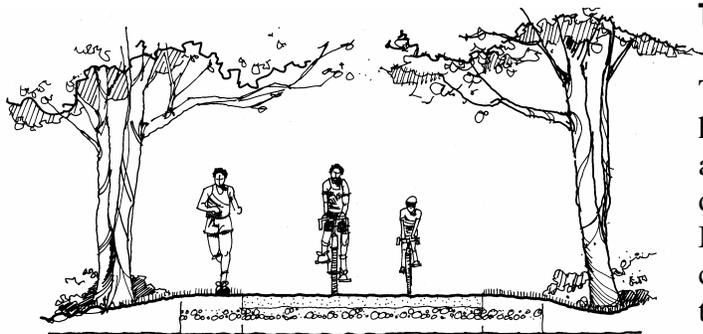


Figure 2-3-Open Space or Greenway Trail

Greenway trails are typically given names rather than numerical designations to indicate the multi-use recreational nature of the trails.

In the not too distant future a runner, cyclist, or skater will be able to access the northern most part of either of these trails and make their way through Allen, Plano, Richardson, Garland and Dallas eventually ending up at the Trinity River and the trails proposed along the Trinity River corridor. Using the major creek corridors provides many advantages for the key components of the Off-Street trail system:

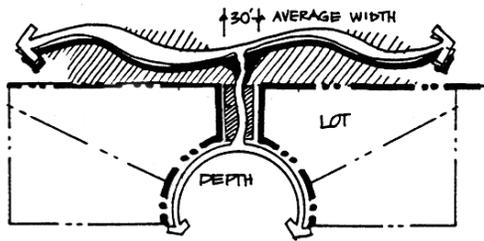
- Major creeks and flood plain areas provide a natural, wooded, meandering corridor that is aesthetically superior to the urban environment of the arterial streets.
- The Frisco Subdivision Ordinance (94-08-19,) Major Creeks Ordinance (99-09-25) and Tributary Ordinance (01-03-25)” protect the 100-year flood plains and adjacent areas from development. These green areas provide natural east-west corridors that do not require trail users to be on city streets or competing with automobile traffic.
- The creek corridors connect with neighboring cities providing opportunities for links and access to amenities outside the City of Frisco such as Lake Lewisville and the downtown McKinney Courthouse Square.
- The development of trails within the linear greenway parks will help provide another level of security.

Trail Connections

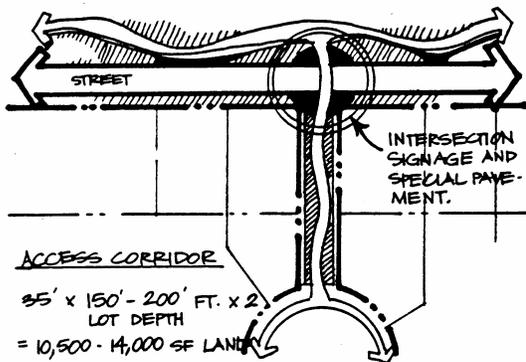
There are several trails within the city that have been developed by private developers in association with their residential and office developments. One of the objectives of the Master Plan is to provide Off-Street trail connections to link the private sector trails and the public sector trails (Open Space Trails) to form a cohesive and continuous trail system for the residents of Frisco.

There are four types of connections that should be considered when connecting private trails to the City of Frisco Off-Street trail system as required in the Subdivision Ordinance (Sec.7-08 & 7.09.) Developers and City Staff should coordinate their efforts during the early stages of approval to ensure that the connections to existing and future trails are made. Points of connection that should be considered are:

- 1) Access point - End of cul-de-sac (1 lot).



- 2) Access point - End of cul-de-sac (2 lots).



- 3) Access point - Parallel drainage corridors at major streets.

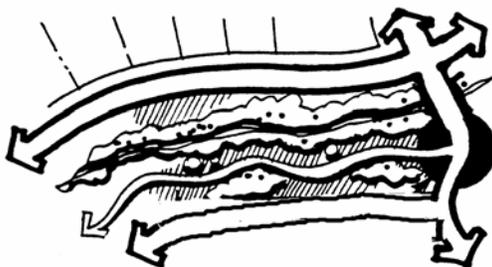


Figure 2-4-Access Points

The other type of Off-Street trail is the trail that is within the street right-of-way (**Figure 2-3**) and is basically an extra wide sidewalk designed to accommodate the higher travel speeds of cyclists and skaters. These trails are, typically, 6'-12' wide and are separated from the vehicular traffic by at least 6' if sufficient width of the right-of-way or easement is available. They are not always parallel to the curb but can meander around existing trees and landforms to give interest and variety to the walking or riding experience. These trails usually connect residential neighborhoods to neighborhood centers, retail, schools and parks.

An example of this type of trail can be found along both sides of Parkwood between SH 121 and Lebanon Road and along the south side of College Parkway between Hillcrest Road and Coit Road. The trails along Parkwood will eventually link the downtown area with the Bridges of Frisco retail center to the south. The College Parkway trail will link *Collin County Community College* and Shawnee Park with the White Rock Creek Trail.

Renner Road in Richardson is a good example of an Off-Street trail set in a landscape zone. The Renner Road trail will eventually run from Highway 190 to Waterview. The City of Richardson, in conjunction with Cisco Systems, is also building an 8' trail parallel to President George Bush Turnpike (SH190) that will connect with the Renner Road trail, providing the employees of Cisco Systems and nearby residents with an extensive trail system to use for commuting and recreation.

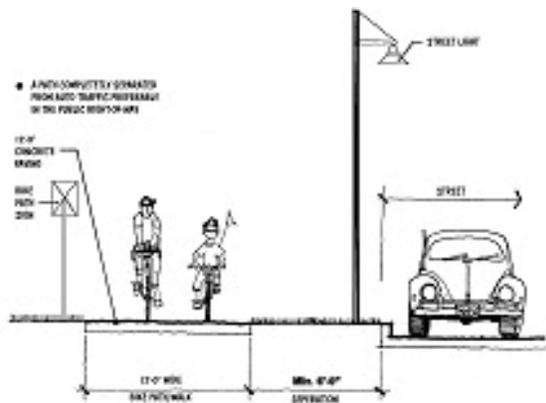


Figure 2-3-Off-Street Trails

On-Street Bicycle Routes

By law and by definition a bicycle is a vehicle and may use any street or surface traveled by a motor vehicle and must abide by all laws pertaining to vehicles using public streets. The surfaces and design standards for the two are quite similar. It is the vehicle size and speed of travel that makes safety a critical issue for cyclists. While separating the cyclists from the automobile and truck traffic might solve the speed differential problem it creates an even wider set of safety and maintenance problems.

A network of On-Street bicycle routes has been defined in the Master Plan for the serious cyclist who wants to commute to work via bicycle; or is in training for competitions; or rides for aerobic conditioning. A series of north-south and east-west On-Street routes have been identified within the city limits. The On-Street routes form a grid system using arterials, collector streets and residential streets. These routes will be signed and designed to accommodate combined motor vehicle and bicycle traffic.

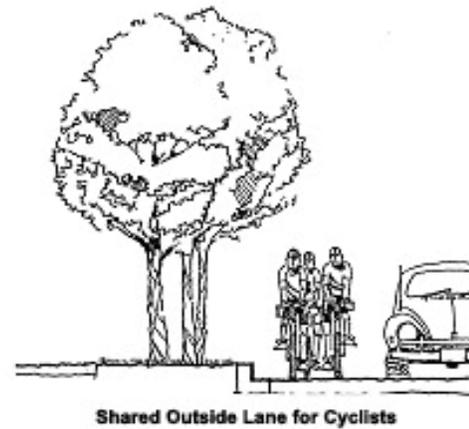


Figure 2-5-On-Street Trails

Using the *2006 Comprehensive Plan* as a base, the selection of routes was based on the following criteria:

- Location of existing and future schools and libraries
- Location of Collin County Community College
- Location of Stonebriar Centre and Bridges of Frisco retail complex
- Location of existing and proposed retail areas
- Location of existing and future community and regional parks
- Location of future recreation centers
- The condition and design of existing thoroughfares
- The design of future thoroughfares and their locations
- Avoiding dead end routes, loops are the optimum configuration
- Connections to Greenway Trails and linear park system
- Avoiding high volume streets such as Preston Road, State Highway 121, US 380, FM 423 and Dallas North Tollway Service Roads.

SECTION III MASTER PLAN RECOMMENDATIONS

on a case by case basis dependent on cost, available funding and bicycle traffic.

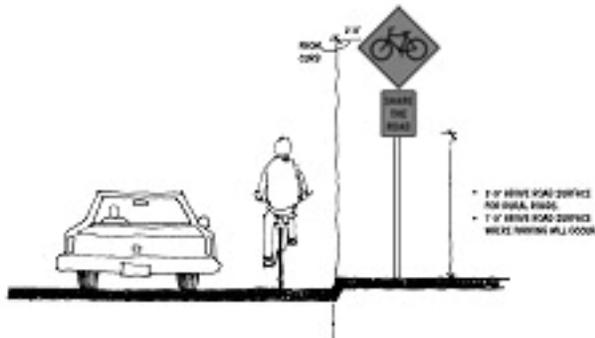


Figure 3-1 Bike Route Signs

- *No additional roadway lane width or striping will be included for on-street bike routes.*
- *Bike route signage will be used to identify bike routes as illustrated in Figure 3-1.*
- *Bike route signage will be added to all on-street bike routes identified in the Bike Route Plan.*
- *On-street bike route signage will not be added to Type A&B thoroughfares (arterials) until at least two lanes of traffic are constructed in both directions.*
- *On-street bike route signage can be added to Type C&D thoroughfares (collectors) when only two lanes of traffic are available.*
- *The existing roadway striping will be removed and the traffic lanes restriped to provide a wider outside lane for bicycle traffic. The restriping will take place when the following conditions occur; roadway has six lanes, restriped traffic lanes are at least 11' wide, restriping will allow for at least 1.5' of additional lane width in the outside lane. Restriping will be considered*

Off-Street Trail System

The Off-Street system will be made up of trails 6' or wider that parallel arterials and collector streets and the 12' wide trails that will be constructed in the creek corridors.

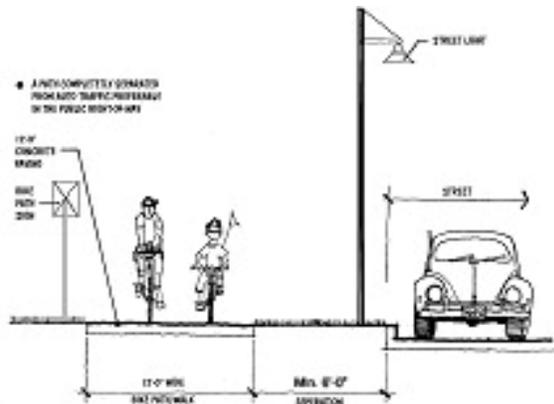


Figure 3-2 Off-Street Trail or Walk

The following is a list of the routes that have been identified in the Master Plan as potential Off-Street trails.

- US HIGHWAY 380** --- It is the recommendation of the Master Plan that the City of Frisco work with TxDOT and Collin County to coordinate the construction of a 12' wide bike path on the south side of US HIGHWAY 380 from the intersection of FM 423/*Main Street, FM 3537* to the intersection with Coit Road. This Off-Street trail would connect with McKinney and could possibly connect to trails at Lake Lewisville.
- SH 121** --- the City of Frisco should coordinate with TxDOT, Plano, Allen and McKinney to get a 12' wide trail constructed as part of the upgrades and improvements to SH 121. This trail would serve as a link to connect the Rowlett and White Rock Creek trail corridors. This trail section would also complete a loop of trails around the perimeter of the city.
- Commuter Rail Trail** --- Should *commuter* rail become a reality for the old Frisco/BNSF rail line, the Master Plan recommends that the City of Frisco work closely with *the rail provider* to develop a
- 12' wide commuter trail from SH 121 to US HIGHWAY 380. This commuter trail would connect the 3 potential rail stations with Legacy Business Park and the retail center in Frisco Bridges.
- Lebanon Road** --- the Master Plan exhibit shows a trail on the north side of Lebanon Road from Legacy to Lake Lewisville to the city limits on the west.
- Stonebrook** --- a trail is indicated on the north side of Stonebrook from Legacy to the city limits on the west.
- Rolater** --- the plan shows a trail on the south side of Rolater Drive from Preston to Custer.
- Main Street/FM 3537** --- The Master Plan indicates a trail on the south side only. The ideal condition for Main Street would be to have a 6' to 12' wide trail on both sides of Main Street from FM 423 to the new Frisco Square location and from Preston Road east to Custer. Main Street would be similar to Parkwood with this double-sided configuration. It is the "spine" and the bisecting line dividing north and south, passing through the heart of downtown Frisco. This could be a grand landscape and street tree opportunity as well. The entire length of Main Street could have a special "hike and bike trail" theme to complement the Velodrome as a key feature in a bike friendly community. Through-bike traffic should be routed to the Bike Lanes on Main Street in the downtown area to keep the walks clear for heavier pedestrian traffic
- Eldorado Parkway** --- The plan indicates that a 12' wide trail should be constructed on the north side of Eldorado from FM 423 to Custer. A trail is also recommended on the south side from the proposed middle school site east of Legacy to the intersection of the Panther Creek Greenway trail. This would facilitate access to several key locations including the middle school and the *Virginia*

Parkway commuter rail station as well as the Panther Creek trail crossing.

- **Panther Creek Parkway** --- the Off-Street hike and bike trail shown on the plan for Panther Creek is shown on the north side that will facilitate connecting the new northwest high school site with the Panther Creek trail. This trail can also serve as a connection to McKinney on the east and Little Elm on the west.
- **Virginia Parkway** --- The plan recommends a 12' wide trail on the north side of Virginia parkway from FM 423 to Coit Road. This trail is also one that could connect to trails in McKinney and Little Elm.

MASTER PLAN RECOMMENDATIONS

- *Physical barriers, including street trees, to be installed between off-street trails and the adjacent roadway will be determined on a case-by-case basis.*
- *Off-street trails shall be placed a minimum of six feet from the edge of the roadway if ROW is available.*

Open Space/Greenway Trails

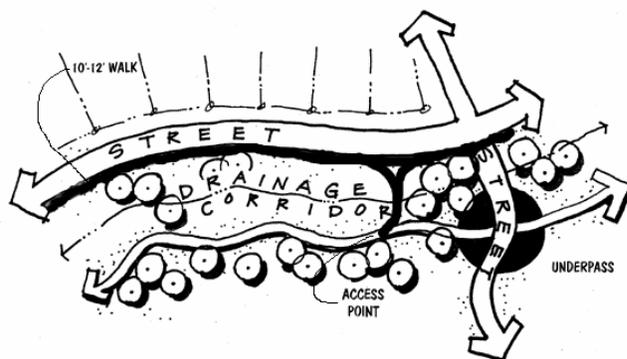


Figure 3-3 Open Space Trail

There are five major creeks and drainage-ways that run perpendicular to Preston Road flowing west to Lake Lewisville or southeast to the Trinity River. They are Stewart Creek, Cottonwood Creek, Panther Creek, Parvin Branch Creek and Rowlett Creek. Rowlett Creek and White Rock Creek are identified in the Six Cities Trails Master Plan as key Open Space Trail corridors in Collin and Dallas counties. The Frisco Hike and Bike Trail Master Plan proposes trails in all the major creek corridors (often referred to as linear parks or greenways) located within the City limits.

The trails proposed in the creek corridors will be located inside the 100-year flood plain limits. Trails locations shall comply with City of Frisco engineering standards for erosion control setback. Trails will be constructed to City of Frisco AASHTO and TxDOT specifications. They will be constructed of concrete, 12' wide. These trails will be designed to allow maintenance and emergency

vehicles to use them without doing damage to the pavement. Bridges will be used to allow the trails to cross back and forth across the creek to provide access to key destinations, to save trees and avoid steep slopes and sensitive environmental areas. Low water crossings will be used on small drainages swales where large volumes of water will not undermine the trail.

When possible, open space trails shall be as accessible and visible as possible for the following reasons:

- Trail visibility improves public safety;
- Emergency vehicle access; and
- City maintenance crew access.

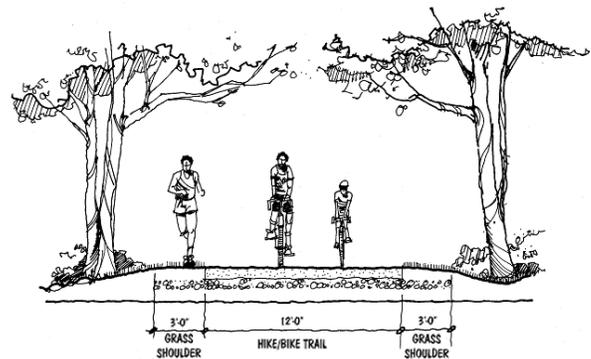


Figure 3-4 Typical Trail Cross Section

Trails are not the only recreational use that can be developed in the creek corridors. There are currently three golf course developments in Frisco that have precluded building a continuous trail system in three of the creek corridors. Plantation Resort Golf Course, Stonebriar Country Club and Blackstone are all constructed in such a manner that no trails can be built along the creek corridors where these courses have been built.

Plantation Resort eliminated the possibility of connecting the White Rock Trail to the Collin County Community College Campus and Velodrome along the creek. The only option now is to construct trails along Coit Road and Lebanon Road to complete the connection.

Stonebriar pre-empted any creek corridor trail connections in the southwestern quadrant of the City to destinations like The Colony Open

Space Trails and the south end of Lake Lewisville from the Legacy employment centers and retail areas along Warren Parkway and the Tollway.

The construction of the Blackstone course may force the Cottonwood Branch trail to be constructed along alternative Off-Street or On-Street routes in the residential neighborhoods to the south of the creek.

Criteria shall be adopted by the City Council that will require golf course developers (public or private,) who want to develop in the creek corridors and restrict the alignment of trails to provide an alternative right-of-way or easement for the construction of a 12' wide trail to ensure continuity and connectivity of the trail system as proposed in this Master Plan. This policy should become an amendment to the Creeks and Tributary Ordinance-[7.09.13. A (7) or as amended.]

It is critical to the overall intent and success of the Hike and Bike Trail Master Plan that the key element, the **Open Space Trail System**, is continuous and separated from vehicular traffic and major streets and thoroughfares to ensure that they offer the safest and most environmentally diverse cycling, walking and running experience.

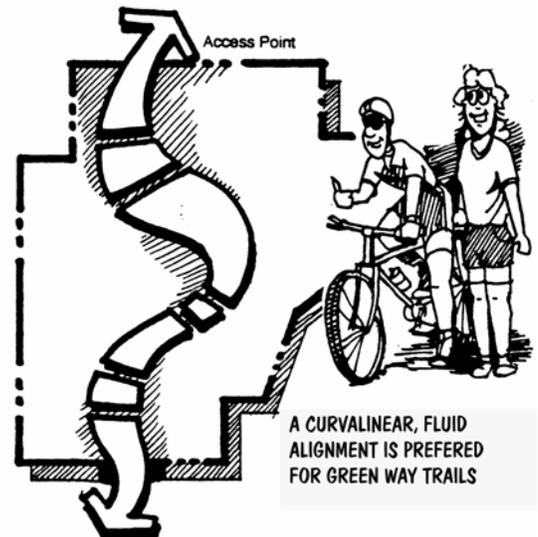
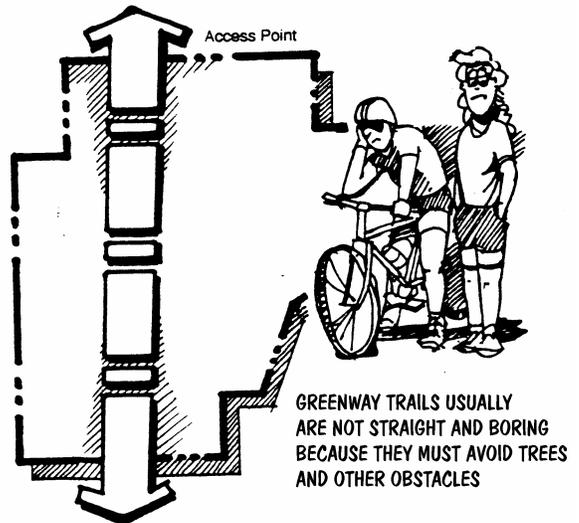
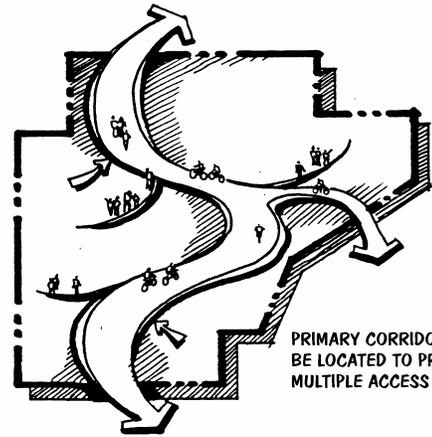


Figure 3-5 Preferred Trail Alignments

- **Panther Creek Trail---** The Panther Creek Trail will eventually run from about one half mile west of FM 423 east to Preston Road. The Master Plan shows the Panther

Creek Trail connecting with the Rowlett Creek Trail near the extension of Hillcrest. At completion Panther Creek Trail will be approximately 8.5 miles in length. The City of Frisco should work with Collin and Denton County and the Corps of Engineers to extend Panther Creek Trail to Lake Lewisville. This extension would add an additional 3 to 3.5 miles of trail and link the Frisco trail system with one of the best amenities in the Denton and Collin Counties.

- **Rowlett Creek Trail** --- Rowlett Creek Trail will be approximately 4.0 miles long upon completion making the Panther Creek-Rowlett Creek combination 12.5 miles long, extending from the west city limits to SH 121 on the southeastern edge of the City. The Rowlett Trail will connect to trails being planned by the Cities of Allen and Plano as part of the Rowlett Creek Greenway Trail System. Rowlett Creek Trail will connect to Panther Creek Trail at Hillcrest.
- **Parvin Branch** --- Parvin Branch connects to Panther Creek about half way between the Tollway and Legacy Drive. The Parvin Branch trail will extend northeasterly to connect with the trail paralleling US HIGHWAY 380 near Coit Road. The Parvin Branch section of trail is approximately 4.5 miles.
- **Cottonwood Branch** --- Cottonwood Branch originates near the intersection of Hillcrest and Main Street and flows easterly to Lake Lewisville. The Cottonwood Branch Trail will be approximately 7 miles from Preston Road to the connection with the Off-Street trail along FM423. The Cottonwood Branch Trail skirts the north edge of downtown Frisco along the *Wakeland High School* site and Bicentennial Park. This trail could also extend through Little Elm and Hackberry to Lake Lewisville.
- **Stewart Creek** --- This Open Space Trail follows *Stewart Creek* from its origin near the Collin County Community College

south to the Frisco-The Colony city limits. The City of Frisco should collaborate with The Colony to connect the Stewart Creek trail with the existing trails in The Colony thereby extending the length of useable trail for the citizens of both municipalities. The city should also work with developers to try to extend a trail through the Lone Star Ranch development that could connect with public land (Corps of Engineers) west of FM423. Stewart Creek will eventually connect the community park site and the southeast high school site with Collin County Community College and Shawnee Park.

- **White Rock Creek** --- Trail development along the White Rock Creek corridor in Frisco has been precluded by residential development and the construction of the Plantation Golf Course. There is, however, an opportunity to connect to the Plano section of the White Rock Trail to allow Frisco residents access to the trail. Near the area where White Rock Creek crosses under SH 121 an Off-Street section of trail will need to be constructed through the commercially zoned parcels along SH 121, making the connection to On-Street and Off-Street trails along Lebanon Road, Coit Road and College Parkway. There will be no trail constructed north along White Rock Creek. Once the trail enters the City of Frisco City Limits, the trail will veer east and north. The trail connection will be made using the existing TXU electrical easement that runs north and south from the TXU substation on SH121 to Lebanon Road.

Section IV

Detail Design Standards

This section will outline the design standards and guidelines for proper implementation of a trail system. This includes:

- Design Development Standards that establish suitable primary and secondary trail corridors and required access to those corridors.
- Detailed Design Standards for bike routes hike and bike trails, greenway trails and sidewalks.

Hike and Bike Trail

This section of this report documents construction guidelines and issues to consider related to the implementation of the trail system. The issues discussed here and the recommendations presented should be reviewed carefully as each specific project is designed and constructed to ensure that a safe, well-constructed facility is achieved.

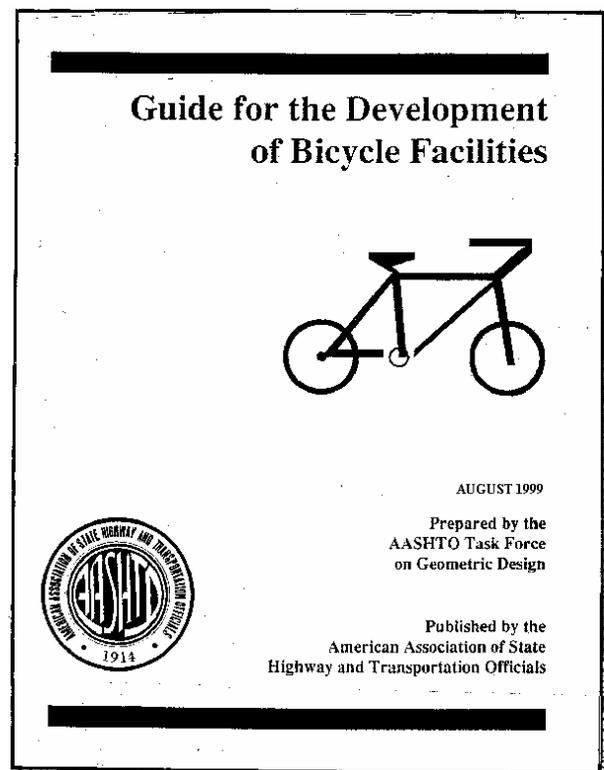
Trails are designed and constructed according to nationally recognized and accepted standards such as those published by the American Association of State Highway and Transportation Officials (AASHTO.) As with any set of design standards, there will be cases where they cannot be met. In such cases, design exceptions will be necessary in order to implement the plan. Signs are typically used to notify trail users where these exceptions are located. (Figure 4-1 - Development Standards.)

Bicycle Route System

Providing a complete Off-Street trail transportation system would be expensive to build and maintain. Such a system would require the complete duplication of the road network - a cost prohibitive proposition.

Many cyclists have the same trip origin and destination needs as motorists, a major focus of the city's bicycle facility efforts is directed toward the existing and future road network.

- *The philosophy of the on-street bike routes is shared use of the roadway with automobiles and cyclists.*
- *Bike routes will only be identified with signage.*
- *No additional lane width or striping will be used to designate an on-street bike route except where restriping is warranted and the conditions previously described are met.*



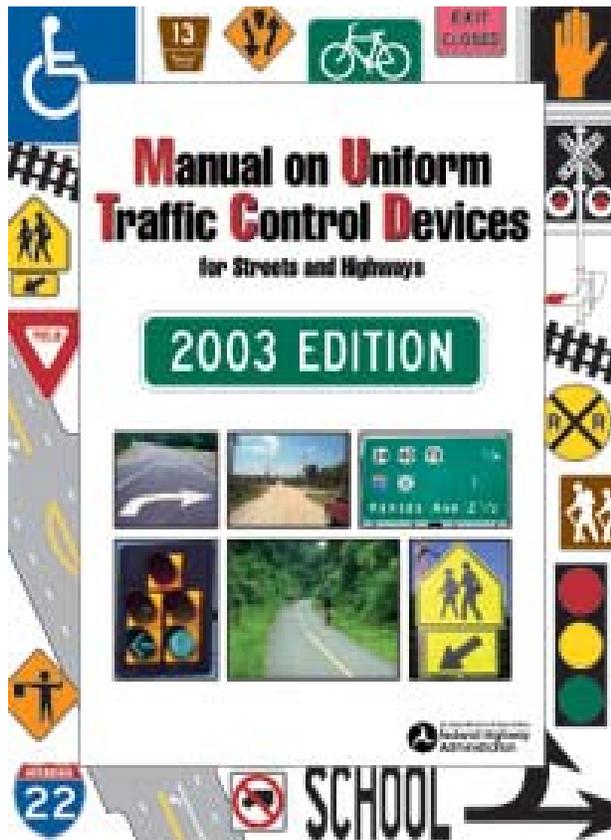


Figure 4-1 - Development Standards

Trail Width and Structure

The primary green way trails should be concrete paving with a minimum of twelve feet (12') in width. Three foot (3') grass shoulders should be constructed on either side of the concrete paving. The clear zone for primary trails constructed in the City of Frisco is 25'. This area should be mowed during the summer months. Secondary trails should be constructed of concrete and be a minimum of 8' in width and also have 3' grass shoulders. Tertiary trails or linking trails should be a minimum of 6' in width, constructed of concrete with a non-skid finish. The concrete should be placed on a compacted stabilized base, which should extend into the grass shoulders on either side. The 3' wide shoulders on each side of the trail are primarily for joggers and to ensure proper sight distances to help avoid crashes. The shoulders also serve as a space for bicyclists to use when they are avoiding an accident. The shoulders shall be flush with the trail to help eliminate safety hazards and are mowed to keep them in

a useful state. (Figure 4-2 - Hike and Bike Trails.)

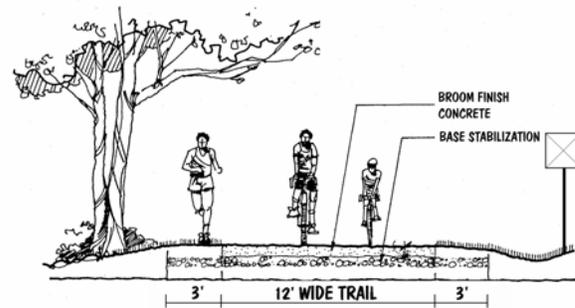


Figure 4-2 - Hike and Bike Trails

Where the trails run parallel with a linear obstacle, such as a street or drainage ditch, a minimum separation of 6' should be placed between the trail's hard edge and the obstacle. All underpasses and bridges should have a full trail width including space for shoulders, existing conditions permitting.

Warning devices must be used where the combined trail and shoulder cannot be full width. Reference the TMUTCD (Texas Manual of Uniform Traffic Control Devices) for signs to use where these exceptions occur.

Design Speed

A design speed of 25 miles per hour will provide a safe layout for the hike and bike trails. Designing for a 25 mph speed does not mean that users must or even can ride the trail at that speed. Very few cyclists can ride at 20 mph, much less at 25 mph. Even though almost no one can ride at 20 or 25 mph, there are, however, significant reasons for using the 25 mph figure:

- The curves along the trail will be more gentle,
- The sight distances will be increased, and
- Hazardous intersections, maneuvering difficulties, and steep slopes will be reduced.

The above effects reduce trail accidents and increase user security.

The following information sets forth the minimum standards for curve radii, vertical curves (hills), lateral clearances on horizontal curves, and stopping sight distances.

Minimum Curve Radii: The minimum design radius of curvature can be established by the following formula:

$$R = \frac{V^2}{15(e+f)}$$

Where:

R = Minimum radius of curvature (feet)

V = Design Speed (mph)

e = Rate of super elevation (cross slope)

f = Coefficient of friction (from AASHTO)

Designing for a speed of 25 mph at a cross slope of 2%:

$$R = \frac{25^2}{15(.02 + 0.25)}$$

$$R = \frac{625}{15(.27)}$$

$$R = \frac{625}{4.05}$$

$$R = 155 \text{ ft.}$$

Vertical Curves. A path should be designed with adequate stopping sight distances in mind. The chart from AASHTO shows the minimum length of vertical curve necessary to provide minimum stopping sight distance at various speeds on the crests of vertical curves (e.g. hills.) (**Figure 4-3 - Minimum Length of Vertical Curves.**)

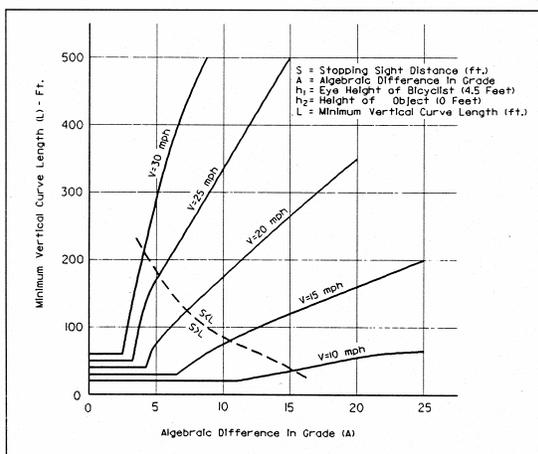


Figure 7. Minimum Length of Vertical Curves (from AASHTO Bicycle Guidelines)

Figure 4-3 - Minimum Length of Vertical Curves

Lateral Clearances. **Figure 4-4 - Minimal Lateral Clearance on Horizontal Curves** is from the 1991 AASHTO Bicycle Guidelines. Either the formula or the graph can be used to obtain the lateral clearance needed to maintain the desired sight distance in a horizontal curve.

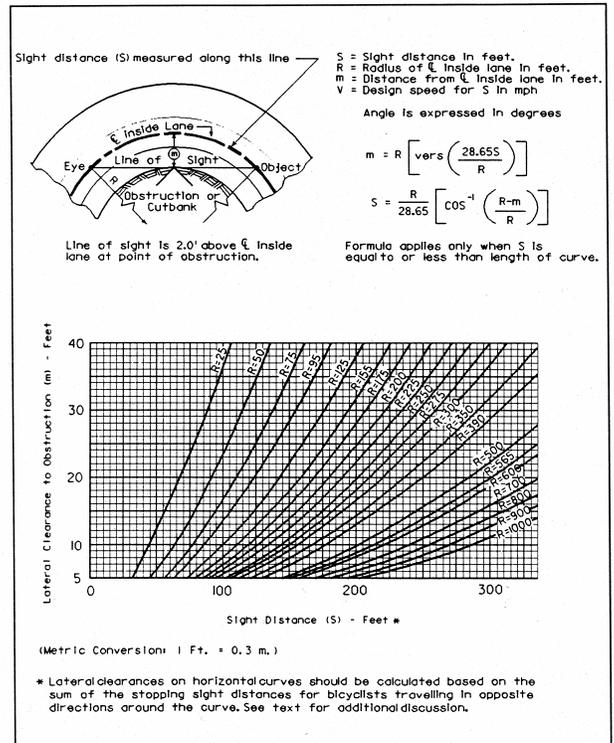


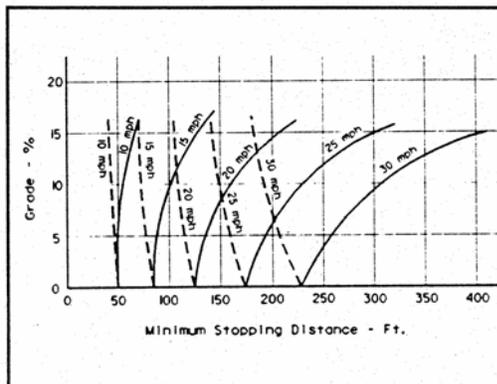
Figure 8. Minimum Lateral Clearances on Horizontal Curves (from AASHTO Bicycle Guidelines)

Figure 4-4 - Minimum Lateral Clearances on Horizontal Curves (from 1999 AASHTO Bicycle Guidelines)

Stopping Sight Distances. Based on slope and speed, **Figure 4-5 - Minimum Stopping Sight Distances** gives the minimum standard stopping sight distances. The graph indicates ascending as well as descending minimum stopping distances.

Bicyclists have a tendency to ride near the center of the path as well as side-by-side. Because of these reasons and seriousness of head-on collisions, lateral clearances on horizontal curves should be calculated as the sum of the stopping distance for bicyclists traveling in both directions. If this is not possible, then a combination of alternatives can be used, for example, widening the path through the curve, placement of warning signs, or installing a yellow solid center stripe.

Solid = Descending
Dash = Ascending



Minimum Stopping Sight Distances

Figure 4-5 - Minimum Stopping Sight Distances

Slopes

Trails should have a cross-slope of 2 percent. Greater cross-slopes make it difficult for bicyclists and wheel chair users to maneuver on the trail. Smaller cross-slopes hinder trail drainage. (Figure 4-6 - Trail Slopes.)

The longitudinal slope on a trail should not be



FIGURE 4-6 Trail Slopes

greater than 5 percent, especially on long inclines. When a higher design speed is used and additional trail width is provided, grades greater than 5 percent and running less than 500 feet are acceptable. Slopes greater than 5 percent are undesirable because the ascents are difficult to climb (causing some bicyclists to wobble left and right) and the descents cause some bicyclists to exceed the speed they are capable of handling.

Drainage

To minimize storm water run-off from flowing across the trail, drainage swales can be placed on the higher side. Swales are used where the sheet flow drainage across the trail surface might be great enough to increase trail maintenance. Using swales in this situation will also require culverts that are designed to handle the water flow, are safe (relative to the trail users), and have low maintenance.

Water Fountains

Water fountains, faucets, and other water sources should be located on the downhill side of the trail. Placing these water sources on the downhill side of the trail will help eliminate water flow across the trail that could create a slipping hazard. The hazard develops in the case where uphill drains become blocked and a regular water overflow results in a wet trail surface. A constantly wet trail surface is conducive to algae growth

Water fountains should be located every 1 to 2 miles for trails in linear parks. The water fountains should be “freeze-proof” with a top spigot at two levels per ADA requirements and a lower faucet for water bottles and animals. The lower faucet needs to be spring-loaded to ensure that it shuts off after use. (Figure 4-7 - Water Fountains.)

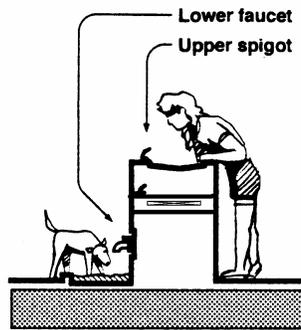


Figure 4--7 - Water Fountains

Obstacle-Free Area

To provide a safer trail, an obstacle-free area (clear zone) should be maintained. This zone shall have no signs, trees or light fixtures, utility poles, etc. located within it. (Figure 4-8 - Obstacle-Free Area.) Any existing condition (e.g., an overpass) within the 10-foot vertical clear space must be signed as to its height.

Typically, in any place where people will gather (e.g., parking lots, trail maps, bike parking areas, water-fountains) amenity elements should be set back from the trail edge 25 or more feet.

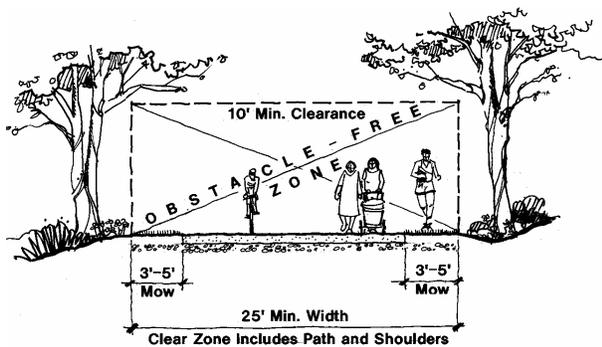


Figure 4-8 - Obstacle-Free Area

Lighting

Lighting the hike and bike trail is important and should be provided at all at-grade street crossings. The horizontal illumination levels should maintain an average between 0.5 and 2 foot candles. Where special security concerns exist (e.g., tunnels, underpasses), a higher

illumination is recommended. The light pole and fixture should be in scale with bicyclists and joggers except at at-grade street crossings. Full-sized poles and fixtures are used at street crossings. All trail lighting shall conform to the "Dark Skies" ordinance. All light fixtures shall have sharp cut-off or house side cut-off features to prevent spill over light into neighboring properties.

Railings

Railings for bridges and steep drop-offs, should be a minimum of 4.5' in height and have a smooth "rub rail" attached to it. The rub rail should be of 2 inch x 6 inch rectangular tubing (12 gauge steel) placed so the railing's center is 3.5' above the surface. The 6-inch rub railing vertical dimensions is a minimum. Chain-link fencing is prohibited. (Figure 4-9 - Rub Rail)

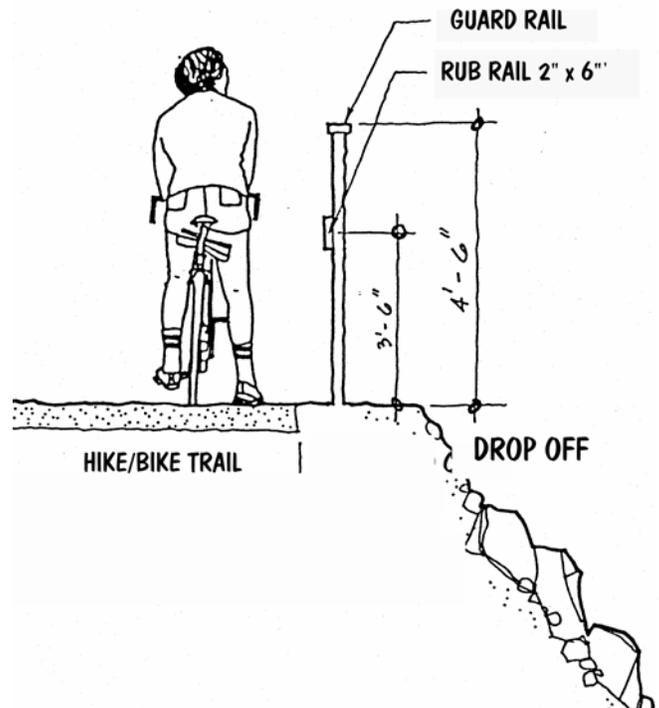


Figure 4--9 - Rub Rail

Trail Marking

There are several ways to mark the hike and bike trail pavement. A double solid stripe should be used to indicate a no-passing zone on steep hills, intersections and tight curves. A dashed yellow stripe down the center should indicate 2-way traffic. The paint used in

marking the trail should be non-skid and reflective for nighttime riding visibility. A standard used by the Texas Department of Transportation is glass beads sprinkled on wet paint as it is applied. This makes the paint reflective and gives it a sandpaper-like non-slip surface. White stripes at the edges of the trail are not recommended because they have a tendency to narrow the usable trail space. Centerline reflectors (tiles) are not recommended due to the fact that they create a hazard by acting as miniature speed bumps and are slippery when wet. (Figure 4-10 - Trail Markings)

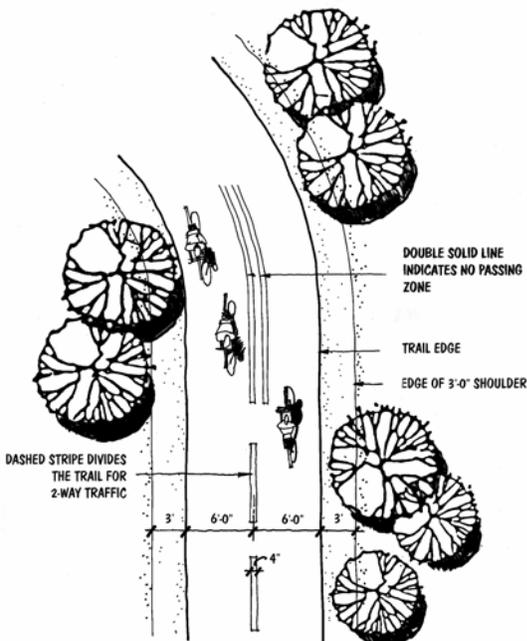


Figure 4-10 - Trail Markings

Signs

Adequate signs are critical on hike and bike trails to communicate to trail users and motorists the appropriate regulatory messages and to warn of potential conflicts. All trail signs must conform to the Texas Manual of Uniform Traffic Devices – Part 9 Traffic Control for Bicycle Facilities. There are five basic types of sign groups:

- warning signs
- directional markers
- information signs
- regulatory signs

- identification markers

Warning Signs

These signs alert trail users of a safety threat such as sharp curves, approaching intersections, or steep drop-offs. Typically, these signs are yellow and diamond-shaped with black lettering. (Figure 4-11 - Signs)

Information Signs

These signs typically provide the trail user with useful or important information. (Figure 4-11 - Signs)

Regulatory Signs

These signs are usually white and rectangular with black lettering. Regulatory signs give instructions on trail use and etiquette. (Figure 4-11 - Signs)

Identification Markers

These signs identify trails and streets that cross the trails. All intersections and street crossings should have a sign identifying the street for trail users and a sign identifying the trail for road users. Overhead name blades should be located on underpasses and should include the street name and block number. Trail maps and the name of the trail should be located at the beginning and end of each trail. Mile markers should be located every 0.25 mile. The identification markers are important to trail users, maintenance crews, police, and emergency personnel. (Figure 4-12 - Identification Markers)

Directional Markers

Directional markers use arrows or wording to indicate which direction to travel. These signs are important when multiple trails come together. (Figure 4-12 - Identification Markers)

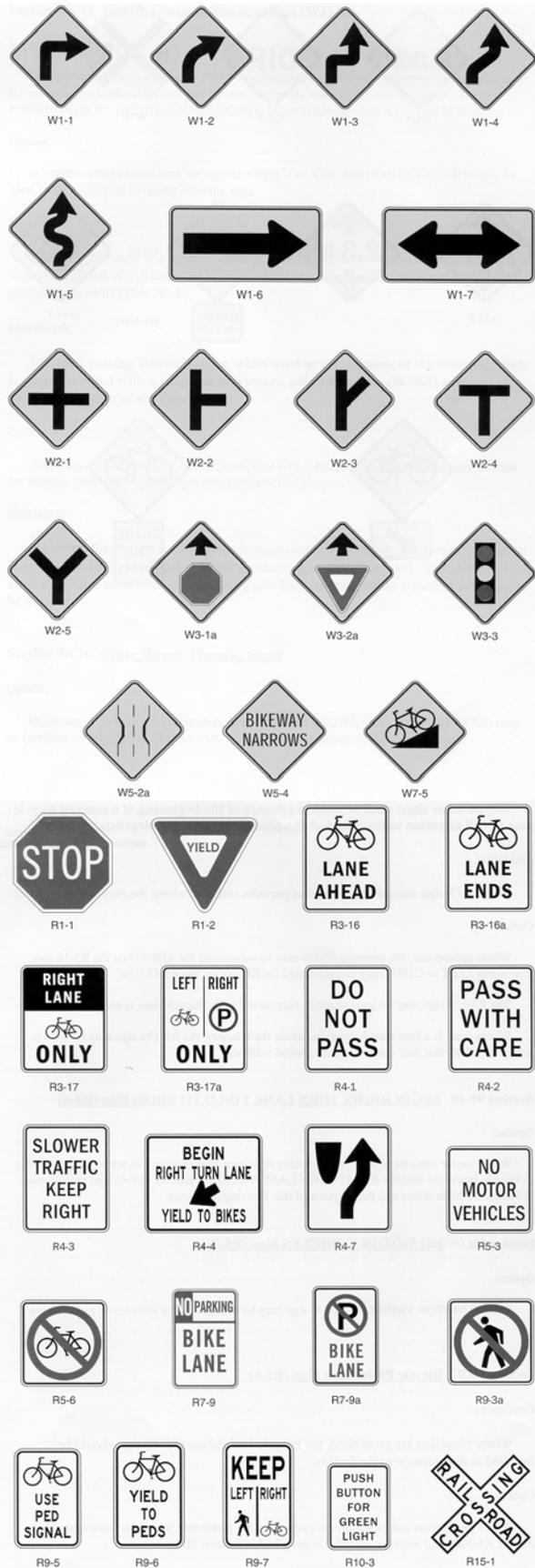


Figure 4-11 - Identification and Directional Markers

Mow Pads

To help minimize trimming during the mowing season, mow pads should be placed around all signs, furniture and water fountains. The pads should be designed so that a tractor can easily mow around these objects without hitting them. Mow pads shall be poured-in-place, reinforced concrete with a broom or non-skid finish. (Figure 4-12 - Mow Pads)

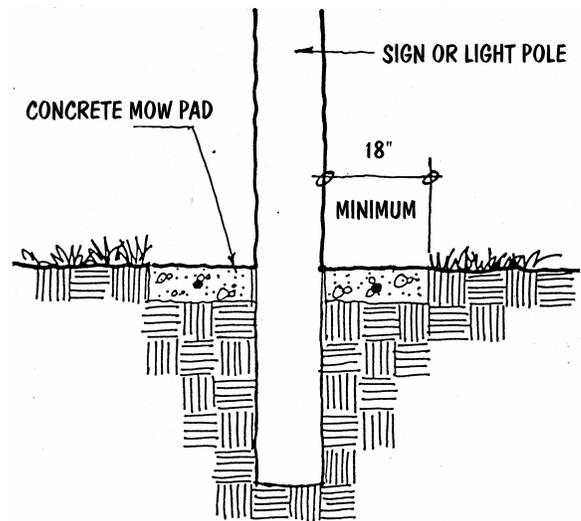


Figure 4-12 - Mow Pads

Intersections

In hike and bike trail design, intersections with roadways are very important. When trail and street intersections occur at-grade, some type of traffic control needs to be used (signal, stop sign, yield sign, etc.) in accordance with the Texas Manual of Uniform Traffic Control Devices (TMUTCD.) A mid-block crossing is best when crossing a low traffic volume road. Where a trail intersects a busy street, the trail crossing should be located at the pedestrian crosswalk.

Road Crossings. Where primary, secondary and linking trails cross thoroughfares where possible, the crossing should be a grade separated crossing with the trail beneath the road. (Figure 4-13 - Grade Separated Crossing)



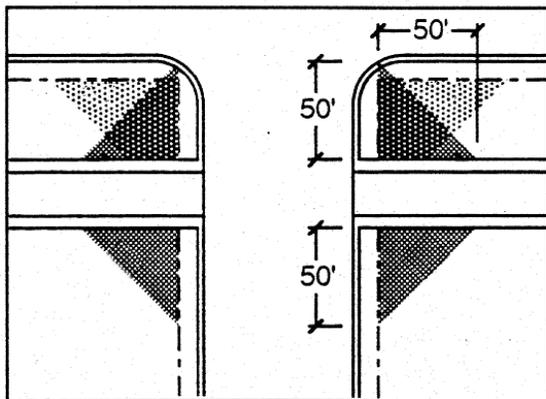
Figure 4-13 - Grade Separated Crossings

Grade separated crossings typically occur at existing roadway crossings over drainage ways. If drainage at these crossings is accommodated in a box culvert the culvert for the drainage should be independent of the culvert to accommodate the trail users.

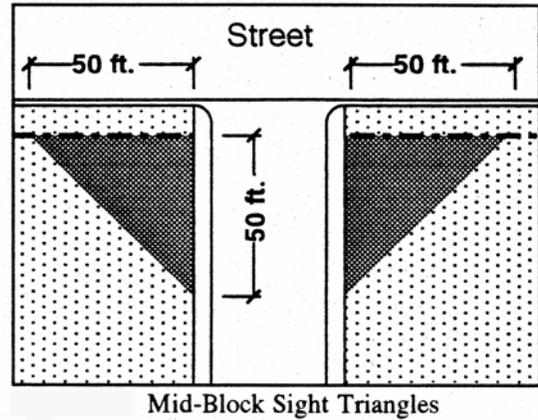
Sight Triangles / Corner Clips

It is important to eliminate blind spots at intersections where multi-use paths intersect with streets. Clear zone sight line triangles must be defined for the trails to eliminate blind spots. Landscape improvements designed within this zone must be below 2.5' and above 9 feet in height to provide unobstructed cross-visibility for trail users.

(Figure 4-14 – Sight Triangles/Corner Clips)



Trail at 4-way, Sight Triangles



Mid-Block Sight Triangles

Figure 4-14 – Sight Triangles/Corner Clips

Key Trail Locations/Overlooks

Trail map markers, rest stops, overlooks, and creek scenic areas are all examples of trail points of interest. These points should be integrated into the trail. Trail maps and guides give users directions. (Figure 4-15 - Trail Maps)

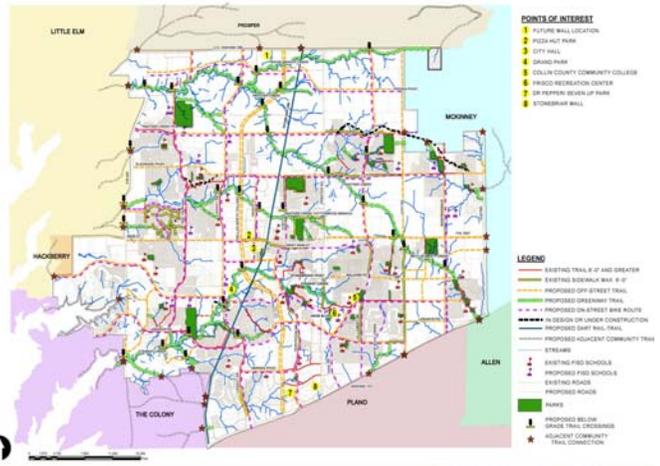


Figure 4-15 - Trail Maps

Saw cut all joints 0.125 inches wide to help eliminate hazards to skaters. Different materials and forms can be used on special areas such as overlooks and rest stops, depending on its function and location. (Figure 4-16 - Trail Jointing and Figure 4-17 - Special Overlooks.)

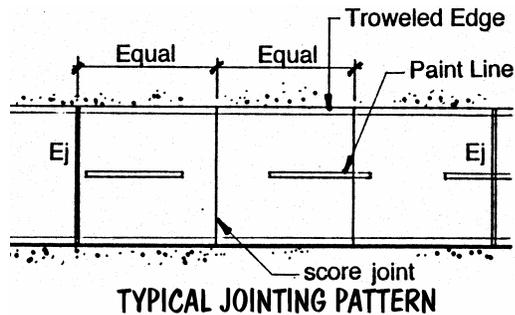
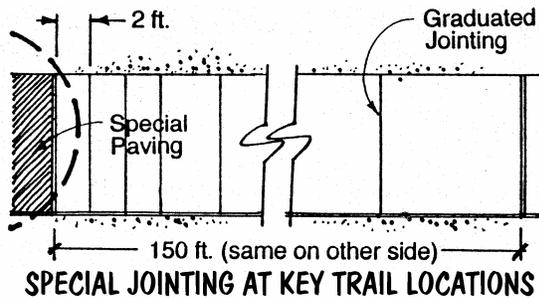
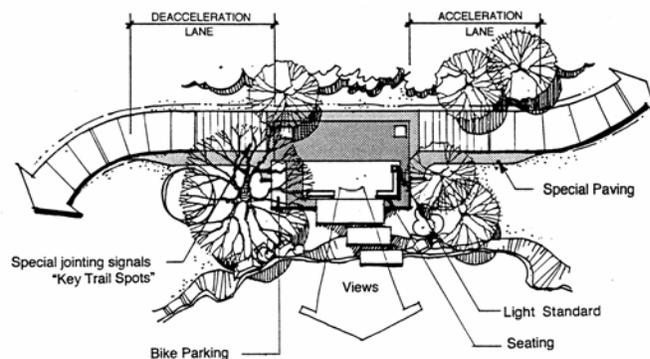


Figure 4-16 - Trail Jointing



Trail Heads

Location

Typically, trailheads are associated with the greenway or a regional open space system rather than On-Street or Off-Street trails. The principal reason for this relationship is that Open Space Trails become destinations for recreational users. Users will drive to a convenient access point, park their cars and access the trail system, typically doing a loop or an out-and-back run or ride. Once the trails are developed providing access to other parks and regional trail systems, the City can expect not only Frisco residents to use the greenway trails but residents from surrounding cities will use the trails as well. Parking is one of the

most important elements of a well-designed trailhead. Trail Heads for the Open Space Trail system should be located in City Community or Neighborhood Parks. In addition to the park locations optional informal trail head locations could be designated at shared *School District/City* school-park sites that are adjacent to an Open Space Trail. Ideally, park sites are preferred since there would be sufficient room to provide all the trailhead amenities listed below.

- Paved Parking
- Bicycle Racks or lean-rails
- Lighting
- Drinking Fountain
- Kiosk or Information Board
- Trail System Map with mileage chart
- Landscaping/Shade Trees
- Portable Toilets (optional – need should be monitored)

Parking

Parking requirements at trailheads will vary over time. As the trail system becomes more developed offering more options and destinations and as the population of Frisco increases so will demands for parking at trail heads. Locating trailheads in parks or sites adjacent to trails should accommodate most parking needs. Trailhead parking lots should have 10-20 spaces with a minimum of one handicap space. Trails, trail amenities, parking and trail access will comply with ADA and TAS requirements for accessibility.

Kiosks

Information bulletin boards or kiosks should be located near parking areas, water fountains, and restrooms where people have a reason to stop. Locating them at the beginning or end of the trail and adjacent to the parking areas is effective because people are stretching or unloading bicycles. These locations are also good for placing the Trail Guidelines (which should be brief and clearly posted.) Informed trail users are more likely to be courteous and behave safely on multi-use trails. **(Figure 4-18 - Kiosks)**

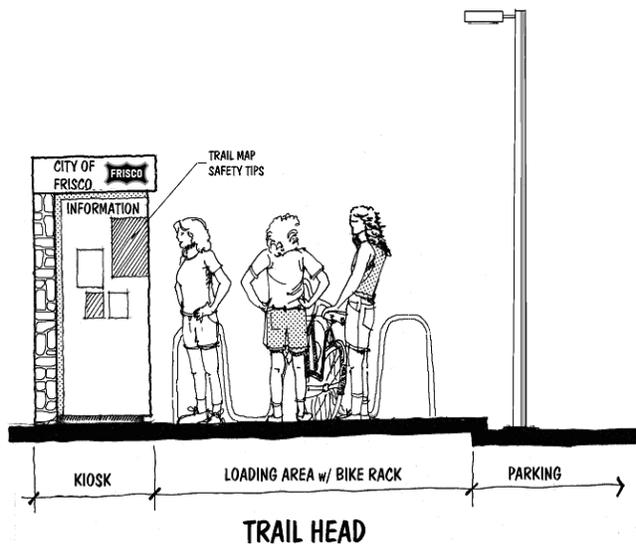


Figure 4-18– Kiosks/ Trailheads

Information Signs

These signs should be placed within the first 150 feet of the trail. Specific trail names, length of the trail, and regulations concerning trail use are included on information signs. Placing these signs at the beginning of the trail allows the users to plan their ride and to gather and review any pre-ride preparation

Drainage

Water should not be allowed to stand or flow in streams across the trail. Ideally, it should flow across the trail in sheets. There are several ways to remove water from the trail. These include: cut slopes, culverts, and French drains.

- Out-slope all hillside trails. Suggested out-slope for the tread is 1 inch for an 18 inch wide tread and 2 inches for a 30 inch wide tread. (The tread is the horse-hoof compacted, vegetation-free area in the center of the 5' wide, obstacle-free clear zone.)
- Draining the trail surface can effectively be done with culverts and French drains. Initially, these two types of drainage systems cost more, but they rarely require major maintenance.

Culverts are used to drain small streams, swales, and low places under the trail. Culverts come in a variety of materials. To assure proper performance, the culverts need to be sloped a minimum of 2 percent

French drains collect water from the surface of the trail. Initially time consuming to build; French drains are practically maintenance free. A French drain is made up of a slotted piece of pipe, gravel, and filter fabric. The trail surface goes right over the drain and water filters down through to the drain.

The infiltration characteristics of a soil depend on the type or density of the soil and the slope of the surface. These two characteristics determine how often water needs to be diverted from the trail so it will remain maintenance-free

CRITERIA FOR MID-BLOCK CROSSINGS

The mid-block crossing is not the preferred method of crossing because user safety is a major concern when these crossings are at-grade. For this reason, a very detailed design crossing must be done. (Figure 4-19A&B - Mid-Block Crossings - Possible Treatment)

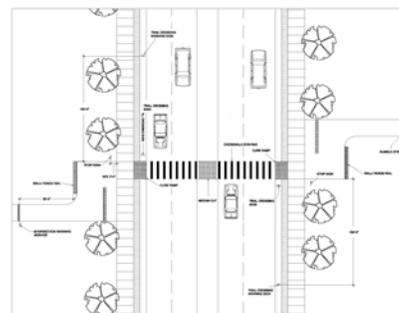


Figure 4-19A - Mid-Block Crossing - Possible Treatment (Divided Roadway)

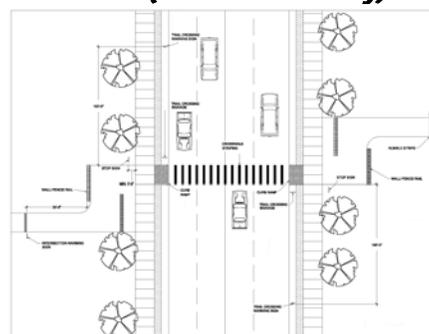


Figure 4-19B - Mid-Block Crossing - Possible Treatment

- A double-head streetlight in the median or two single head fixtures on each side of the street are needed on a four- to six-lane street with a mid-block trail crossing.
- Signs are always placed outside of the "obstacle-free area". Warning signs (e.g. STOP AHEAD) are used to alert hike and bike trail users that they are approaching a street intersection.
- The sidewalk users will have WATCH FOR BIKES signs placed at eye level to warn of mid-block crossings.
- The trail users will have a stop sign and stop bar painted at the extended outside sidewalk line. If there is no sidewalk, the stop bar is placed at the extended curb line.
- *Physical barriers such as walls, fence or rails will be placed in the trail to force trail traffic to stop and navigate around the barrier before crossing the street.*
- *Rumble strips will be added to the trail prior to reaching the roadway crossing to alert trail users of an approaching crossing.*
- *Bollards should be the "break away" type and painted with a bright reflective paint for day and night visibility. The bollard in the center should be removable to allow for maintenance and emergency access to the trail, but be locked in place to prevent unauthorized vehicles from entering the trail.*
- BIKE CROSSING signs let motorists know there is a hike and bike trail crossing. Standard cross walk markings indicate crossing to both motorist and trail users.

FOUR-WAY INTERSECTIONS

Trail users need to watch for conflicts with vehicles from all four directions. The direction of greatest concern changes with the location from which the user approaches. Although the trail users will have a stop sign,

the concerns apply to cyclists starting from a stop, as well as those who ignore the stop sign. **(Figure 4-20 - Conflicts at a Four-Way Intersection)**

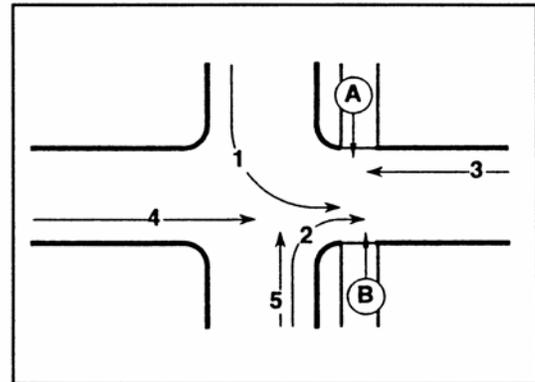


Figure 4-20 Conflicts at a 4 way Intersection

The trail should cross this type of intersection at the crosswalk location (which is between the extended curb line and the stop bar for the vehicular traffic.)

Signs are posted on the trail to alert users to possible motorists in their blind spots; e.g., TURNING TRAFFIC TO RIGHT (on the left side) and TURNING TRAFFIC TO LEFT (on the right side.) These kinds of conflicts are the most dangerous to the users crossing this type of intersection.

BIKE CROSSING signs *may be* placed on motor vehicle approach directions. Also on this sign is the name of the trail that crosses the street.

Standard Treatments for Signalized Intersection

Cyclists crossing at this type of intersection are in the most danger from the motorists within their blind spot. Regulatory signs are used on the trail to alert users of the possibility of motorists within this zone. These signs read TURNING TRAFFIC TO RIGHT and TURNING TRAFFIC TO LEFT.

Pedestrian push buttons are mounted on the traffic light standard on the right side of the trail. Detector loops are also placed in the right side of trail pavement and are marked with a painted bicyclist logo. The trail buttons and loops will reduce the intersection light

timing changes to a minimum by only being "active" when the trail is in use. Since trail traffic is lower than road traffic, the decision to signalize or not is almost always decided by the road traffic. Signal timing will need to be adjusted to allow bicyclists to cross the street based on a start up time of 2.5 seconds and a traveling speed of 10 mph. An all-red interval may be required

Freeway Intersections.

A grade separated trail is the only solution for freeway crossings. The most realistic opportunity for crossing the freeway is at existing or proposed underpasses or bridges. (Figure 4-21 - Freeway Underpass)

The ultimate (and most expensive) solution is to construct a tunnel or bridge dedicated to getting the trail across the freeway. It is usually more economical to cross the freeway as part of an extra wide road bridge (designed and built from the start with the extra width for the trail on one side.)

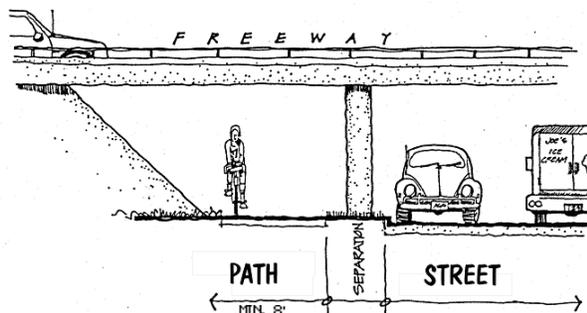


Figure 4-21 - Freeway Underpass

Alternative Trails

Special historical and visual points of interest along the trail should have spin-off trails for pedestrians and joggers. Bicycle rack parking should be provided for bicycles. Spin-off trails should be narrower and signed appropriately to discourage bicycle use on them. (Figure 4-22- Spin-Off Trails)

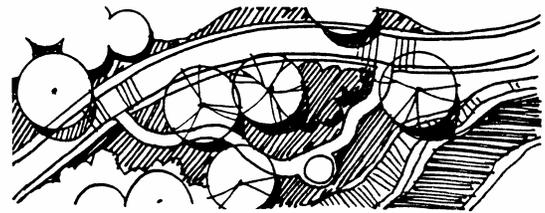
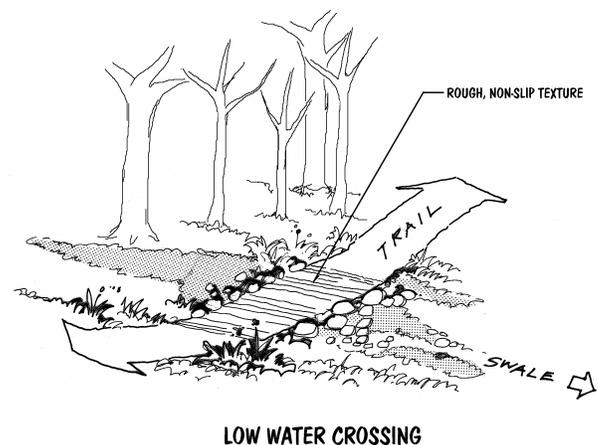


Figure 4-22 - Spin-Off Trails

Water Crossings

Single span bridges are a better solution than low water crossings. High maintenance costs and trail closures are associated with low water crossings. The trail will have to be closed during periods of high water and remain closed until the mud and branches are cleared away. The time needed for post-rain cleanup will reduce the trail's availability. There is also a safety problem when frequently wet spots, like low water crossings, develop a slippery, algae growth.



**Figure 4-23 Water Crossings
On-Street Connectors/Bike Routes**

On-Street connectors are trail connections utilizing low-traffic volume streets. On-Street connectors can be used where drainage corridors and other trail corridors cannot naturally connect. Proper signs and trail markings are very important because these connectors are not dedicated to trail use. They are shared with automobile traffic.

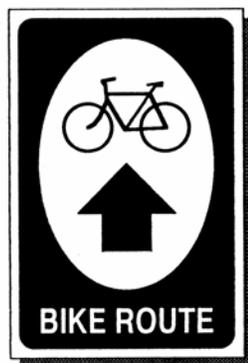
Route Signs

Route identification signs are the main sign type for On-Street bike routes. The following criteria should be used to develop these signs:

- *Bike route signs shall be W11-1 diamond shaped, bicycle warning sign with a W16-1 or W16-7p companion rectangular shaped SHARE THE ROAD sign, color, and size shall conform to Texas MUTCD.*
- *All bike route signage shall adhere to Texas MUTCD (Global) standards.*
- *All bike route signage shall be reflectorized.*
- To help minimize the chance of vandalism or damage to the sign, it is always oriented vertically. The signs are **always** placed on the right side of the road. If a sign is placed on the left side of the road due to sight line considerations, a duplicate sign is still placed on the right side because that is where vehicle operators expect them to be.
- Bike route signs are placed wherever bike routes cross other bike routes and major thoroughfares. Signs are also located at the beginning and end of each route.
- To confirm that the bicyclist is still on the bike route, signs are provided every 0.5 to 1 mile intervals.
- Missing signs along the bike route should be replaced as soon as possible because missing signs make the routes unusable. Once a bicyclist is off the route, there is no indication of how to get back on the route.

Assurance Stickers

"Assurance" stickers *may* be placed on stop and speed limit sign poles that are along bike routes where the route goes straight and a bike route sign is not already planned. The top of the stickers are placed approximately 6 inches below the bottom edge of the stop or speed limit sign. "Assurance" stickers are 3 by 4 inches and are reflectorized. The stickers give assurance to the bike route users that they are still on the right route without adding to sign clutter. As an added benefit, they cost almost nothing. Since bike route signs are used at every bike route turn, assurance stickers are only used where the route goes straight. (Figure 4-26 - Bicycle Route Assurance Sticker)



Assurance sticker

Figure 4-26 - Bicycle Route Assurance Sticker

Drainage and Manhole Requirements

Where storm drainage elements occur, recessed curb inlets are preferred over drain grates. If grates must be used, they must be bicycle- and wheelchair-safe with openings no wider than 1 by 2 inches.

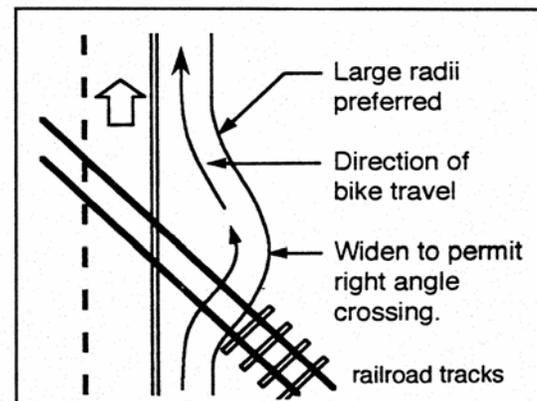
Grates and manhole covers should be flush with the surface and be maintained in a flush state when the roadway is resurfaced.

After completion of any roadwork (e.g., utility cuts or street repairs), the roadway surface should be returned to a smooth, flush condition.

Railroad Crossings

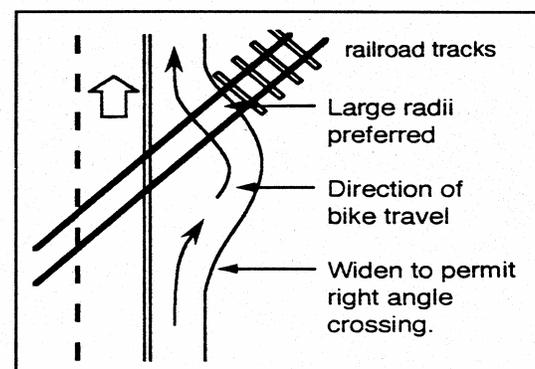
A smooth, flush surface is also important at railroad crossings. The use of rubber mat crossing materials in new installations and provision of road flare-outs at dangerous angled railroad crossings are also important. Extra wide spots in the road at railroad crossings can allow a cyclist to swing to the right or left as needed to cross the tracks at nearly a right angle. (Figure 4-27 - Acute Angle Bikeway/Railroad Crossing and Figure 4-28 - Obtuse Angle Bikeway/Railroad Crossing) Flange-way fillers should be used where train speeds are low and perpendicular crossings cannot be achieved through other techniques.

The gap between the road edge and track bed edge should be repaired or filled as needed to compensate for uneven settling rates.



Bikeway and Angled Railroad Crossing (acute angle).

Figure 4-27 - Acute Angle Bikeway/Railroad Crossing



Bikeway and Angled Railroad Crossing (obtuse angle)

Figure 4-28 - Obtuse Angle Bikeway/Railroad Crossing

Bicycle Parking

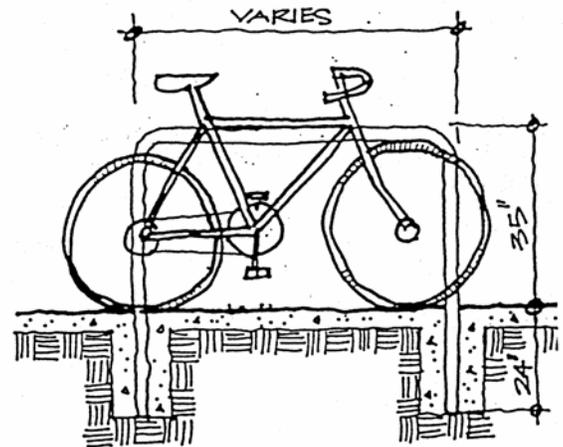
Lack of convenient and securable bicycle parking at schools, employment, and shopping and cultural facilities has been shown to be one of the greatest impediments to increased bicycle use. Bicycles that are unsecured or improperly secured are an invitation to thieves who know how easily bikes can be converted into cash. It has been estimated that millions of bicycles are stolen each year - this makes bikes the most frequently stolen item in the United States. To encourage more people to use their bicycles as an alternative to automobiles, provisions must be made for secure bicycle parking.

The City's Off-Street parking ordinance needs to be updated to include bicycle-parking requirements for both long- and short-term users. Employees and transit commuters typically use long-term bike parking, while short-term bike parking is mostly for customers and clients.

A Bicycle Parking Manual section in the ordinance should be developed that defines the bicycle parking requirements and provides detailed guidelines for the development for bike parking facilities. The Bicycle Parking section should work hand-in-hand with zoning ordinances and Off-Street parking requirements and should detail the following:

- Long-term and short-term bicycle parking devices, e.g., racks, lockers, hitching posts, etc. (Figure 4-29 - Bicycle Parking

Devices.)



Bicycle Parking Devices

Figure 4-29 - Bicycle Parking Devices

- Placement and design of bike parking signs. (Figure 4-30 - Bicycle Parking Signs)
- Standards for bike parking construction and access.

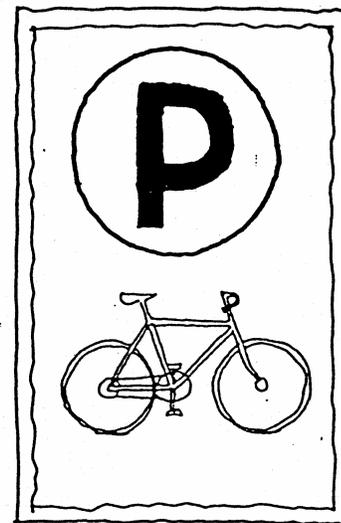


Figure 58 - Bicycle Parking Signage

Figure 4-30- Bicycle Parking Sign

SECTION V

MASTER PLAN IMPLEMENTATION

An important component of the Trail System Master Plan is an implementation plan that will aid in an orderly and deliberate development of the system. The final location, design and funding of the facilities called for in this plan will require Council approval. This implementation plan consists of:

- prioritization of Hike and Bike Trail elements,
- recommended components needed to implement the plan,
- identification of funding sources,
- identification of mechanisms to encourage trail system development,
- steps that should be taken to preserve the trail system corridor resource, and
- Actions to be taken to promote bicycling as an alternative transportation mode.

Prioritization of Hike and Bike Trail Elements

Before the individual trail elements can be "bundled" together into a system and targeted for implementation, a prioritization must be developed for these elements. Priorities are based on need, availability of resources, public input, and cost. The Trail System Master Plan prioritization was developed using the following priority considerations:

- Sign On-Street bike routes *when the criteria are met as described on page 16.*
- Initially, development of trails and bike route should be on park land, along existing roads, or on land that is already available to the city. This will avoid a lengthy land acquisition process. Initial development should also provide connections to as many community

facilities as possible, be centrally located, and be very visible to the citizens.

- Trails within the Major Creek Corridors should be the next components added to the system because of their importance to satisfying the growing recreational demand of the citizens of Frisco. This will also create the spine for the future trail spurs which private development will be encouraged to implement. Future golf course developments that are constructed in the creek corridors must allow trails to be continuous along the creeks.
- The trails that are along thoroughfares already built to final approved cross-sections may require additional R.O.W. and/or easements. Trails in this category need to be coordinated with new development and/or existing uses. Even though a trail may not be built in the near future, a lot of analysis needs to be done up front in order to decide where the trail will go, and to minimize the impact of future development on trail implementation.
- The trails that are a part of the not-yet-built-to-ultimate-design thoroughfares would be implemented as improvements to those thoroughfares occur. The most significant of these would be Main Street/*FM3537* that provides a major east/west link to the future Dal-Homa Trail alignment.
- Development of the public portions of the secondary system is the lowest priority. Their development and usefulness is heavily dependent on the rest of the trail system already being in place.

Component One: On-Street Bike Routes

On-Street Bike Route Signs, Pavement Re-striping, and Bike Route & Multi-Use Trail Map.

The On-Street bike route components were developed with the "availability of resource" priority being the prime factor. Those routes that utilize existing wider or low-traffic volume roadways that need little or no modification are the first to be implemented. Those that are a part of future road and highway projects come in later phases of implementation as they are constructed.

Bike routes should be initially implemented on those roadways where no modification to the current cross-section is required.

Signing about 50% of the 30-mile On-Street bike route system could begin immediately by using existing bicycle-friendly roads.

The On-Street signs, combined with a map showing the signed routes and the trail system, will make it possible for current and potential bicyclists to expand their recreation and transportation horizons. The specific bike routes to be included in this phase will be selected later with citizen and council input as to the relative priorities of various routes.

- widening roadway to final thoroughfare plan specifications
- lane striping to accommodate Bike Lanes
- repave rough surfaces

Future roads will be constructed as dictated by development and as traffic increases within the City. This component includes the remaining 50% of the 30-mile bike route system.

Component Two: Rowlett Creek Trail

- City has ownership of right-of-way for the trail.
- Important link to Rowlett Creek regional trail system.
- Provides trail access to two parks and several schools on the east side of Frisco.
- Sets a standard for future Open Space Trail development.

- Have trail ready for improvements to SH 121.

Component Three: White Rock Trail

- Requires only a short segment of trail to be constructed in order to get a connection to the second regional trail system, White Rock Trail.
- Majority of Residential development is in the Hillcrest Road corridor.
- Have trail in place prior to improvements to SH 121.

Component Four: Stewart Creek

- Would provide access to The Colony trail system and potential access to Lake Lewisville and Corps of Engineers public land.
- Relatively short trail segment to construct.
- Second largest area of development within the city.
- Potential to link from downtown to the southeast, *William Fisher E.S.*, *Izetta Sparks E.S.*, *Reba Cobb Carrol E.S.*, future school and park sites.

Although new to north Texas, the approach of combining rail and trail in the same R.O.W. has proven very successful and safe in other parts of the country. The Master Plan shows a future trail opportunity parallel to the existing rail line.

Connection/Linkages to Lake Lewisville and the Dal-Homa Trail

The Dal-Homa Trail will follow the Elm Fork of the Trinity River. Its exact location is not known, even to the point of being able to say which side of the river it will be on. (The west side is Frisco; the east side is Carrollton.) This project will eventually connect all the way from Dallas to Oklahoma. The in-progress Corps of Engineers Dal-Homa Trail Study will resolve many of the current unknowns. The trail was listed last because of the uncertainty concerning its exact location and timing.

Implementation Check List

The successful implementation of a bicycle and pedestrian trail Master Plan calls for the cooperation and support of many departments within the City. Since the plan addresses recreation and transportation, implementing the plan is not something that can be assigned to one department to implement without input and cooperation from other departments.

The follow up items *listed below* only scratch the surface of what will, in the long term, change the way citizens, staff and council view recreation and transportation in the City of Frisco:

- Modify ordinances as needed such that all future development is required to provide at least bicycle and pedestrian access between adjacent developments. Just as adjacent office developments have a common *vehicle* access, ALL adjacent developments should have common *non-vehicle* access. This means that adjacent residential developments would have access to each other, as well as to any schools, parks, retail or office developments they happen to be next to. This will give citizens a bigger chance to leave the car behind when making short transportation trips in Frisco *and/or surrounding communities*.
- Preserving floodplain land for trail corridors.
- Require golf course developments proposed in the 100 year flood plains to provide right-of-way for Open Space Trail connections.
- A bike parking section can be created to support the changes to the Zoning Ordinance. This information will be needed because developers are not familiar with the details of implementing successful bicycle parking. This manual should be separate from the ordinance because it will include a level of detail that would be

inappropriate for an ordinance and because, as a working document, it will need to change more often than an ordinance would.

- Submit applications for funding for Trail Master Plan implementation. The best strategy would be to apply for everything that can be built at this time.

Thoroughfare Plan additions:

- Identify roadway sections with trails along them and specify which side of the road the walk will be on. Implementation will be most flexible where the road hasn't yet been built or widened to its ultimate design width.
- Where the trails are being added to existing ultimate cross-section roads, the options for implementation are more limited. These areas will require special monitoring by staff to be sure that space is set aside for the trail as piecemeal development occurs before the trail section is implemented. The trails will most likely be built *within the roadway R.O.W.*
- Change Open Space trail easements required through new developments to a minimum 25-foot obstacle-free width with a 12-foot concrete trail. A wider easement is needed when walls or other barriers block sight lines. The easements will also need to comply with horizontal and vertical radius of curvature requirements as per the 1999 AASHTO Guide for the Development of Bicycle Facilities.
- Develop Standard Construction Details for Hike and Bike Trails to reflect current AASTHO and TXDOT regulations.
- Modify other City of Frisco Standard Construction Details where roads, driveways and sidewalks can be made more bicycle-friendly.

Funding Sources

Local Funding

The city has several funding options available regarding funding and implementing of the trail system. A few of these sources include:

- CDC funds
- CMAQ/STPMM Funds
- Safe Routes to School Program
- Park dedication funds
- General Fund
- Enterprise and revenue funds
- Grants-In-Aid
- Parks and Recreation Capital
- Improvement Program
- Half or one cent sales tax dedicated to trails

Of these alternatives, bond funds offer the best potential for funding the implementation of the system.

General Obligation (GO) bonds would aid the implementation of the "greenway trails" and the bike route program as part of the implementation of the Thoroughfare Plan.

Other local funding opportunities could come from the private sector through foundation grants, company grants, individual donors and memberships, service clubs, special events, and fundraisers.

Mechanisms to Encourage Trail System Development

As was mentioned earlier in this report, the City should be responsible for the implementation of the network of **primary trails** throughout the City with the private sector being encouraged to implement the secondary trails. In that regard, various mechanisms should be considered and evaluated to encourage this development within both the public and private sector. These mechanisms should be geared to respond to four broad issues:

- Land Acquisition
- Joint development techniques
- Preservation of the Natural Qualities of the Trail System Corridor Resource
- Promotion of Bicycling as an Alternative Transportation Mode

Land Acquisition

There are many techniques that could be employed to add land to the park system in addition to fee-simple purchase. Of these, the following appear to be especially suited to promoting acquisition of land for the trail system corridors:

- Taxation
- Land Donations

Taxation

The tax advantages to a landowner for allowing the city to use a portion of his property through a conservation or activity easement make this an attractive mechanism to consider. Tax abatement or tax deferral might encourage owners of undeveloped property through which the trail corridor passes not to develop all or a portion of their property. Property taxes could be assessed at the property's undeveloped tax rate but would not be collected until the property is developed or sold for development. During this deferral period, the public would have use and enjoyment of the land. When development does occur on the property the City would be

in a position to take a proactive role in having the trail corridor integrated into the new development. The use of easements could also be a useful technique in securing the needed space to extend the trail corridor through built out portions of the City. Hand in hand with the use of easements would be the City's assumption of liability associated with the site's use as a park. There are also **tax reductions** available for the donation of private land for recreational and scenic use.

Land Donations

The city should encourage property owners to donate portions of their land for development of trail corridors. This would be a useful technique especially where small slivers of privately owned property are required to add to existing drainage easements for the proper trail development. Specific tax advantages are available to those persons interested in donating land.

Joint Development Techniques

Joint development would entail the use of funds for private development that would also include new public facilities. New services of tax revenue and other benefits are generated through these public-private cooperative agreements. One technique to be considered might be incentive zoning where a developer would be allowed to build at a higher density in return for providing trails, linear parks, etc.

Preservation of the Trail System Corridor Resource

Successful implementation of this system of trail corridors will depend, in part, on the natural drainage ways of the city. Most of these drainage ways are within private property including some land considered within the 100-year flood plain. The consideration of adopting a Watershed Management Ordinance that would preserve flood prone property as publicly owned or controlled open space. This could help further the development of a linear park system that could make the implementation of the Off-Street trail system much easier.

Promotion of Bicycling as an Alternative Transportation Mode

There are a number of actions that the city could take to promote bicycling as an alternative transportation mode; however, two actions stand out as having the greatest immediate impact:

- Provide for secure and easy-to-use bicycle parking.
- Develop a comprehensive bicycle education program.

Bicycle Parking

It has been shown that one of the greatest impediments to increased use of bicycles is the lack of convenient and securable bicycle parking at educational, employment, shopping, public facilities, cultural, and residential facilities. Unsecured or improperly secured bicycles are an invitation to thieves, who can easily convert stolen bicycles to cash. It is estimated that over four million bicycles were stolen during 1993, making bicycles the most frequently stolen item in the United States. The provision of secure bicycle parking will encourage more people to use their bicycles as an alternative to automobiles.

As a separate action to the development of the Trail System Master Plan, bicycle-parking regulations should be developed as part of the City's Zoning Ordinance. The sections needing review and modifications are:

- Off-Street parking requirements
- Definitions

Staff and/or consultants will suggest the specific modifications at a later date. Items to be addressed include:

- Number of required short- and long-term bicycle parking spots for each use.
- Maneuvering area requirements for bicycle parking.
- Bicycle parking location requirements.

- The requirement for bicycle parking signs and racks.
- Definitions of terms related to bicycle use (e.g., Bicycle, Primary Entrance, Short-Term Bicycle Parking, and Long-Term Bicycle Parking.)

In addition to the above suggested ordinance changes, a **Bicycle Parking Manual** should be developed to guide and regulate the development of parking facilities. The manual would cover the details that are critical to successful bicycle parking, but at a level of detail that would be inappropriate for the Zoning Ordinance. The manual is also much more flexible (e.g., more easily changed) than the Zoning Ordinance. The manual will work hand-in-hand with the Zoning Ordinance and include the following:

- Design and construction standards to include items like pavement standards and the prohibition of adjacent motor vehicle parking overhang.
- Pre-approved commercially available short- and long-term bicycle parking devices. (Bike racks and lockers)
- Designs for approved bicycle-parking devices for short- and long-term use (e.g., parking racks, lockers, hitching posts, etc..)
- Criteria for designing custom bicycle parking devices not already approved.
- Bicycle parking sign placement and design requirements.

Bicycle Use Education Program

Important to the success of any efforts to encourage bicycle use are the education of both **bicyclists and motorists** as to their respective rights and responsibilities.

Bicyclists must realize they are operating vehicles and that the same rules of the road apply to them as apply to the operators of any other vehicle. The Texas Bicycle Coalition (TBC) has prepared the excellent "*Texas Super Cyclist Project*" that addresses these

bicyclists' issues. It is available at no cost for 4th and 5th graders. The program can be reviewed on the World Wide Web at Supercyclist.org.

Another way to educate bicyclists is to offer the **Effective Cycling Course**, developed by the League of American Bicyclists, at City recreation centers, schools or Collin County Community College. This course teaches traffic handling skills so that cyclists are able to better communicate with motorists. These communication skills, when combined with an improved respect for the law, make cyclists more predictable and therefore less of a hassle for motorists. The course also teaches bicycle handling skills and bicycle maintenance.

Motorists are often not aware that bicyclists have a legal right to use the roads. The TBC has also worked with the state on significant changes to the Texas Department of Public Safety's Driver's Handbook.

Many video Public Service clips, aimed at motorists and bicyclists, are also available from the TBC. Past clips have featured famous people including John Tesh and Tom Landry.

Information to be provided during bicycle safety instruction sessions at Frisco Fire Safety Town.

A regulatory roadside sign explaining the legal status of bicyclists has proven to be effective in areas where large numbers of bicyclists and motorists are competing for a narrow lane.

Education at area schools can have a great impact by addressing the basics:

- ride on the right side of the road,
- use hand signals to communicate,
- use a light at night,
- stop at stop signs and red traffic lights, and
- Always wear a bicycle helmet.

The first three of the above basic bicycle safety tips are required by law and should be addressed by police during normal patrol. In most cases, a friendly talk can serve to increase bicyclists' awareness of, and compliance with, the law. Officer discretion will play an important part in the decision to ticket or not; in either case, the goal is to maximize the potential for future compliance and safety.

Security Concerns Regarding Multi-Use Paths

Security concerns regarding multi-use paths center on two broad categories:

- The security concerns of landowners adjacent to the trails.
- The security concerns of trail users.

Adjacent Land Owner Security Concerns

The landowners adjacent to proposed trails are naturally concerned about security for themselves and their property. They fear the unknown and need facts on the impact that a new trail will have. Their concerns are issues such as crime, vandalism, reduced property values and litter. Where a soon-to-be-abandoned railroad corridor is involved, adjacent landowners often want the land to revert to their ownership.

Statistics available from cities with trail systems show that crime does not become a problem along trails. But the concerns about crime are real and must be addressed from the landowners' point of view. Reported crime climbs when a trail first opens because there are now witnesses to currently unreported crime.

Trails have proven to be self-patrolling, i.e., the more a trail is used the less likely there will be crime. Crimes along trails occur at the same or lower rates as at other locations.

Property values remain neutral or increase up to six percent. After trails are built, adjacent

landowners use them and prefer them to what was frequently an unmaintained eye sore before the trail. A classic example is the railroad conversion to a trail where land owners wanted 8' high walls along the frontage, but finally agreed to try the first year without a wall as long as they could have a free wall installed after the year ended. It has been several years and none of the owners exercised their option.

The best way to handle the security issues process is for the City to be positive and open. It is important to encourage communication and keep everyone informed.

Reaching out to landowners (and the general public) heads off rumors and any misinformation that may exist. The City should be proactive and make certain that everyone hears the good and bad news from the City first. Special efforts are needed to listen to and address the concerns of opponents and help them become allies in support of the proposed project.

The City should require developers to not design subdivisions with lots that back to open space and open space trails. This will reduce the number of people who don't feel they should have a trail behind their house. The trail becomes less of a back door to neighborhoods.

There are several studies that show the positive impacts of trails, including one by the National Park Service addressing trails along old railroad rights-of-way.

Trails bring additional business to a city and also bring recognition to the area as a good place to live.

But the best proof of all that trails are desirable is Dallas' White Rock Creek Trail (running from the north end of White Rock Lake Park to Valley View Park near LBJ Freeway at Hillcrest.) The trail, opened in 1986, has actually drawn development. A developer built upper end "life style", single-family homes (costing \$250,000 to \$350,000 each) on the north side of Royal Lane directly across

from the trail because "people would have immediate access to the trail and also see an adjacent golf course." One current resident, an attorney, told Dallas Park Department personnel that he specifically bought his home because he wanted to have the trail at his doorstep.

Trail User Security Concerns

Trail users are concerned for their personal safety (accidents and crime) and the safety of their property (theft of bikes, cars, etc.)

Safety among the diverse trail users is promoted through good design using CPTED standards and ongoing maintenance. A wide trail, shoulders on both sides, center striping, hazard signing, solar powered "911" call boxes in remote locations, intersection and underpass lighting and a concrete surface all contribute to a safer trail environment. Maintenance of sight lines and the level grass shoulders contribute to a reduction in accidents and also reduce the hiding places for the criminally inclined. Trail user behavior guidelines on signs along the trail and at kiosks at staging areas can also contribute greatly to the smooth interaction among trail users.

Those who are not trail users often quote fear of personal attack as a concern. Those who do use trails do not have this fear because threats to personal safety have been proven to be no more than an occasional problem. Normal neighborhood or street patrol by police officers will address trail user concerns about personal attack.

Easy access to the trail by police, emergency and maintenance vehicles will all contribute to the perception and reality of user and resident safety. This means that bollards need to be removable by operators of the just mentioned vehicles. Occasional unpaved turn-around spots needs to be included in areas where the trail is surrounded by vegetation (e.g., don't make a fire truck back out of a wooded area.)

The best way to address trail user concerns about the safety of their cars while they use the trail is to provide sidewalks and make roads

bicycle-friendly. This will encourage trail users to walk or "drive" their bikes to the trails.

Even with bicycle-friendly approach roads and sidewalks, many trail users will choose to arrive by motor vehicle and will need parking areas with easy access to the trails. Their parking and security needs can be met by having joint use parking areas where weekday employee parking will allow evening and weekend trail user parking. Parking lots that are easily seen from long distances tend to have the fewest problems.

If trail user car parking is near restaurants, food stores, and other attractions, there will be a double benefit from before-and-after-trail-use business and further reduced parking area security problems.

Bicycle parking should also be installed at trail parking areas in order to encourage the maximum spill-over to nearby businesses and to allow users the maximum flexibility. For example, an individual might bike to the trail and then walk from the trailhead or bike to the trail and then walk to a restaurant for a meal.

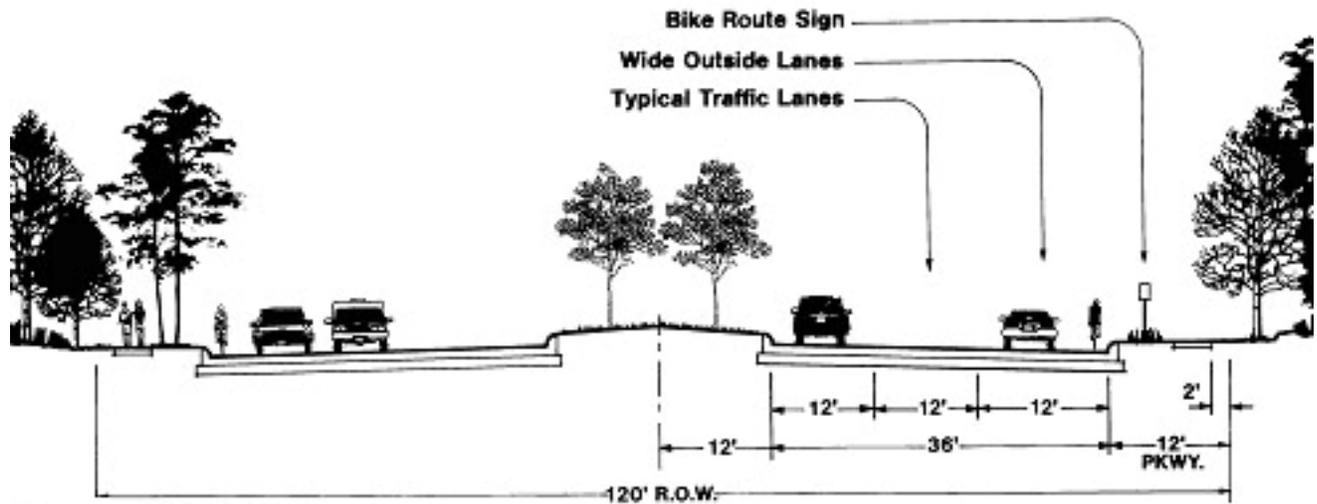
Trail System Master Plan References

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- 2006 City of Frisco Comprehensive Plan*

Appendix A: Thoroughfare Cross-Sections

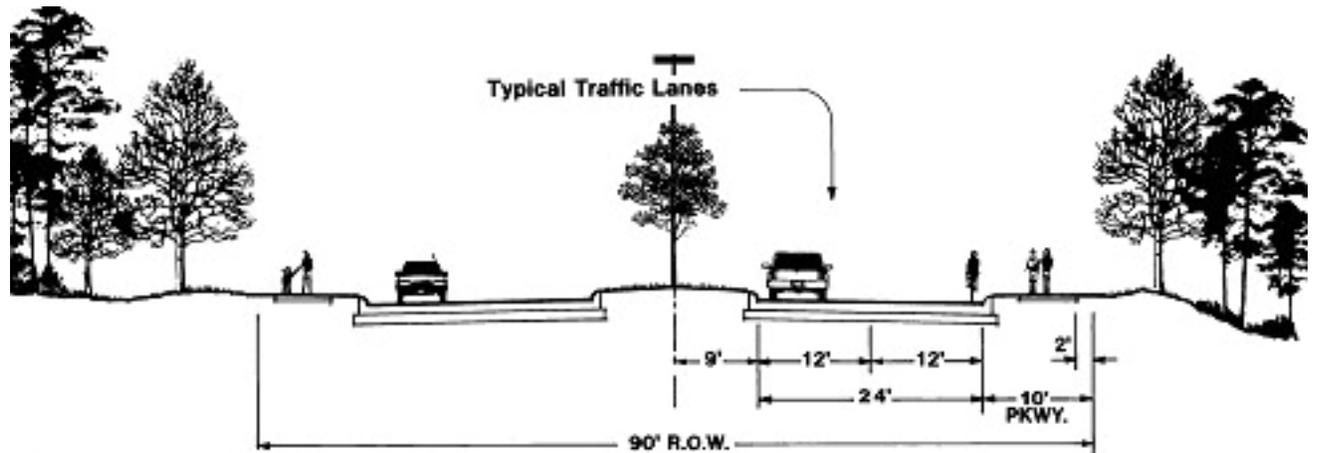
Because this Trail System Master Plan depends on thoroughfares within the city to assist in accomplishing its objective, close coordination with the thoroughfare plan is important. The various thoroughfare classifications are shown here with recommendations for incorporating greenway trails, wide outside lanes for bike routes, and sidewalks into the overall cross-section requirements.

The following recommended cross-sections are suggestions that City Staff may have to modify for any given project. Please refer to the City of Frisco Thoroughfare Plan for the minimum requirement for cross-sections.



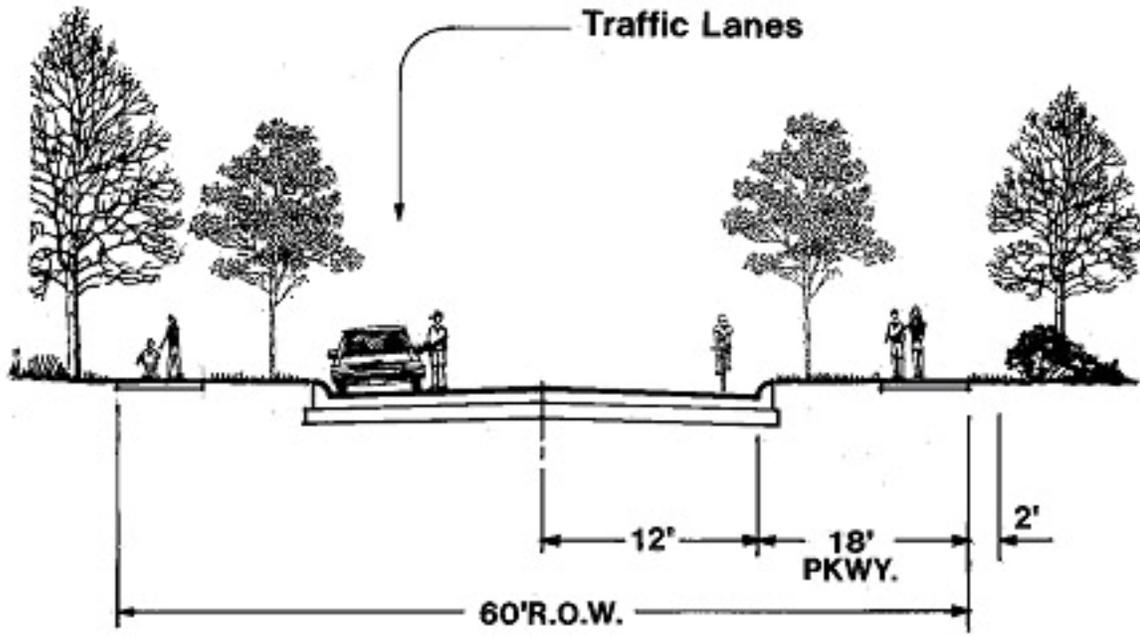
Proposed Modifications
Major Thoroughfare 'A'

Figure A-1-



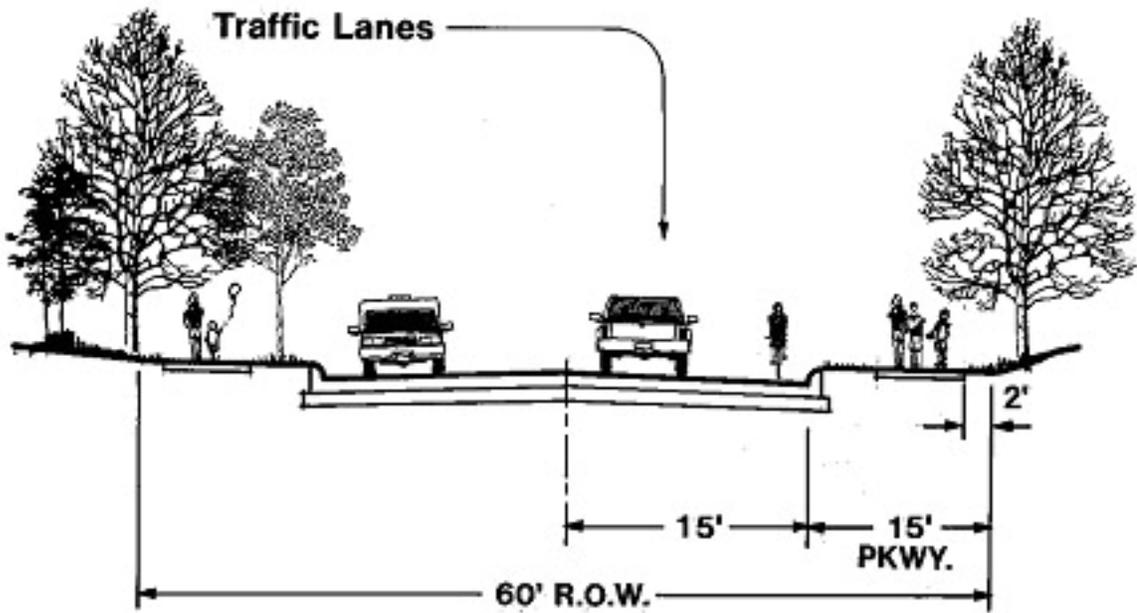
Proposed Modifications
Minor Thoroughfare 'B'

Figure A-2-



Local 'F'

Figure A-3-



Collector - Residential 'D'

Figure A-4-

Appendix B: Relative Bicycle Safety

It is apparent from the table shown below that a bicyclist is 2.6 (292/114) to 5.0 (292/58) times more likely to have an accident when bicycling Off-Street when compared to cycling the same distance on streets. ^[1]

The natural inclination is to think that the rate of serious accidents per mile of travel will be higher for On-Street cycling when compared to Off-Street cycling. It is perceived that an accident with another cyclist or pedestrian can't be as bad as an accident with a car, but this is not true. The accident data also shows that the ratio of serious accidents to total accidents is approximately the same for both On-Street and Off-Street cycling. This means that cyclists are more likely to have serious accidents on hike and bike trails when compared to cyclists who use the roads to travel the same distance. ^[2]

It is also interesting to note that a cyclist is safer than the average motorists when considering the accident rate per hour of exposure ^[3]. Dividing accident rate per mile by the time it takes to travel a mile gives the accident rate per hour. Doing this calculation, for both cyclists and motorists, reveals that a cyclist is safer being on the road for an hour than is a motorist (the cyclist just doesn't go as far.)

Type of Facility	Accidents Per Million Miles of Travel	Relative Safety Rate
Low traffic bike route streets	58	5.0 (292 / 58)
Minor arterials (4 lanes)	104	2.8 (292 / 104)
Major arterials (6 lanes or more, with median)	114	2.6 (292 / 114)
Off-Street (Hike and Bike Trails, sidewalks, alleys, etc.)	292	1.0 (292 / 292)

References:

^[1] J A Kaplan, Characteristics of the Regular Adult Bicycle User (Office of Highway Safety, Federal Highway Administration, Washington, DC, 20590), 1975.

^[2] J Forester (Cycle Engineering Consultant), Personal Conversation (Custom Cycle Fittings, 726 Madrone Ave, Sunnyvale, CA 94086), Apr 1985.

^[3] J S Allen, "How Dangerous Is Bicycling?" Bicycling (33 E Minor St, Emmaus, PA 18049), March 1984.

Appendix C:

Texas Bicycle Law Summary and Excerpts

Texas Bicycle Law Summary:

Texas law has defined a bicycle as a vehicle since September 1, 1983. Senate Bill 843 amended Texas law regarding the legal status of bicycles to conform to the national Uniform Vehicle Code. The law makes it clear that a bicycle is a vehicle. It also clarifies the circumstances under which a bicyclist is permitted to ride away from the right edge of the road.

The important points of Senate Bill 843, which became Texas law on September 1, 1983, are:

- A bicycle is now defined as a vehicle in Texas.
- A bicyclist has the same rights and responsibilities as the drivers of all other vehicles.
- A bicyclist may ride on a sidewalk if not prohibited by local ordinance (e.g., sidewalk riding is not allowed in the downtown Dallas central business district.)
- A person may stop, stand or park a bicycle on a sidewalk as long as it does not impede the normal and reasonable use of the sidewalk.
- A bicyclist should ride to the far right of the road (i.e., on the right shoulder) except when passing, when turning left, **WHEN THE RIGHT CURB OR EDGE OF THE ROAD IS UNSAFE (including surface hazards, parked or moving Vehicles), OR WHEN THE RIGHT LANE IS TOO NARROW FOR A BICYCLE AND A MOTOR VEHICLE TO SAFELY TRAVEL IN THE LANE SIDE BY SIDE.** (The last two cases cover about 90% of the roads in north Texas.)
- A bicyclist may ride to the left curb or edge of the roadway on a one-way roadway having two or more marked traffic lanes. Even though legal in some cases, riding to the left is not a good riding practice. In general, it is best to ride to the right (and take the **ENTIRE** right lane when appropriate) because motorists are more likely to do something crazy when encountering a bicyclist riding to the left side of the road. You can take the entire right lane by riding where the left tire of a car would be - your lane position will combine with the curb to effectively occupy the entire right lane.
- A bicyclist may ride in any lane of a street if he is able to keep up with traffic. It is difficult to keep up with traffic in all but the most unusual of circumstances, and then only with a significant effort. In any case, it is not a good idea to ride away from the right of the road, where a motorist might react dangerously upon "encountering" you. Legal or not, you lose when push comes to shove and you "encounter" a 3,000 pound car. This effectively means you should ride to the right whenever it is **SAFE** to do so.
- Bicyclists may ride two abreast in a single lane as long as they do not impede normal and reasonable traffic flow.

Texas Bicycle Law Excerpts:

The following lines come from Senate Bill 843.

- S.B. No. 843, Page 1

AN ACT relating to the application of certain vehicle and traffic laws to bicycles and bicyclists;

- S.B. No. 843, Page 1

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF TEXAS:

SECTION 1. Subsection (a), Section 1, Chapter 88, General Laws, Acts of the 41st Legislature, 2nd Called Session, 1929, or as amended (Article 6675a-1), is amended to read as follows:

"(a) 'Vehicle' means every device in, or by which any person or property is or may be transported or drawn upon a public highway, except devices used exclusively upon stationary rails or tracks." [This section previously excluded anything "moved only by human power" from the definition of a vehicle. It now includes a bicycle within the definition of a vehicle.]

- S.B. No. 843, Page 2

SECTION 4. Section 95, Uniform Act Regulating Traffic on Highways (Article 6701d), is amended to read as follows:

- S.B. No. 843, Page 4

"(c) A person may stop, stand, or park a bicycle on a sidewalk if the bicycle does not impede the normal and reasonable movement of pedestrian or other traffic on the sidewalk." [This means you can "park" your bicycle next to a sign, light or telephone pole and lock it to the pole before walking away.]

- S.B. No. 843, Page 4

SECTION 6. Sections 179, 180, 182, and 187, Uniform Act Regulating Traffic on Highways (Article 6701d), are amended to read as follows:

"Section 179. TRAFFIC LAWS APPLY TO PERSONS RIDING BICYCLES; COMPETITIVE RACING. (a) Every person riding a bicycle shall be granted all of the rights and shall be subject to all of the duties applicable to the driver of a vehicle by the Act, except as to special regulations in this Article and except as to those provisions of this Act which by their nature can have no application."

- S.B. No.843, Page 5

"... 'Bicycle' as used herein means a non-motorized vehicle propelled by human power."

- S.B. No. 843, Page 5 , Page 6

"Section 182. RIDING ON ROADWAYS AND BICYCLE PATHS. (a) Except as provided by Subsection (c) of this section, a person operating a bicycle upon a roadway at less than the speed of the other traffic on the roadway at that time shall ride as near as practicable to the right curb or edge of the roadway, except when:"

"(1) The person is overtaking and passing another vehicle proceeding in the same direction;"

"(2) The person is preparing for a left turn at an intersection or onto a private road or driveway; or"

"(3) Conditions on the roadway, including fixed or moving objects, parked [doors opening into your path] or moving vehicles, pedestrians, animals, surface hazards, or substandard width lanes, make it unsafe to ride next to the right curb or edge of the roadway."

"(b) For the purpose of Subsection (a) of this section, a substandard width lane is a lane that is too narrow for a bicycle and a motor vehicle to travel in the lane safely side by side." [You will need at least 3 feet in addition to enough space for a Cadillac, about 14 to 15' total, before you can safely travel in the same lane with motorized vehicles. This will leave enough room to maneuver around road hazards without getting into the path of the other vehicles. If you think that 3 additional feet is too much, remember that you are not protected by 3,000 pounds of Detroit steel Parkway. If the right lane is too narrow to safely share, take the ENTIRE lane by riding where the left tire of a car would be - your position and the curb will combine to effectively take the right lane.]

"(c) A person operating a bicycle on a one-way roadway with two or more marked traffic lanes may ride as near as practicable to the left curb or edge of the roadway." [Even though legal in some cases, always riding to the left is not a good idea because most drivers expect to see bicyclists on the right.]

"(d) Persons riding bicycles upon a roadway shall not ride more than two abreast except on paths or parts of roadways set aside for the exclusive use of bicycles. Persons riding two abreast shall not impede the normal and reasonable flow of traffic on the roadway. If persons are riding two abreast on a laned roadway, they must ride in a single lane."

"SECTION 187. DRIVING UPON SIDEWALK. No person shall drive any motor vehicle upon a sidewalk or sidewalk area except upon a permanent or duly authorized temporary driveway." [Since bicycles are not motorized vehicles, they may ride on a sidewalk unless prohibited by local ordinance.]

[End of excerpts from Senate Bill 843.]