LUBBOCK METROPOLITAN AREA

COMPREHENSIVE BICYCLE PLAN

Prepared for
The Lubbock Metropolitan Planning Organization
by
The Bicycle Federation of America
in cooperation with
HDR Engineering, Inc.

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CONTENTS

Lubbock Metropolitan Area Comprehensive Bicycle Plan

Introduction

In April 1994, the U.S. Department of Transportation announced ambitious national goals to double the percentage of trips made by foot and bicycle in the United States, and to simultaneously reduce the number of injuries and fatalities suffered by bicyclists and pedestrians by ten percent. The National Bicycling and Walking Study, in which these goals are set, also has an action plan outlining how public agencies at all levels of government can play a part in achieving these goals.

States and Metropolitan Planning Organizations across the country are completing plans to address bicycle and pedestrian issues, in part to meet the requirements of the Intermodal Surface Transportation Efficiency Act (ISTEA). Many of these plans are adopting the overall targets set by the U.S. Department of Transportation and refining them to reflect local priorities and realities.

The Lubbock Metropolitan Area Comprehensive Bicycle Plan represents the means by which the Lubbock Metropolitan Planning Organization can both meet the requirements of ISTEA and play its part in achieving the goals of the National Bicycling and Walking Study.

Creating a vision

The first step in the development of the Lubbock Metropolitan Area Comprehensive Bicycle Plan is to create a vision for bicycling in the region. In public meetings, and meetings with agency staff and user groups, people were asked to describe their vision of the Lubbock metropolitan area twenty years from now. A wide range of comments were generated by this process, and from a survey of city agencies responsible for different activities which affect bicycling in the region.

Among the strongest sentiments were the desire for a transportation system that offers people the choice or option to bicycle legitimately, throughout the city, on an accessible, safe network of bicycle facilities. A vision statement has been developed to reflect these views.

> *Lubbock will be an area where bicycling is a legitimate, safe, and accessible transportation option for all segments of the population. Residents and visitors will have the opportunity to use a comprehensive network of city streets, special bicycle facilities, and trails for transportation and recreational travel.*

A broad range of societal, environmental and infrastructure changes will be necessary before this vision can become a reality. Many of these changes have been identified in the development of the Comprehensive Bicycle Plan. Many of the suggestions made in the public meetings had common themes. The following are some of the more common examples:

> *"...Lubbock should have a comprehensive network of safe, fluid trails and lanes to provide fun and utility for bicyclists and pedestrians."*
>
> *"...Extensive, safe network to link bicycles to all areas of the city."*
>
> *"...To have bicycling recognized as a legitimate form of transportation through education of both bicyclists and non-bicyclists."*
>
> *"...A system of bicycle paths, intersections, signs, etc... which promote commuting, sport, and recreational uses."*
>
> *"...Bicycle coordinator at the local government level."*

Based on these suggestions, guidance from local agency staff and user groups, and survey of agencies in the area, the Comprehensive Bicycle Plan has identified a series of goals and objectives for the Lubbock metropolitan area which will help make it a better and safer place in which to bicycle.

Overall Goals

G-1 The percentage of trips made by bicycle in the Lubbock Metropolitan Area will double by 2005 and continue to increase during the life of the Comprehensive Bicycle Plan.

G-2 The number of bicycle-related traffic accidents will be reduced by 10 percent by 2005 and continue to decrease during the life of the Comprehensive Bicycle Plan.

G-3 To increase the awareness of bicycling as a viable transportation alternative both in the planning community and among the general public.

Objectives

The plan will adopt a three part strategy to achieve these goals. First, the plan will identify how all future transportation investments in the Lubbock area can include appropriate facilities to promote bicycling and the safety of bicyclists. Second, the plan will identify how the existing infrastructure can be modified to improve opportunities for bicycling and make bicyclists safer. Finally, the plan will identify performance measures to create a basis for which bicycling facilities and safety can be properly evaluated to ensure the goals are being met.

O-1 All new transportation facilities in the Lubbock Metropolitan Area will, at a minimum, accommodate group A cyclists.

O-2 In key corridors identified by the Comprehensive Bicycle Plan, all new transportation facilities in the Lubbock Metropolitan Area will also facilitate travel by bicycle for all types of cyclists in the area.

The type of facility provided will be based on criteria developed by the Federal Highway Administration and American Association of State Highway and Transportation Officials (Details are in the attached technical memorandum). This approach has already been adopted by the Federal Highway Administration and is being used by the Texas Department of Transportation, the Wisconsin Department of Transportation, Minnesota Department of Transportation, as well as by Metropolitan Planning Organizations around the country, including San Antonio, Texas, and Charleston, South Carolina.

O-3 The Comprehensive Bicycle Plan will identify strategies for accommodating bicyclists of all abilities in key corridors in the area. Recommendations for action in each of these corridors will be made.

O-4 The Comprehensive Bicycle Plan will identify strategies for overcoming major barriers to bicycle travel in the area.

O-5 The Comprehensive Bicycle Plan will identify an appropriate leadership role for the MPO in implementing the plan. This will include recommendations for assisting local agencies, neighborhood groups and user groups in developing future neighborhood and corridor plans for bicycling.

O-6 The Comprehensive Bicycle Plan will identify a set of performance measures to gauge the success of the achievement of the overall goals.

To implement the Comprehensive Bicycle Plan, a series of strategies and actions will be developed. This implementation plan will define appropriate roles for the MPO, other local agencies, as well as the bicycle community.

Current conditions and needs

Bicycle use overview

There is very little information about bicycling activity in the Lubbock metropolitan area. One source, the U.S. Census showed that in 1990, 0.3 percent of journeys to work in the region were made by bicycle — roughly the national average for large metropolitan areas, but below the overall national average of 0.5 percent.

It is worthwhile keeping Census data in context, however, since more than 75 percent of all trips — by any mode — are for non-work related trips: going to school and travel for social, recreational or shopping purposes. These trips are generally shorter than commute trips, making them easier to do by bicycle.

In broader terms, it is worth noting that a significant number of Lubbock residents do not have cars available for personal transportation. Almost one quarter of the population is too young to drive and between 6 percent and 7 percent of households in the area do not have cars at all. In some census tracts this figure is well above 20 percent.

Among the bicycling enthusiasts, recreational and competitive racing clubs in the region have several hundred members and organize a busy schedule of rides and events that are well supported. The community has several clubs and there is an active group on the Texas Tech campus.

Turning to the bicycle crash scene, since 1989, roughly 50 to 55 crashes have been reported to the police each year; during that period, seven bicyclists were killed. Crash sites appear to be scattered around the community, but the area near Texas Tech seems to be a real “hot spot.”

While these scant figures are useful indicators of bicycling activity in the region, they tell only a fraction of the story. Further, they do not address the potential that exists in the region for increasing levels of use and improving the safety of bicyclists. Through the public involvement process, numerous obstacles and opportunities were identified. Much of this plan is devoted to identifying and remedying the obstacles while taking advantage of the opportunities.

Publicly identified issues and opportunities

Participants in public meetings, respondents to a general survey about bicycling in the area, and focused discussions with groups of people traditionally underserved by the transportation system identified problems in the following key areas.

Issues

1. No safe places to ride. Few designated or special bicycle facilities exist in the region and until 1994, public agencies in the area have had no plans to develop any. Main roads in the region are busy and have high vehicle speeds. Crossing main thoroughfares such as Indiana Avenue and 19th Street is intimidating. Travel lane widths are often too narrow to allow bicyclists and motorists to share the same lane in comfort. There are few roads with shoulders, no bike lanes, one poorly maintained trail and some streets with wide outside lanes.

As a consequence of these conditions, some existing riders tend to ride outside the city for recreation and do not ride for transportation purposes. Other riders without another transportation choice, ride daily in fear such as a group of employed developmentally disabled adults who ride facing traffic on the busiest, but unavoidable streets. Barriers such as the railroad tracks and industrial complexes in the Chatman neighborhood severely limit bicycle access to and from other parts of Lubbock. Potential riders throughout the region are discouraged by this lack of safe places to ride and physical barriers.

2. Street conditions. Even in cities with a lot of bicycle facilities, most riding is done on ordinary roads where no special provision is made for bicyclists. Concerns regarding street maintenance, shoulder conditions, and broken glass were mentioned numerous times. Many traffic signals do not detect bicyclists (and thus do not change without a car being present) and many do not allow enough time for bicyclists to clear the intersection before they change. Other routine operational difficulties identified by riders in the area include conflicts with motorists in right turn lanes and high-speed merging lanes. Here again, potential riders are discouraged by poor conditions.

3. Low status of bicyclists. The attitude of motorists towards bicyclists in the region is a major concern to existing riders. Motorists are sometimes openly hostile to bicyclists, challenging their right to be using the road and threatening them with harm. More often, motorists simply do not see or acknowledge the presence of bicyclists and do not know how to share the road with them. Many bicyclist report motorists come too close to them for comfort.

Bicyclists themselves received considerable criticism for their poor behavior, which sometimes prompts motorists to react badly to them. The general lack of respect for traffic laws, shown by both motorists and bicyclists, is also seen as a major obstacle to improving bicyclist safety and levels of use.

4. Lack of support facilities. There are few places to securely park a bicycle in the downtown area and few employers provide any bicycle parking and storage, showers or lockers. Bicycle theft is a major concern for bicyclists in the region. Bicyclists and employees at Texas Tech University also report a lack of safe long term bicycle parking at campus residences and employment sites.

5. Land use and development. New development in the region has made conditions worse for bicycling. Low density development has made trips longer and encouraged reliance on the automobile. New streets and highways incorporate designs that discourage bicycle use. Major highways such as the Loop and Interstate 27 have become a serious obstacle to safe and direct bicycle travel.

6. Institutional neglect. In the past there has been little support from the public or from government agencies for improving conditions for bicycling. While this is changing, there are still problems of coordination and consistency between agencies and no one agency has taken the lead to promote bicycling.

Opportunities

While the above assessment of current conditions for bicycling in the region is rather bleak, many of the problems have been successfully dealt with in other communities in the United States, and there are an equal number of opportunities for bicycling that have also been identified in the development of the plan.

1. Large student population. Many of the most bicycle-friendly communities in the nation, such as Davis and Palo Alto, California, Madison, Wisconsin, and Tucson, Arizona have large student populations, and a recent Federal Highway Administration report confirmed the strong link between the two factors. Communities with many students have higher levels of bicycling than the average. Lubbock, with many thousands of students, should have a higher than average level of bicycling — especially with a relatively conducive climate for year round bicycling.

2. Trails. Popular and functional trail facilities for development such as McKenzie Park, the Mae Simmons Loop and Canyon Lake were identified in the public meetings.

3. Wide streets and natural biking streets. Many of Lubbock's existing grid streets are quite conducive to bicycling as they either have low traffic volumes, wide travel lanes or both. These streets can form the basis of a functional and accessible network for bicycle travel.

One of the objectives of the Comprehensive Bicycle Plan is to identify how government agencies, development interests, the business community, neighborhood groups and bicyclists themselves can take advantage of these opportunities and begin to close the gap between the vision of a community where people choose to bicycle and the current conditions identified above which discourage bicycling.

In the following sections, we discuss some of the most important current conditions in more detail.

Population factors

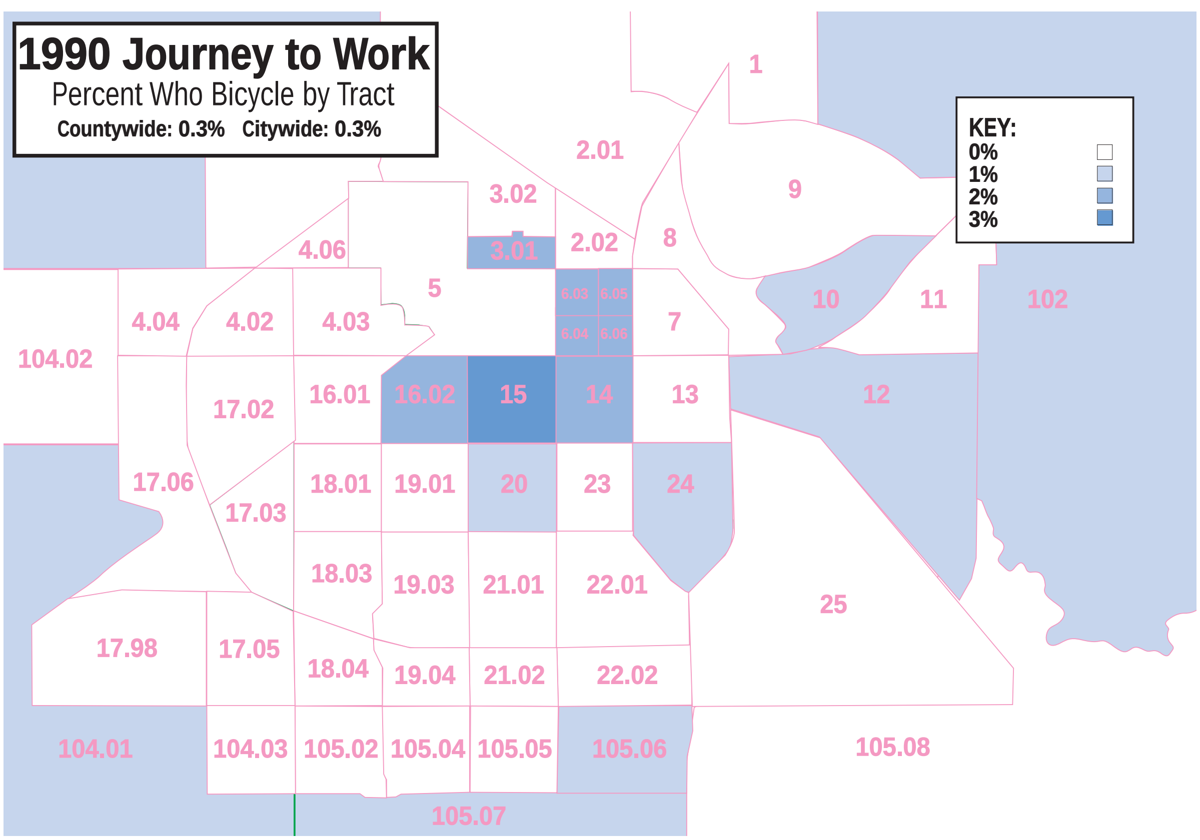
How popular bicycling is or could be in the Lubbock Metropolitan Area depends, ultimately on the area's residents. The following information provides a glimpse into the current situation and some hints of Lubbock's bicycling possibilities.

U.S. Census Journey to Work

The U.S. Census data has very little direct information regarding bicycling. The one piece of actual information it contains on the subject is found in the Journey to Work survey and this source is seriously limited in several important ways. First, Journey to Work data is collected through a telephone survey during April of the Census year. Respondents are asked about their primary means of transportation during the preceding week. In this way, the data is potentially affected by weather considerations and other transitory phenomenon.

Only heads of household are included in the survey. In addition, if a respondent used one means to get to work for two days of the week and another means for three days, only the latter would be counted. And if the respondent took a multi-modal trip (e.g., walked to the bus stop and then took the bus), only the mode used for the longest leg would be counted. Further, all other types of trips are left out of the accounting. According to the Nationwide Personal Transportation Survey, about 25% of all trips are journeys to work; and surveys have shown that many of these other types of trips are more easily converted to bicycling than are work trips.

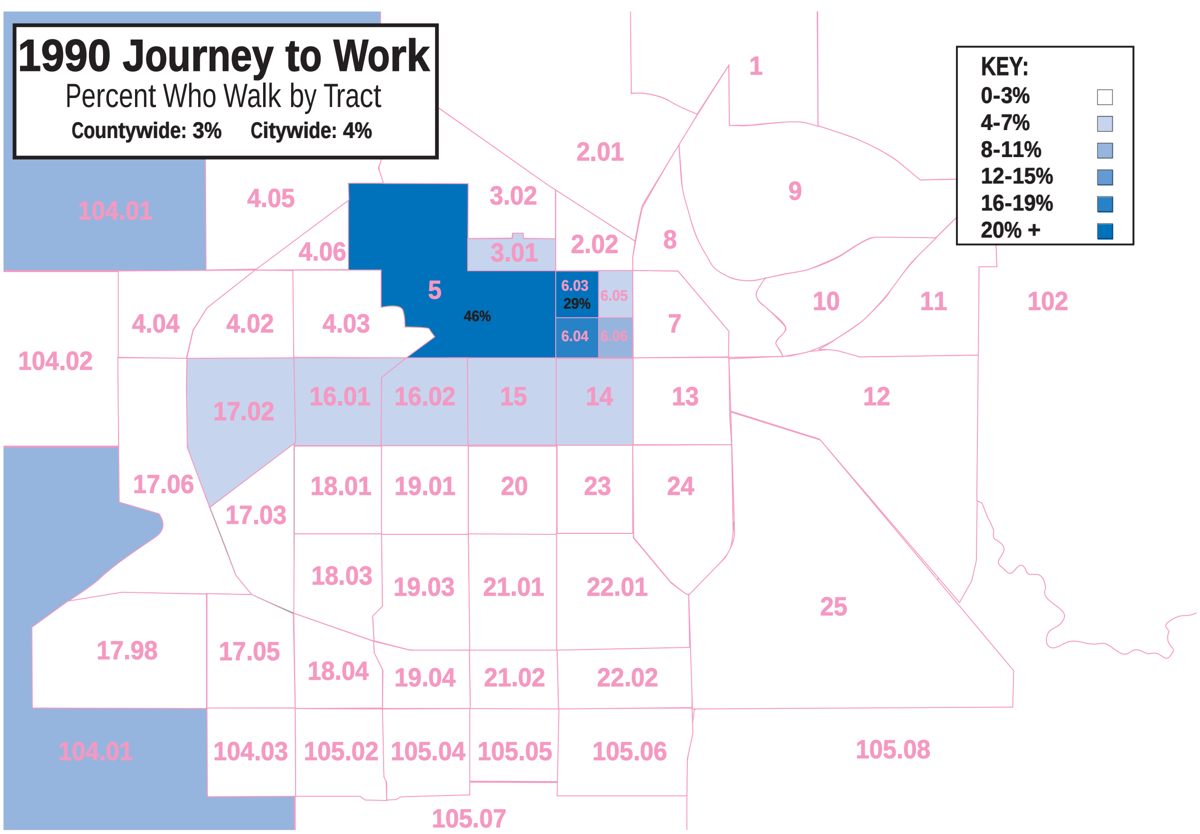
Finally, studies have shown that bicycle use is often restricted by people's fears of traffic combined with a lack of bicycle provisions. As a result, current levels of bicycle commuting, as measured by the Journey to Work survey, may reflect current patterns but may not reflect people's preferences. For these reasons, Journey to Work data on bicycle commuting, while somewhat useful, must be used carefully.



The map shown on the previous page gives the percent of the workforce riding to work on bicycles in Lubbock area census tracts, according to Journey to Work data provided by the City of Lubbock Planning Department. The percentages vary from 0% to 3%. Citywide, approximately 0.3% of the workforce rides to work. Countywide, the percentage is about the same. Census tracts with the greatest percentages of bicycle commuters tend to be near Texas Tech, particularly to the south. Also, a greater proportion of residents living just east and north of the campus ride than in most other parts of town. By contrast, very few residents who live near Loop 289—particularly to the south and west—ride to work.

Nationwide, approximately 0.5% ride to work, so Lubbock shows up slightly below average in bicycle commuting. However, other communities of similar size have significantly more bicycle commuting than Lubbock. For instance, Tucson, Arizona, has approximately 3.5% riding to work, while Madison, Wisconsin, has roughly 10%. It is the opinion of the authors that, with appropriate bicycle provisions, Lubbock could easily increase its bicycle commuting percentages tenfold. This is especially true, since typical trip times for Lubbock commuters are short and vary by tract from 12 to 20 minutes. At the short end of this range, the automobile offers little time advantage over bicycling. In fact, "bike-car commuter races' run in many communities around the country have shown how competitive bicycling can be; typically, the bicycle commuters beat their motorized counterparts by anywhere from a few seconds to five or ten minutes.

While bicycle commuting is rare in Lubbock, walking to work is more popular. Citywide, approximately 4% of the workforce walks to work; countywide, the rate is roughly 3%. The following map shows walking to work by census tract. In much of the Lubbock area, walking to work accounts for less than 3% of the work trips. However, in several tracts, the rates for pedestrian commuting are very high. On the Texas Tech campus (Tract 5) and in one tract just east of campus, (tract 6.03), more than 20% of the workers walk to work. And in most of the tracts just south of the Texas Tech campus, between 4% and 7% walk to work.



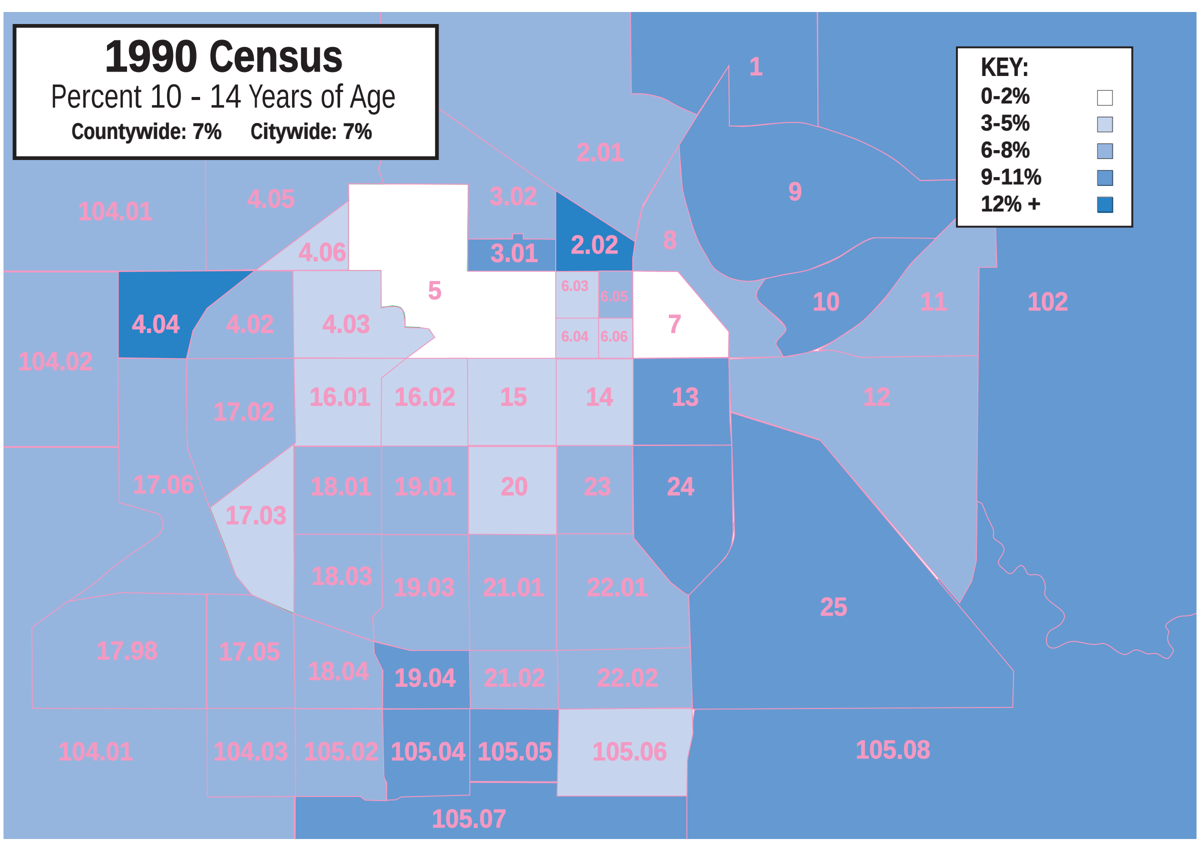
While high rates of walking to work do not necessarily translate into high rates for bicycling to work, they are indicative of people's propensity to get to work "under their own steam."

Other Census Data

While the Journey to Work data is the only Census source that directly mentions bicycling, other sources give some idea of the potential that bicycling has in the Lubbock area, particularly if barriers discussed previously are removed or broken and potential improvements discussed later in this plan are implemented. First, as has been discussed before, ISTEA requires transportation planners to consider the needs of the "traditionally underserved" among the population. Several important publics can be at least partly served through enhanced bicycle transportation.

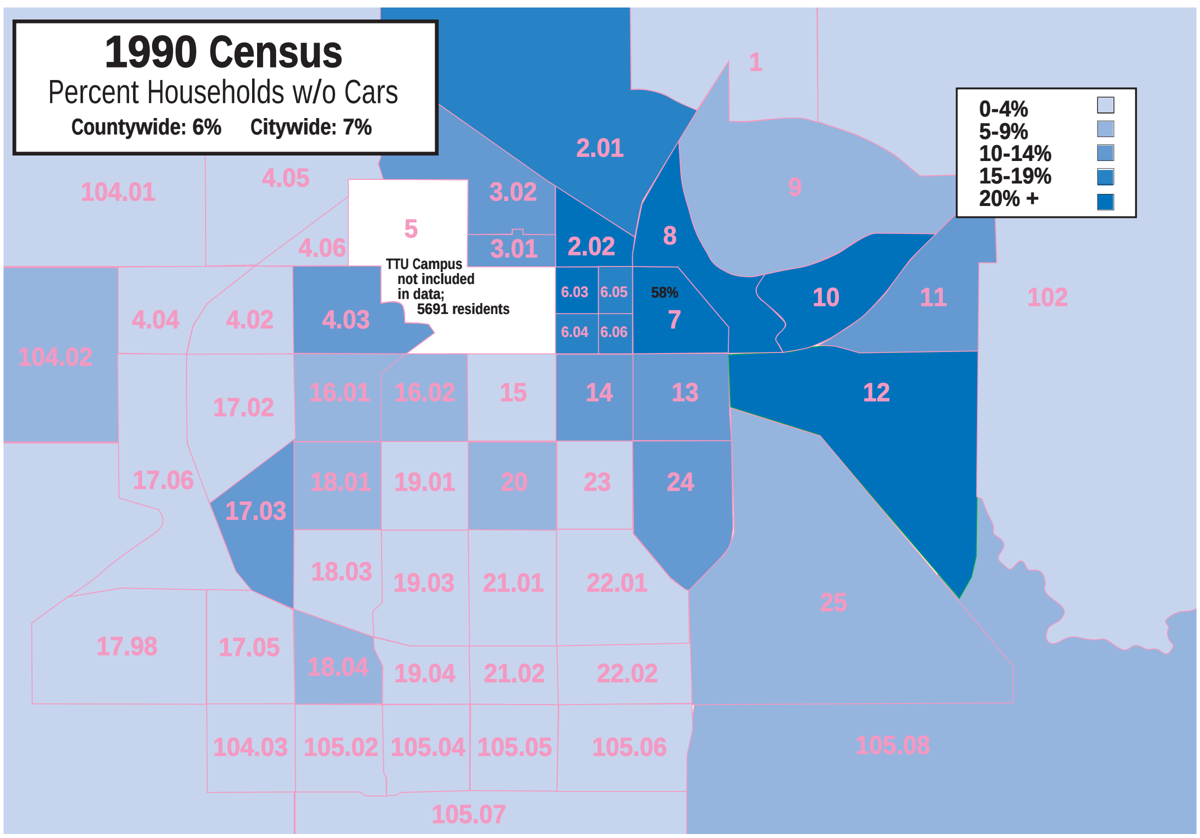
One such group is Lubbock's children, particularly those under the age of 15. Since they are unable to drive, they must rely on other means to get around: (1) parental "chauffeurs;" (2) transit and school buses; (3) walking; and (4) bicycling. Youngsters under 15 account for approximately 23 percent of the County's population, or roughly 50,000 residents. While the very youngest children are most unlikely to ride bicycles, older kids certainly can use the bicycle for some of their travel needs. Trips to friends' houses, to soccer practice, to school, or to a nearby store can often be done on bike. Of the approximately 50,000 "under 15's," about 16,000 are between the ages of 10 and 14 years. A significant percentage of them probably ride bicycles.

The map below shows the percentage of the population in each census tract between the ages of 10 and 14. In several tracts (4.04 and 2.02), youngsters in this age group make up 12% or more of the population, while in many others, they account for between 9% and 11%. Only two tracts (the Texas Tech campus and Tract 7 downtown) have between 0% and 2%. Since they have travel needs, like anyone else, youngsters deserve consideration in transportation planning.



Another population of the "traditionally underserved" are those who, while old enough to drive, do not have access to automobiles. They may not be able to afford an auto (and its attendant insurance, licensing, and upkeep expenses); they may be unable to get a license (through developmental disabilities, advanced age, or deficient driving records); and they may simply not want to own or drive an auto (for environmental reasons, for instance). In any event, this group, while perhaps difficult to quantify, must be considered in transportation planning. Transit use, reliance on taxis, and walking can accommodate some of their needs. However, the bicycle can play an important part in serving at least part of this public. It is well-known, for instance, that many developmentally disabled adults, while unable to obtain drivers' licenses, can ride bicycles. And many in Lubbock do so, relying on the bicycle for their primary means of transportation.

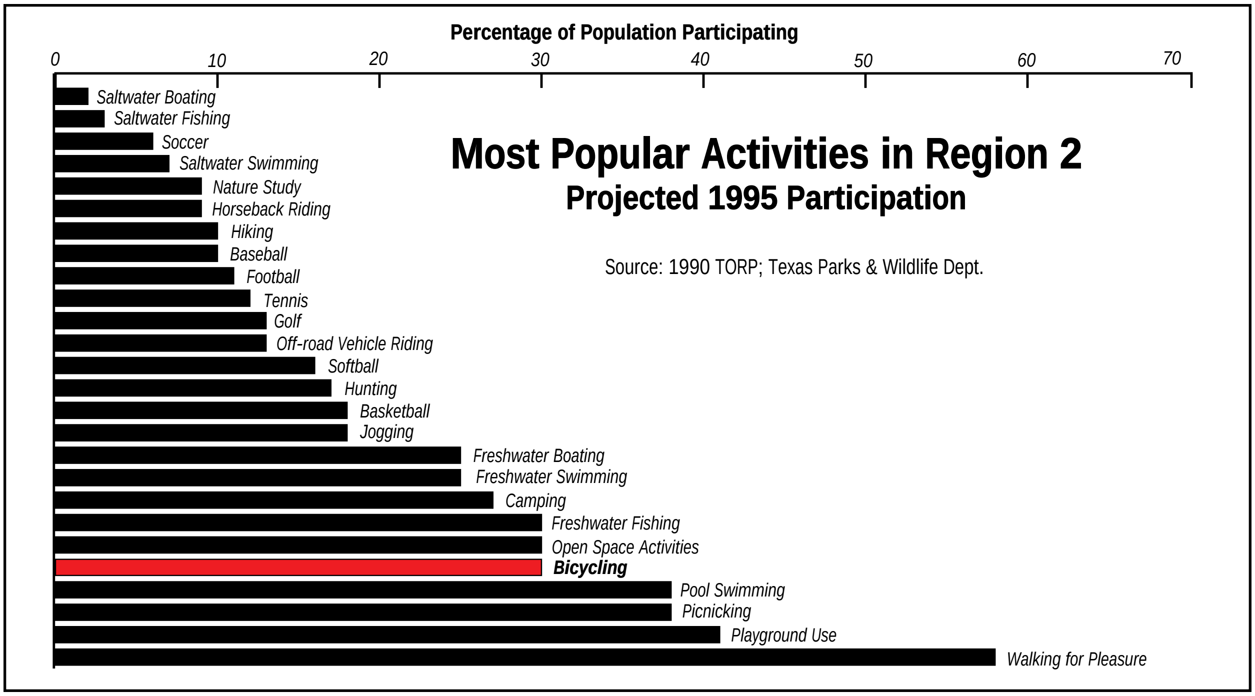
It is difficult to determine the total number of Lubbock's adult residents with transportation needs but without cars; however, it is possible to at least gain some insight using the Census data regarding households without motor vehicles. This will not catch those who live with others who, themselves, have automobiles. However, it gives some indication of the importance of serving the traditionally underserved. The following map shows which tracts have the highest percentage of car-less households.



While some tracts have very high car ownership rates, a significant number have relatively high percentages of households without access to cars at all. In six tracts, primarily in the northeast part of town, at least one household in five is without a car. In four others, at least 15% of the households lack a car. And in eight more tracts, at least 10% of the households are car-less. Clearly, transit use is an important factor in many of these residents' lives, as is walking. However, bicycling—if well promoted and fostered within the community—could be a very attractive option for many whose transportation options are currently quite limited.

Bicycling as a popular activity

According to the 1990 Texas Outdoor Recreation Plan, bicycling is a very popular activity in Region 2, which includes the Lubbock area. Texas Parks & Wildlife Department studies suggest that 30 percent of Region 2 residents will participate in bicycling in 1995 (TORP, p. 2-5). The report ranks bicycling as tied for the fifth most popular activity in the Region and it shows a trend of increasing popularity.



In addition, the following table, also from the Texas Outdoor Recreation Plan, shows projected participation for the years 1990, 1995, and 2000 (expressed in thousands of annual user occasions). Clearly, TX Parks & Wildlife foresees a bright future for bicycling in the region.

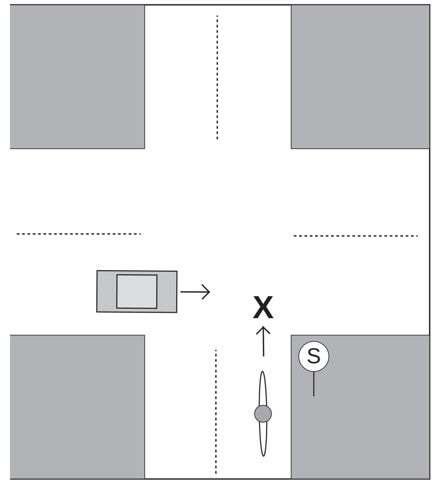
Activity	*1990*	*1995*	*2000*
Bicycling	3966	4031	4095
Bicycling on trails	244	248	252

While recreational bicycling is neither the focus of this plan, nor a supportable activity under ISTEA, it is important to understand the difference between the way in which ISTEA and the FHWA see recreation and the way in which parks and recreation planners see it. For the FHWA, recreational bicycling has a very narrow definition. Basically, they say that recreational bicycling is bicycling as an end in itself with no destinational purpose; they further point out that Federal transportation funds cannot be used for facilities whose sole purpose is to support this activity. The example they give for a facility designed for purely recreational bicycling is a loop trail in a park that reaches no destinations along the way. In other words, if a trail actually reaches potential rider destinations by, for instance, containing spurs into several neighborhoods or going past recreational, institutional, or commercial sites, then it will fulfill more than a purely recreational purpose.

By narrowly defining unfundable facilities, the FHWA provides a relatively “level playing field” for non-motorized vs. motorized projects. After all, allowing the use of Federal funds on a highway project does not hinge on whether motorists are likely to be going to work or to a basketball game.

Bicycle crashes

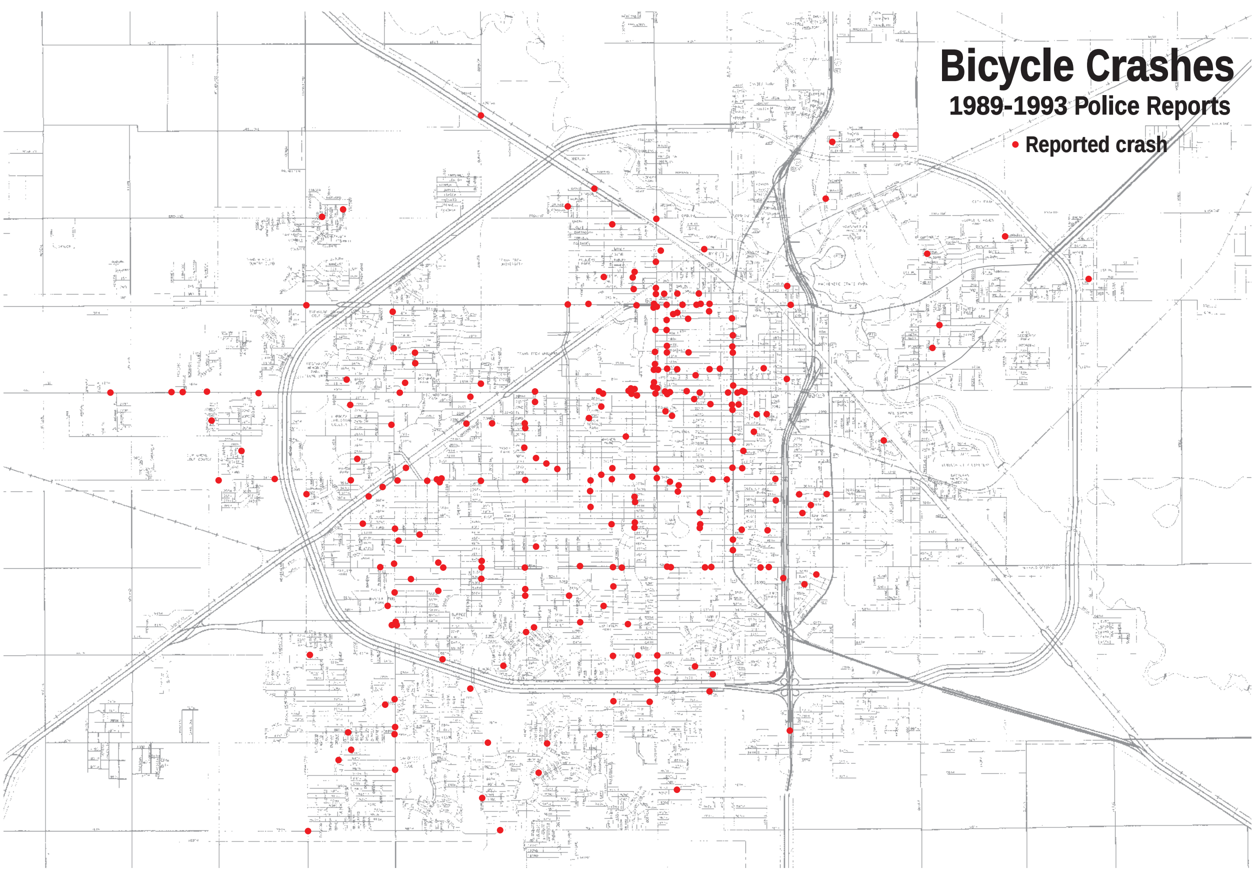
Analyzing Lubbock's bicycle crashes can bring serious safety problems to light. To some extent, it can help identify specific problem locations. But crash analysis is often more useful in determining major causative factors and target audiences. What it cannot do is show the overall scope of the problem.



Studies have shown that, among bicycle-motor vehicle crashes, only one in five that are serious enough to send someone to a hospital is reported to the police. Furthermore, among crashes not involving motor vehicles, typically only one in twenty serious injury-producing incidents are reported.

Since bike crashes are under-reported by factors of five to twenty, relying on police reports to determine the scale of a problem would be a mistake. Going beyond this source of data would require involving the local hospitals, clinics, and "instant care" offices. While this approach is beyond the scope of this study, it would be a good source of future safety data and is highly recommended.

The map below identifies the locations of 260 reported bicycle crashes that occurred from 1989 through 1993. During that period, roughly 50 to 55 crashes were reported to the police each year. Seven bicyclists died. The most common times for crashes were during daylight with the hours between 3 and 4pm and 5 and 6pm having the greatest number. Night time accounted for roughly 16% of the crashes. Police reports recorded few road condition problems; about 95% of the reports cited "no defects."



The following additional points are worth noting. First, the area near Texas Tech University appears to be a “hot spot”for bike crashes. Some parts of town (e.g., the area east of Interstate 27), by contrast, show relatively few reported crashes. Part of the difference may be as much the result of a reporting problem as an indication of actual crash patterns. However, there appears to be a rough correlation between, for instance, the census tracts identified earlier as the highest for bicycle commuting and the areas with concentrations of reported bike crashes.

While little can be said regarding such issues as exposure or causation based on currently available information, some generalizations are possible. First, there appear to be a significant number of reported crashes involving bicyclists in Lubbock. If national study projections apply, each year there are probably between 300 and 1000 serious bicycle crashes that send someone to an emergency room. Second, the number of fatalities seems high, given what appears to be a relatively low level of bicycle use in the community. During the reporting period, there were typically between one and two bicycling deaths per year. In some of the well-known “bicycle towns,” this level of casualties would go along with a very high level of bike use. It appears, although the evidence is thin, that Lubbock is currently a somewhat hazardous place to ride a bicycle. One possible explanation could be a combination of a high level of motor vehicle traffic, few accommodations for bikes, and a low level of bicycle use. It appears to be true that the more bicyclists the community has and the better they are accepted as part of the traffic scene, the safer bicycling will be.Therefore the importance of increasing the visibility and provisions for bicycling and, as a result, the safety and the number of bicyclists in the community is, likely to be a significant factor in saving lives and reducing the number of bicycling injuries.

Future research: For future projects, it would be useful to closely study crash reports and supplement the data with information from emergency rooms in the Lubbock area. One helpful approach would be to go through the actual reports, one-at-a-time, to categorize the crashes according to the system developed for the National Highway Traffic Safety Administration (Cross-Fisher, 1977). In this way, it would be possible to determine the major crash causes, the involved age groups, and other important factors. These factors would be very useful in, for instance, developing education and awareness-building programs.

The Cross-Fisher/NHTSA Bicycle Crash Classes & Types

Data from the national study

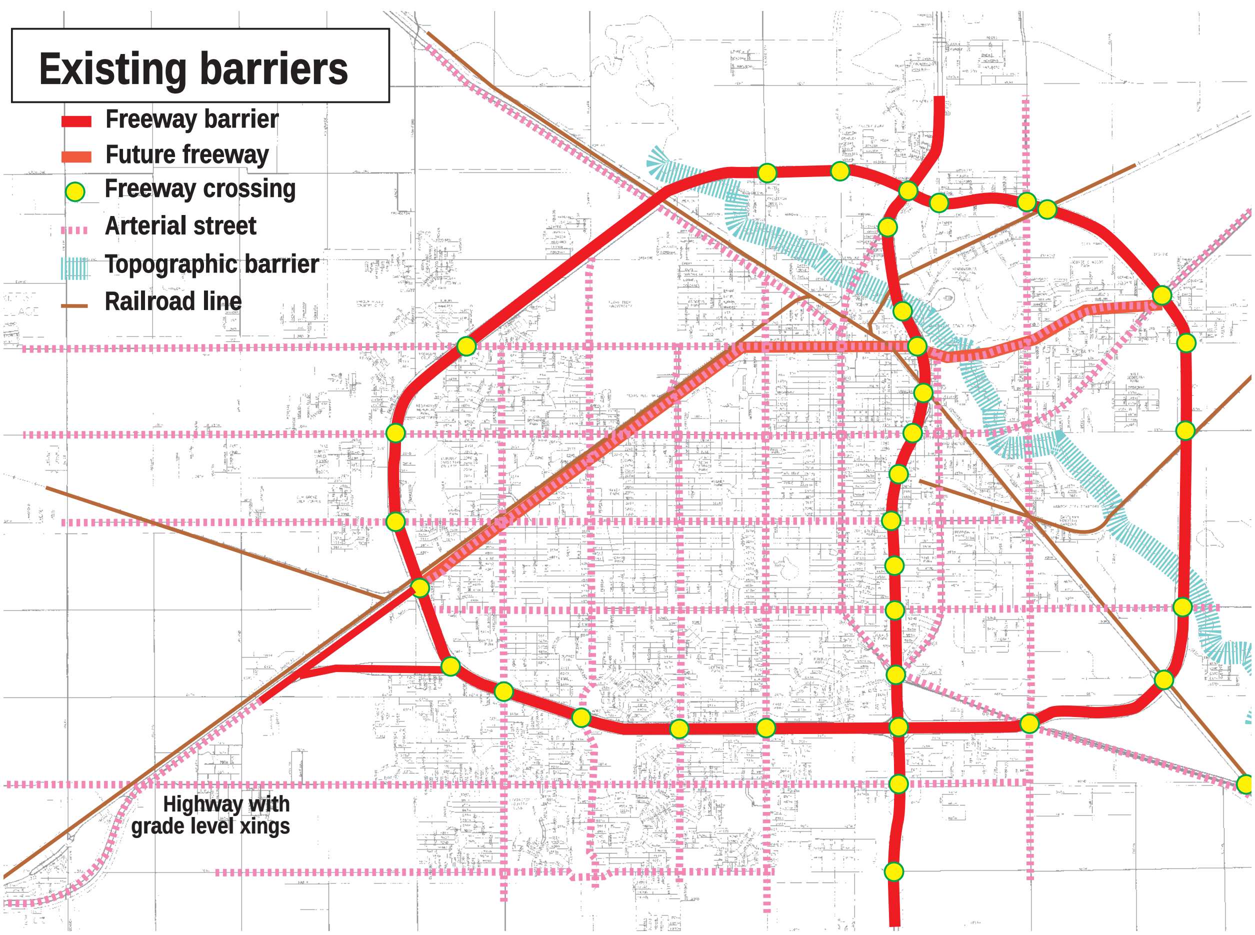
Class/Type	*Injury*	*Fatality*
Class A: Bicycle Ride-out from driveway, alley and other midblock location.	13.9%	15.1%
Type 1: residential driveway ride-out:	5.7%	6.7%
Type 2: commercial driveway ride-out	3.2	2.4
Type 3: parallel direction driveway ride-out	2.5	2.4
Type 4: ride-out over curb or shoulder	2.5	3.6
Class B: Bicycle ride-out at controlled intersection.	17.0	12.0
Type 5: stop sign or yield sign	10.2	7.8
Type 6: cyclist caught in signal phase change	3.1	0.6
Type 7: multiple-threat at intersection	2.0	2.4
Class C: Motorist turn/merge/drivethrough/ drive-out.	18.7	2.4
Type 8: drive-out from com’l dwy/alley	5.3	0.0
Type 9: failure-to-yield at stop/yield sign	10.2	1.2
Type 10: failure-to-yield at signal	1.0	0.0
Type 11: backing from driveway	0.8	0.0
Type 12: didn't slow or stop for signal	0.5	1.2
Class D: Motorist overtaking/overtaking threat.	10.5	37.8
Type 13: cyclist unseen	4.0	24.6
Type 14: out of control	0.7	4.2
Type 15: counteractive evasive action	1.7	2.4
Type 16: misjudged space to pass	2.0	1.8
Type 17: cyclist's path obstructed	2.0	0.6
Class E: Bicyclist unexpected turn/swerve.	14.2	16.2
Type 18: left turn/parallel paths/same direction	8.4	8.4
Type 19: left turn/parallel paths/opposite direction	3.2	3.0
Type 20: left swerve/parallel paths/same direction	1.5	3.0
Type 21: wrong-way/turns right/parallel paths	1.1	1.2
Class F: Motorist unexpected turn.	14.5	2.4
Type 22: left turn/parallel paths/same direction	1.3	0.6
Type 23: left turn/parallel paths/opposite direction	7.6	0.0
Type 24: right turn/parallel paths/same direction	5.6	1.8
Class G: Other.	11.2	13.8
Type 25: uncontrolled intersection/orthogonal paths	2.8	0.6
Type 26: head-on/wrong-way bicyclist	3.6	2.4
Type 27: bicyclist overtaking car	0.9	0.6
Type 28: head-on/wrong-way motorist	0.8	1.8
Type 29: parking lot	0.8	0.6
Type 30: head-on/counteractive evasive action	0.1	0.0
Type 31: bicyclist cuts corner when turning left	0.0	0.6
Type 32: bicyclist swings wide when turning right	0.3	0.0
Type 33: motorist cuts corner when turning left	0.4	0.0
Type 34: motorist swings wide turning right	0.1	0.0
Type 35: motorist drive-out from on-street parking	0.3	0.0
Type 36: wierd (everything else)	0.0	7.2

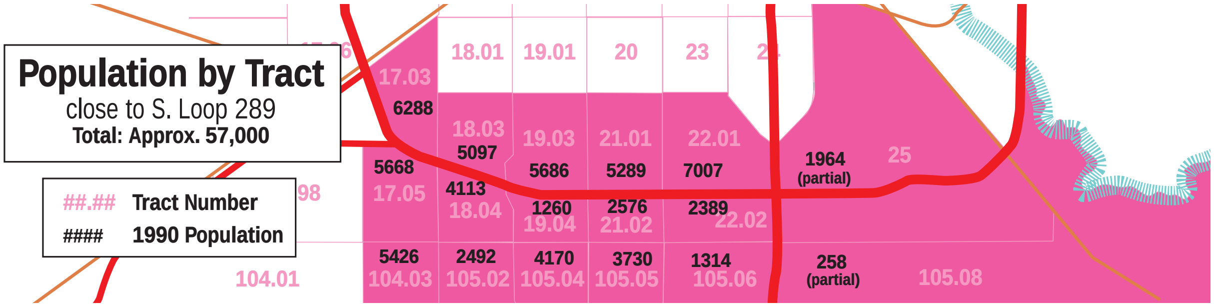
Existing Barriers

In developing a bicycle plan for a community, it is very important to look at barriers. If bicyclists cannot get from point A to point B, then potential increases in bicycle use due to improved roadway design, bike lane striping, route signing, or pavement marking are reduced accordingly.

For instance, if bicyclists live within a half mile of a library but access is blocked by a freeway, then the potential for bicycle trips to that destination is non-existent. However, it follows that eliminating the barrier can help increase bicycling by opening up new opportunities for bicycle trips. A bicycle bridge or underpass that allows riders to cross the freeway has the potential to immediately increase the number of bicycle trips to the library.

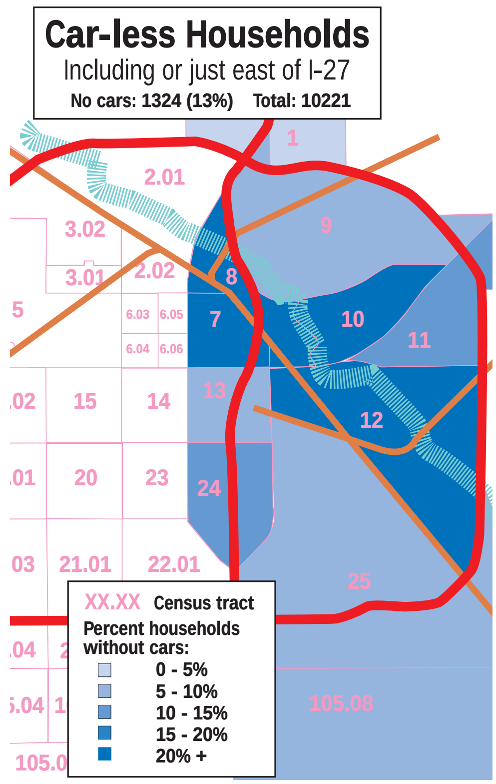
Lubbock has a number of important bicycling barriers; some are more difficult to cross than others. And some affect more potential bicycle trips than others. The map shown below gives a sense of where the primary barriers are located in Lubbock. One of the main concerns expressed by Lubbock residents in the public involvement process was Loop 289. This expressway provides excellent service for motorists traveling around the community's circumference. However, in certain areas, it acts as a very significant barrier to local non-motorized travelers.





This is particularly true where streets that cross the Loop carry high volumes of motor vehicle traffic, primarily those streets in the southwest part of town (see above). As the diagram shows, roughly 57,000 Lubbock residents live within easy bicycling distance of the South Loop (i.e., within a mile). While not every resident is likely to use a bicycle for utilitarian trips, it is clear that a substantial number of potential bicycle trips are truncated by this barrier (see map above).

Interstate 27 through Lubbock also acts as a barrier (see map at right), although there are more crossing opportunities than are found on Loop 289 and the arterial street traffic volumes are generally lower. However, while the population in this area is also lower than found near South Loop 289 (approximately 30,000 vs. roughly 57,000), the proportion of households without access to motor vehicles is significantly higher.



In the census tracts near South Loop 289 (shown in purple above), only two tracts (17.03 and 18.04) have percentages of non-car-owning households anywhere near 10%. Overall, residents in roughly 3% of the households in tracts near South Loop 289 do not own motor vehicles. On the other hand, in the tracts near and to the east of I-27, the proportion of households without motor vehicles is roughly 13%. In four tracts (7,8,10, and 12), it runs from a low of 23% to a high of 58%.

Note that there is some overlap between the two groups (i.e., both include tracts 105.08 and 25). However, these tracts both have relatively low populations with non-car-ownership running approximately 5% to 6% of households for each.

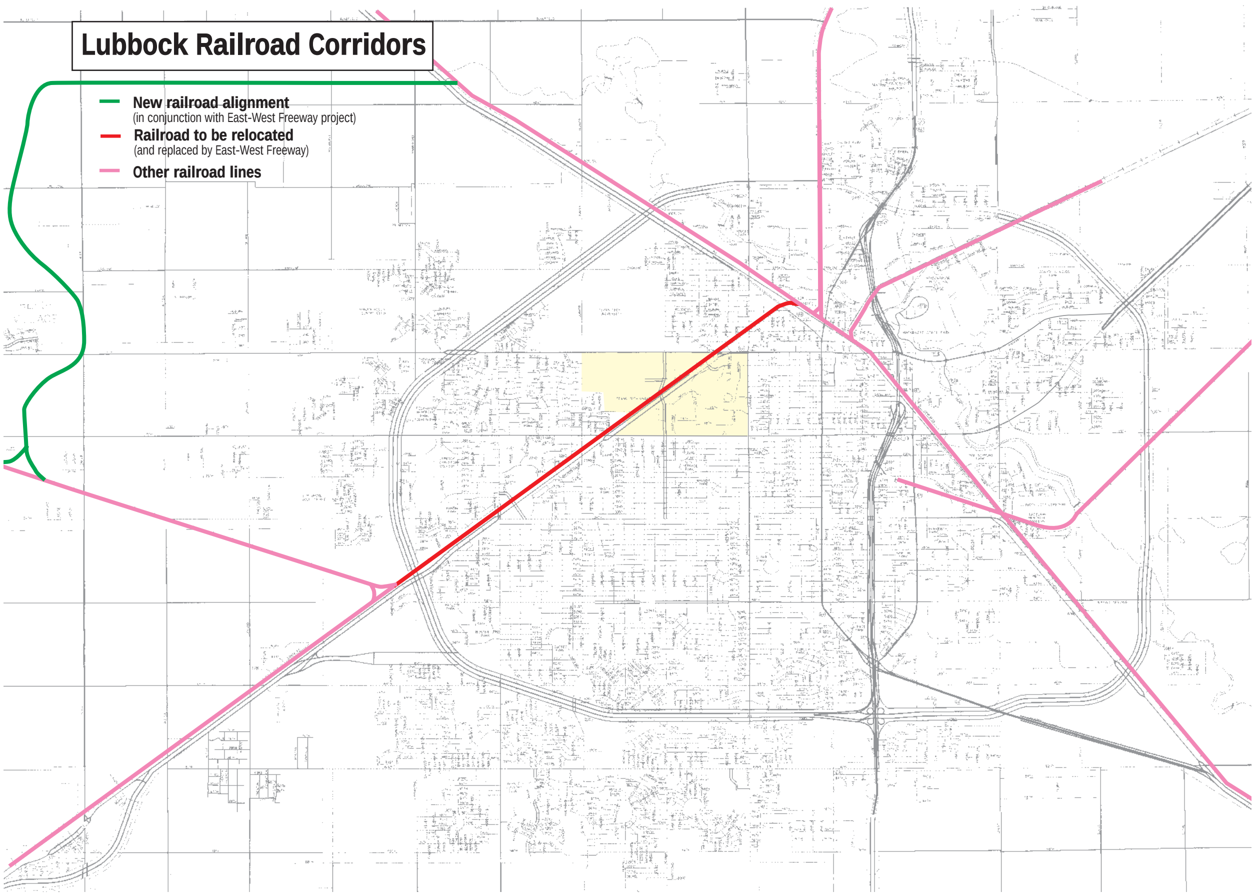
Thus, while the South Loop is important in terms of high traffic volumes at its crossings and overall population, Interstate 27 is important in terms of the large number of households without access to motor vehicles. Residents of the former corridor might be enticed out of their automobiles through bicycle provisions while bicycle accommodations in the latter corridor might give critical access for a significant number of people.

Other sections of interstate highway or expressway are serious barriers as well. Several neighborhoods to the north and east of Loop 289 are relatively isolated. Fortunately, existing crossings have comparatively low traffic volumes, making it somewhat easier to bicycle through the interchanges. On the west side of town, the Loop forms a barrier that, as city grows in that direction, will become more and more serious.

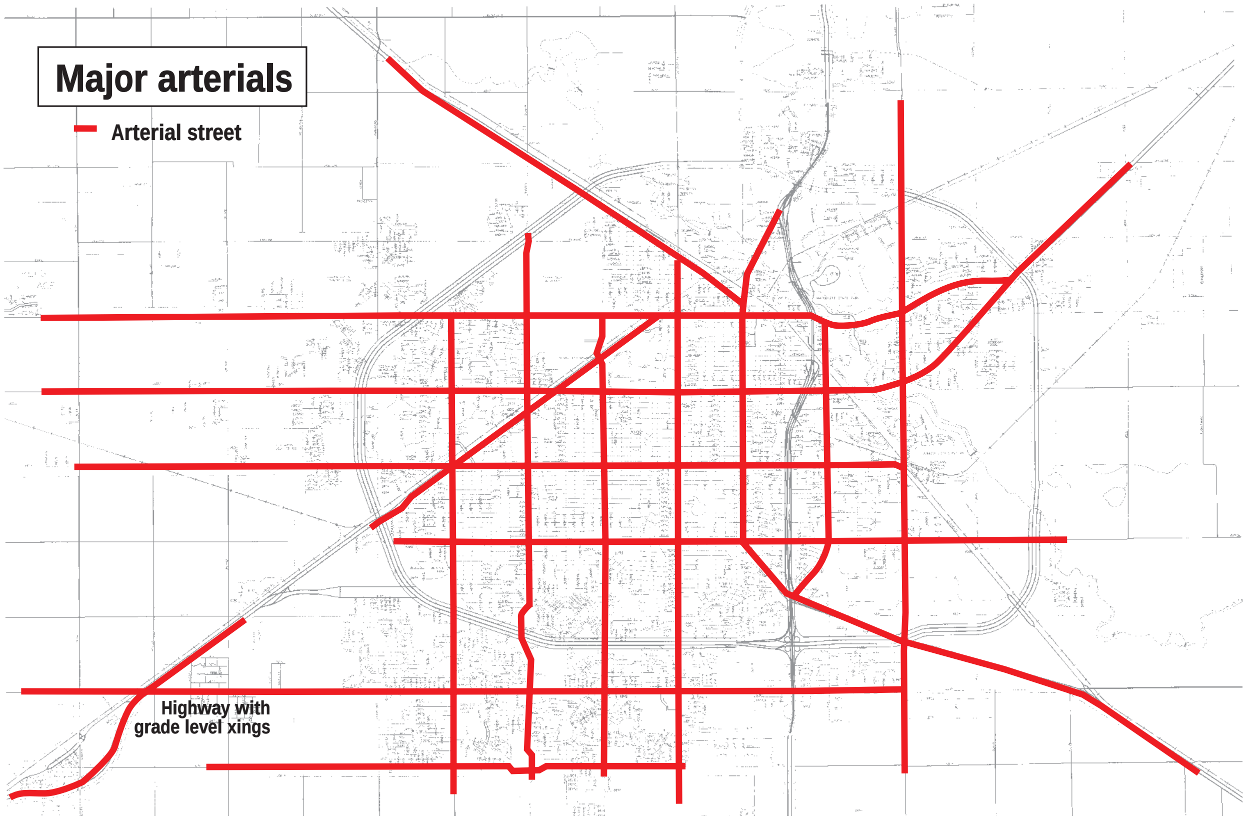
Another expressway corridor that merits concern is the proposed East-West Freeway. Fortunately, since this one has yet to be built, the opportunity exists to make the new roadway crossings "bicycle-friendly" and to provide any needed independent crossings in the course of the project. In general, it is less expensive to consider bicycle provisions as part of a project in the first place, than it is to retrofit them later. Aside from the substantial population living west of the proposed highway corridor, it is worth noting that many university students live in the vicinity (both west of the Texas Tech campus and to the north). If they are to be able to bicycle to campus, it will be imperative that the new freeway design consider bike access.

The next barrier of concern is the network of railroad tracks that cross the community. While not, perhaps, as imposing as the expressways, they do sever the street network and funnel motorized and non-motorized traffic into certain corridors. With the exception of the tracks paralleling the Brownfield Highway, most of the rail lines are in the east and northeast side of town.

The map below shows existing rail lines in purple, the existing—but soon to be removed—line in the proposed East-West Freeway corridor in red, and the future alignment of the relocated rail line in green.



Another important barrier type, again mentioned by Lubbock's bicyclists, is the arterial street network. In certain areas, the arterials act as barriers that are almost as impermeable as the Loop. While, unlike the Loop, bicyclists can *physically* cross the arterials, the volume of traffic at some locations often makes it *practically* impossible. This is particularly true of Types B and C bicyclists. In general, the higher the traffic volumes and the wider the roadway, the more of a barrier an arterial becomes. The map at the top of the following page shows the locations of the primary arterial street network.



Finally, the Canyon Lakes area, with the most significant topography in the urbanized area, forms something of a barrier as well. Many streets end on one side or the other. And, for many Type B and C bicyclists, the grades are challenging.

When looked at together, Lubbock's major bicycling barriers are significant and, in all likelihood, form the greatest impediment to increased bicycling. On the other hand, breaking the barriers can lead to a significant increase in bicycling. Once it is possible to "get there from here" by bike, more people are likely to do so.

Beyond these major categories of barriers, there are myriad smaller features that cut bicycling access. In one area, it may be a large parcel of land that stops a street from going through. In another, it may be a street that offsets a block to the right as it crosses an arterial. While it is beyond the scope of this report to identify all such problems and propose solutions, it is important to keep bicycle access in mind as changes to the built environment are proposed. Whenever possible, such access should be enhanced, rather than curtailed.

The following section on Hazardous Locations has much in common with the discussion of barriers. In many cases, major barriers force bicyclists into traveling through hazardous situations.

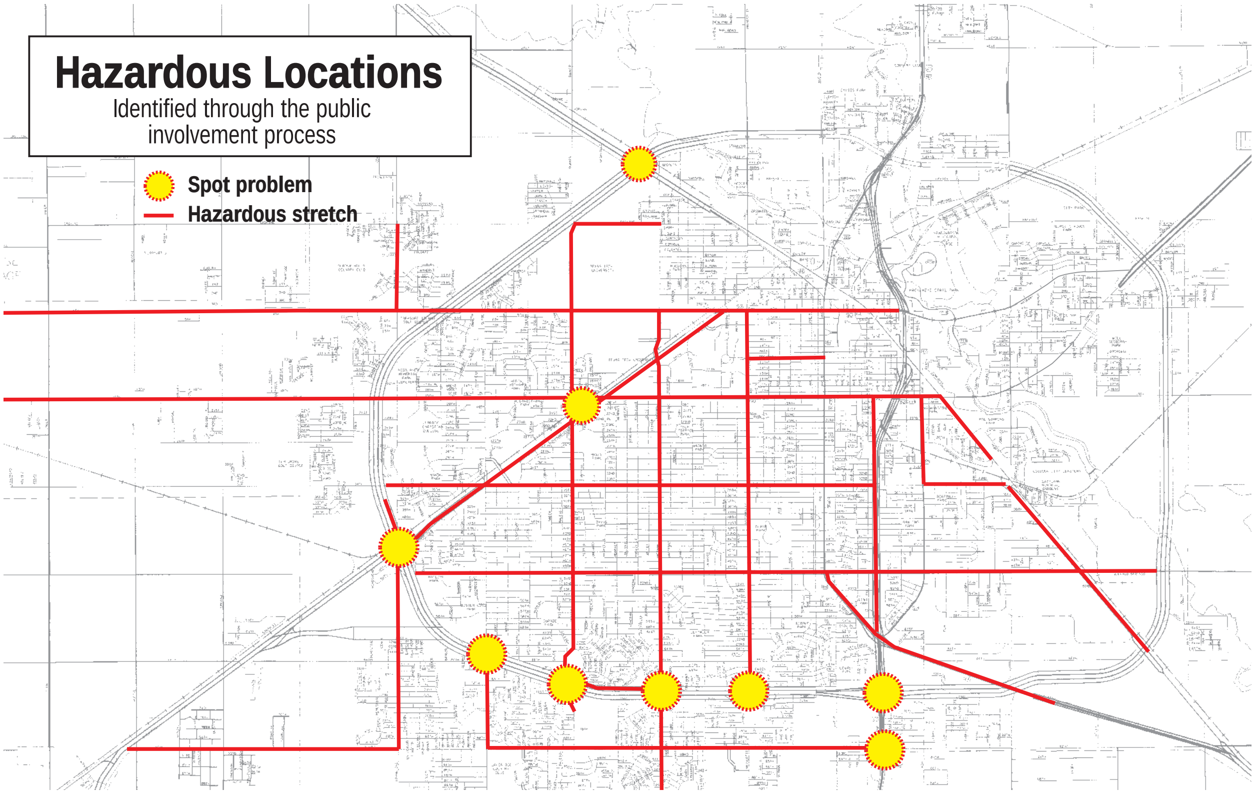
Hazardous locations

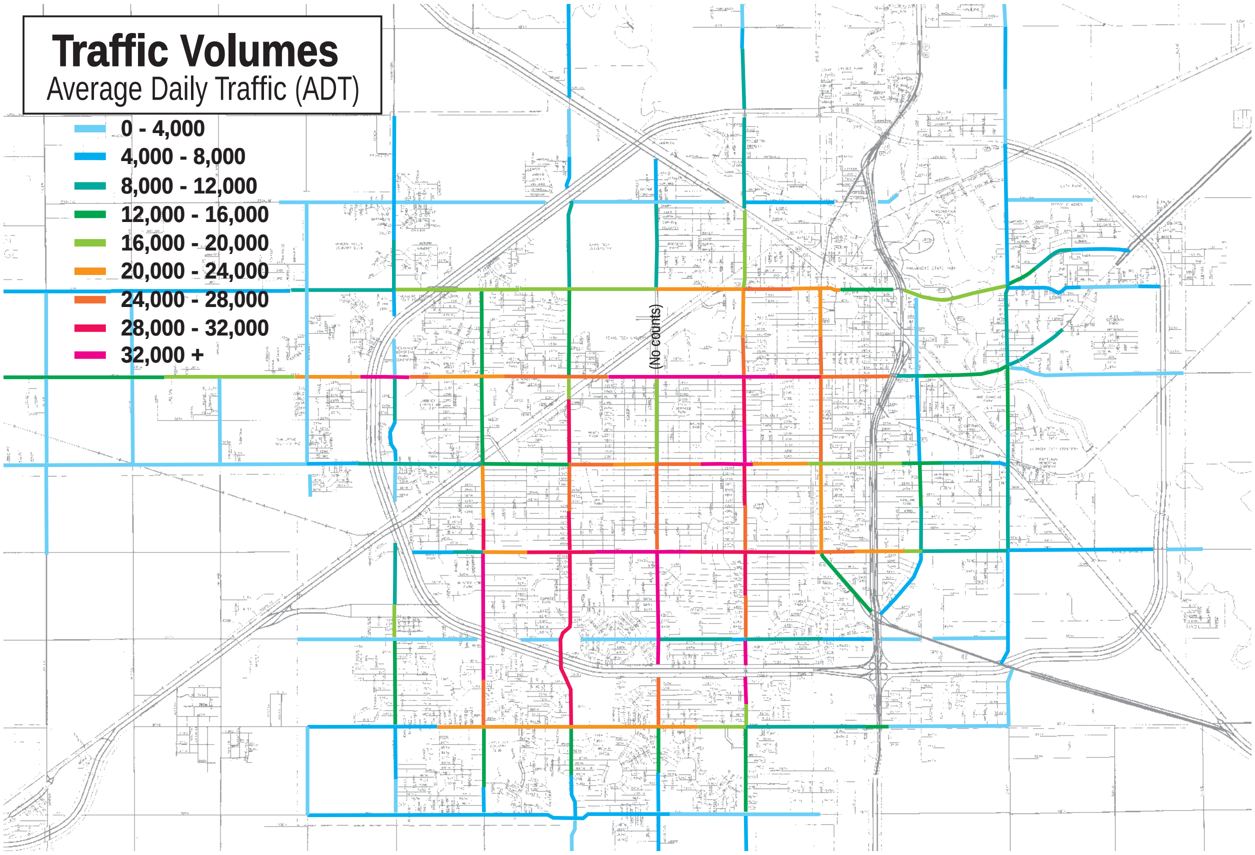
Through the public involvement process described earlier, a series of important hazardous locations were identified. These locations included both particular "hot spots," as well as lengths of road considered hazardous by the public. The map shown below gives the compiled results of people's comments.

As might be expected, the public identified much of the primary arterial street network, as well as major crossings of Loop 289, especially crossings of South Loop 289. The primary concerns expressed were a combination of traffic volumes, speeds, and narrow lane widths.

Another location noted numerous times was the intersection of 19th St., Quaker Ave., and the Brownfield Highway. This complex intersection was identified as both a serious hazard and a location used by many students on their way to Texas Tech; its size, the traffic volumes coming from three different directions, and the geometric complexities were all mentioned. It is, by the way, scheduled to be changed when the proposed East-West Freeway is built.

In many cases, the hazardous locations identified by Lubbock's bicyclists correspond relatively well with the locations with the highest traffic volumes (see the Traffic Volume map on the following page for comparison). The correspondence, however, is not perfect—primarily reflecting concerns with high speeds on several rural routes to the west, as well as heavy truck traffic in industrial areas on the east side of town. In general, the factors most often identified as leading to hazardous conditions were volume, speed, geometrics, and road condition.



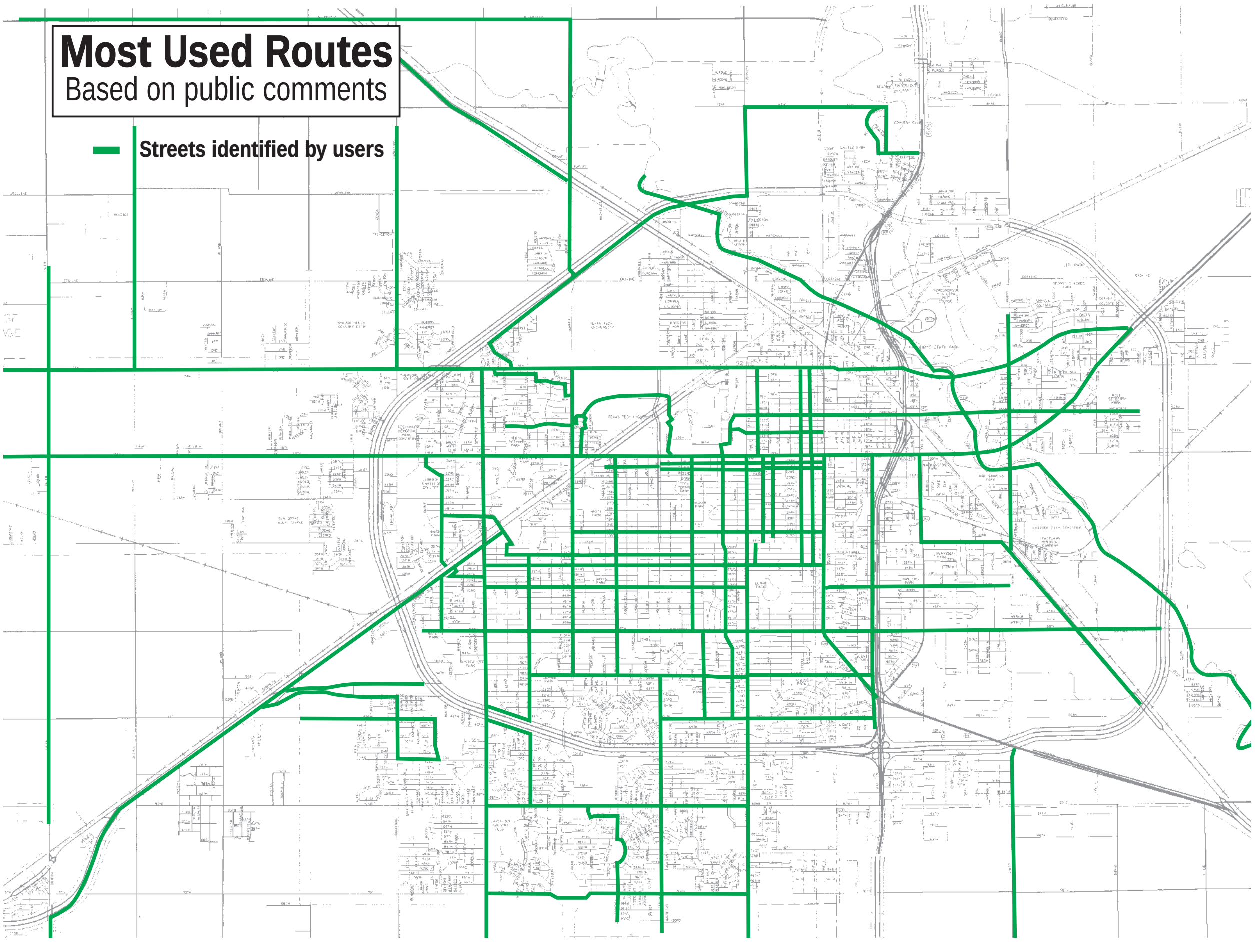


Traffic volumes, as shown above, are particularly high on certain stretches of the east-west thoroughfares of 19th, 34th, and 50th Streets; north-south arterials Slide, Quaker, Indiana, and University Avenues are especially busy as well.

Another important factor concerning the major thoroughfares is their standard geometrics. As will be discussed later in this report, narrow outside lanes (e.g., 12 feet of width including the gutter pan) render these roads particularly difficult for many bicyclists to use in comfort. This factor, coupled with the high traffic volumes, produces a situation where bicycling “levels of service” for these roads are typically in the D to E range (see further discussion in the Appendix). Other geometric factors include the number of lanes and the complexity of intersections. In general, the wider and more complex, the less “bicycle-friendly” a roadway will be.

When coupled with relatively high traffic speeds, the factors of available width and high volume produce even less friendly roadways. Speeds of 45mph and above render narrow travel lanes especially worrisome for bicyclists who, then, feel threatened by overtaking traffic passing closely. When the high speeds and narrow lane widths are combined with high volumes of motor vehicle traffic, the situation becomes even less hospitable.

To some extent, the Hazardous Locations map shows a similarity to the Most Used Routes map, also produced from public comment (see following page). While riding in these situations feels dangerous to many bicyclists, they do not always have reasonable options. After all, the arterial streets are the primary through routes for getting from point to point in Lubbock. It is worth noting, however, that a significant number of bicyclists use lower volume routes across town. This is particularly the case in the part of town where the street grid is most uniform and complete. Many of the routes suggested in this aspect of the public process were analyzed and a significant number used in the proposed route system discussed later in this report.



Another aspect of the street network worth consideration is the pavement quality, particularly near the right edge of the roadway. On a number of arterial streets, the seam between the edge of the asphalt pavement and the concrete gutter pan is ill-defined and uneven. Typically, the roadway surface is above the surface of the gutter (see diagram below). This situation renders the right edge of the roadway less usable for bicyclists, who must ride farther into the roadway in order to avoid the danger caused by the edge.

If a bicyclist were to drift into the gutter area and attempt to regain the roadway surface, he or she would probably be thrown to the pavement. The situation would be similar to what would happen to a motorist who drifted off onto a low shoulder and attempted to swerve back onto the road. In both cases, a serious crash is highly probable.

Existing bicycle facilities

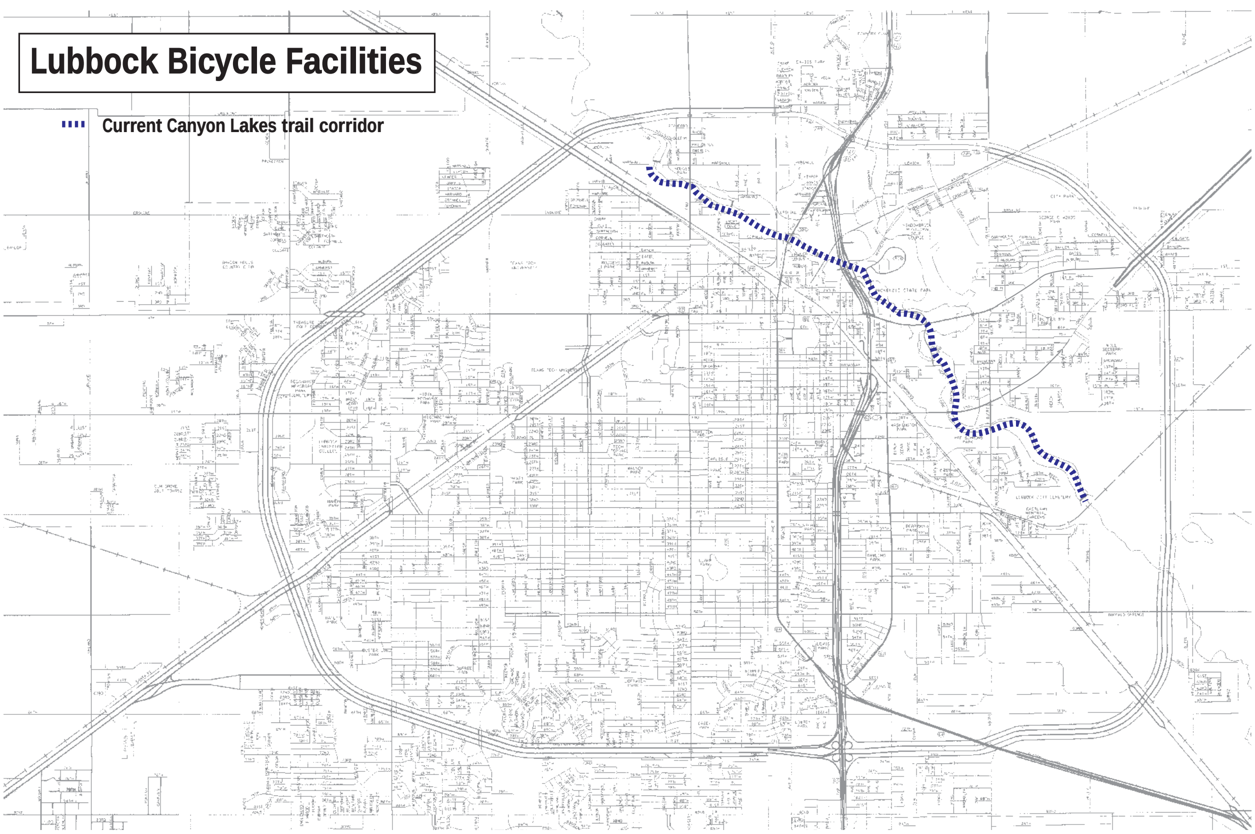
Lubbock has little in the way of existing bicycle facilities. The only facilities identified in the course of developing this plan were segments of trail in parks in the Canyon Lakes corridor (see map below). In general, the trails, while providing an off-road bicycling experience for Lubbock's riders, need to be re-vamped to bring them up to the at least the minimum geometrics contained in the AASHTO *Guide for the Development of Bicycle Facilities*.

The most noticeable problem concerns the width of the trails. They are substantially narrower than the suggested minimum found in the AASHTO *Guide.* In that they are identified on plans as "hike/bike" trails, they should be paved to a width of at least 10 feet. Current segments do not meet this criteria.

In addition, several intersections with the park roadway and parking lots are of concern. While the intersections do not typically suffer from vegetative sight restrictions, they occasionally cross the road at sub-optimal locations and run through parking areas. In one spot in Atzlan Park, for instance, the trail crosses the road in a curve. In another location near Loop 289, the trail adjoins the roadway for a distance. In general, these conditions should be changed in order to reduce the potential for crashes and possible agency liability.

Finally, the trails have little in the way of pavement markings, signing, or other traffic controls. Centerline striping should be applied as a matter of course. Bike route signs with destinations should be used at key locations. Warning signs should be used in locations where unavoidable hazards exist.

All in all, trail designers should go through the existing trail network with an eye for sub-standard locations and should endeavor to bring them into compliance. This crucial renovation will become more and more important as the trail system grows and becomes more popular.



Planning Approach

The Comprehensive Bicycle Plan is the first step in the development of a bikeway network for the Lubbock metropolitan area. The plan identifies a network of bikeways and other general changes to the transportation system which must be designed and implemented in the years ahead. The plan has been developed in four stages:

Stage One: Identify and understand different *types of bicyclist*

Stage Two: Identify and understand different bicycle *facility options*

Stage Three: Identify *general changes* to the future design and implementation of highway system which will ensure accommodation for bicyclists becomes a routine feature.

Stage Four: Identify a community-wide *bicycle network*

In addition, the plan identifies a series of implementation measures to be taken by the cities, MPO and other agencies and organizations within the region to help make the plan a reality.

Stage 1: Bicyclist types

One of the basic insights necessary to developing a bicycle plan is the understanding that there are different types of bicyclists. These different types of bicyclists have different characteristics, needs, problems, and desires. There are three primary categories:

Type A bicyclists:skilled adult riders
Type B bicyclists:basic adult riders
Type C bicyclists:children

Type A/Skilled adult riders

Type A or skilled cyclists represent approximately twenty percent of bicyclists and, it is estimated, ride up to eighty percent of all bicycle miles traveled. They tend to be highly skilled and comfortable in most traffic situations. They travel long distances (seldom less than five miles at a time and often more than 100 miles) and can maintain high average and peak speeds. Their bicycle trips often involve long commutes to work and lengthy recreational and fitness rides.

In urban areas, they are best served by provision of adequate space on the road without any special designation. In rural areas, they may prefer wide smoothly-paved shoulders.

Type B/Basic adult riders

These bicyclists make up much of the eighty percent of the bicycling public who ride only twenty percent of the bicycling mileage. They tend to lack the confidence and skill of Type A riders and ride much shorter distances. Average trip lengths are much closer to the two miles reported in the Nationwide Personal Transportation Survey. Their bicycling trips often involve rides to a nearby store or park, exercise jaunts around the neighborhood, and family outings of 1 to 2 miles.

In urban areas, they are best served by provision of bicycle lanes on busier streets and bicycle routes and traffic calming on neighborhood streets. Separate trails are among their favorite riding environments. Type B riders may not often ride in rural areas, they may be found riding in small towns that line some rural highways.

Type C/Children

Young bicyclists ride very short distances but their lack of other transportation options means they often ride daily, where other types of riders may limit their bicycling to weekends. Children have all the confidence of the Type A riders but they lack either their skill or their knowledge of traffic.

Trip lengths tend to be very short, often averaging well below 2 miles, and they ride for a variety of utilitarian purposes (to school, to the store, to friends homes), as well as for recreation.

In urban areas, they are best served by provision of bicycle lanes on moderately busy streets and particularly by bicycle routing and traffic calming on neighborhood streets. Separate trails are among their favorite riding environments. While they aren't often found riding in rural areas, they may be found riding in small towns that line some rural highways. This is particularly true near schools or other potential attractors.

Stage 2: Bicycle facility options

Over the past thirty years, a variety of options have been developed that satisfy the needs of the above-described bicyclists. These include separate bicycle trails, typically found on their own rights-of-way; striped bicycle lanes, generally installed on streets that serve important bicycling corridors; bicycle boulevards, quiet traffic calmed streets that parallel major thoroughfares; wide curb lanes, often provided on the busiest roads; shoulders on rural roads; and general improvements to all streets, which serve to improve the safety for riders wherever they travel.

The following chart describes how some of the basic options can be used to satisfy the different bicycling publics. While these ratings reflect commonly held beliefs about the facilities, it is important to determine local desires and needs through a well-conducted public involvement process. In the following section, these facility options will be described in more detail.

Bicyclist type	*Bicycle Trails*	*Bicycle Lanes*	*Bicycle Boulevards*	*Wide Curb Lanes*	*Paved Shoulders*	*Gen'l Improvements*	*Comments*
Type A	1	2	2	3	3	3	
Type B	3	2	3	1	2	2	
Type C	3	2	3	1	2	2	

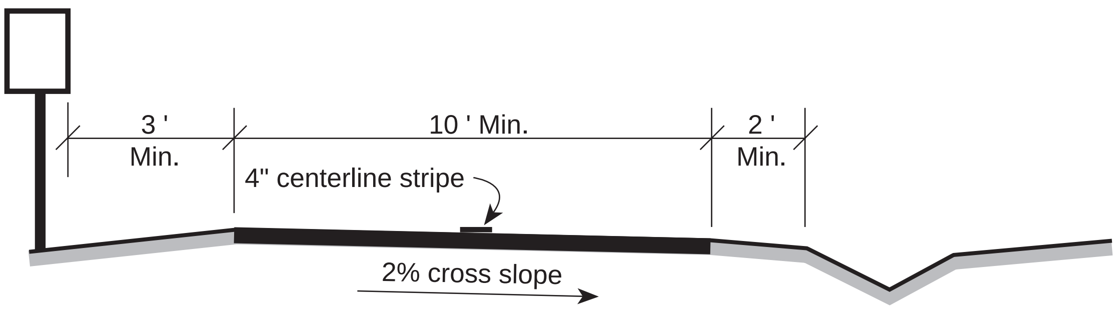
1= Low preference 2=Med. preference 3=High preference

Facility Option Descriptions

Historically, a variety of somewhat confusing and, occasionally, contradictory terms were used to describe bicycle facility options. Early typing systems, some using numbers, as well as combinations of numbers and letters have fallen into disuse and have been replaced by the following simple descriptive terms.

Bicycle Trails: Bicycle trails or paths are separate facilities intended for the use of bicyclists. Typically, they exist on their own rights-of-way, possibly using a non-transportation corridor, like a river flood plan, utility easement, abandoned railroad right-of-way, or linear park. In some cases, they use the right-of-way of an existing road; however, in such cases they are separated from the road by either distance or a physical barrier. Provision of a trail within an interstate corridor would be an example of such a facility adjacent to a road.

Generally, however, use of a road right-of-way for trail construction is considered undesirable. This is particularly true of surface streets in urbanized areas, where the trail's integrity would likely be compromised by cross streets and driveways. The following diagram shows a typical section of a bicycle trail.



While bicycle trails, as a rule, are separated from motor vehicle traffic, they often serve other non-motorized users. For instance, pedestrians are often found on bicycle trails, particularly those trails near pedestrian traffic generators like residential areas, schools, or neighborhood commercial districts. Additional users may include rollerbladers, skaters, joggers, as well as the occasional equestrian.

For this reason, bicycle trails are often considered mixed-use trails and designers have had to learn how to reduce conflicts between users. In some communities, separate bicycle and pedestrian trails are included in the same corridor. In others, trail user ordinances are used to clarify the right-of-way rules on mixed-use paths. In still others, some users (e.g., rollerbladers and skaters) are banned from the paths.

Bicycle trails can serve a number of important functions. First, they can help bicyclists get to previously inaccessible destinations. For instance, a trail could provide bicyclists with a legal alternative to reach a park only served by an interstate highway. In addition, trails can provide low-stress alternatives to high-stress roads. For instance, a trail could be used to help school students avoid a major high-volume arterial street on their way to school.

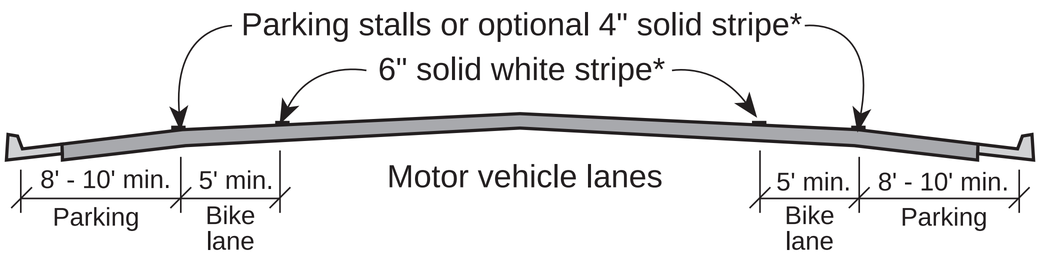
Further, a trail could encourage casual riders to try bicycling in a non-threatening setting. Many people who would never think of riding the arterial and collector street network would welcome the chance to ride several miles on a trail system. Once they have found how easy and enjoyable bicycling can be, they may be enticed to ride for other purposes and to other destinations.

Finally, well-located trails can provide recreational opportunities near people's homes. The Texas Outdoor Recreation Plan (1990) suggests that bicycling is one of the most popular forms of outdoor recreation among Texans, only exceeded by walking. When asked why they do not participate in outdoor recreation more often, 31 percent said that desirable outdoor recreation areas were too far away.

Bicycle Lanes: Bicycle lanes are portions of the roadway reserved for the preferential use of bicyclists. While various approaches have been used to separate bicyclists from other traffic, experience has shown that, for most situations, the best approach is simply to stripe a lane. Physical barriers tend to trap debris, restrict bicycle movement, and encourage conflicts at intersections. For this reason, most current literature (e.g., the AASHTO Guide for the Development of Bicycle Facilities) recommends against using barriers like curbs to designate bicycle lanes.

In most communities, bicycle lanes are provided on either arterial or collector streets that serve popular bicycling destinations like schools, universities, parks, and shopping districts. They are seldom provided on quiet residential streets because low levels of motor vehicle traffic are not seen as significant threats to bicyclists; additionally, the likelihood of significant numbers of bicyclists using such a street would tend to be low. Nor are they typically provided on major high-volume arterial streets with many lanes, complex intersections, and high traffic speeds. However, a large number of potential candidate streets fall between these two extremes and can make excellent candidates for bicycle lanes.

Bicycle lanes are typically striped between the outside travel lane and the curb. If there is curbside parallel parking, the bicycle lane will be to the traffic side of the parking. On two-way streets, one-way bicycle lanes are provided on each side. On one-way street couplets, one-way bicycle lanes going in the direction of traffic are typically provided on the right side of the roadway, with a lane going the opposite direction provided on the other street of the couplet. In some cases, bike lanes have been striped on the left of a one-way street; for example, if most bicycle traffic enters from residential areas on the left and leaves to the left.



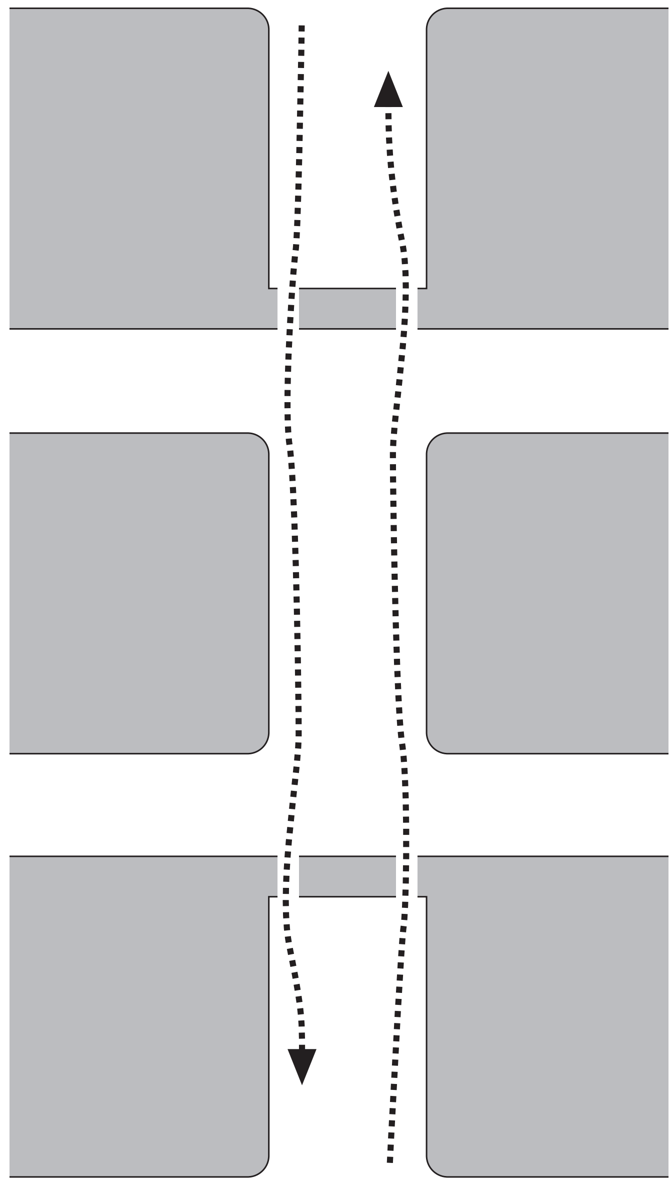
* The optional solid white stripe may be advisable where stalls are unnecessary (because parking is light) but there is concern that motorists may misconstrue the bike lane to be a traffic lane.

One primary purpose of providing bicycle lanes is to give less experienced bicyclists the sense that they have a legitimate place to ride. Often, Type B and C riders fear motor vehicle traffic and bicycle lanes help mitigate those fears. Research currently under way at Northwestern University's Traffic Institute shows this pattern very clearly. Type B and C riders reported an increased willingness to ride particular streets when bicycle lanes were installed.

In addition, provision of bicycle lanes can reserve space for bicyclists that might otherwise disappear as a road is re-channelized. This often happens on roadways where there is extra space left at the right edge of the road but that space is not allocated to any specific purpose; in such a situation, bike lanes can act as a reminder of the needs of bicyclists.

Bicycle Boulevards: The term bicycle boulevard came from an early experiment conducted in Palo Alto, California, and it describes traffic calming modifications made to residential streets that parallel heavily traveled arterials. The idea is to install barriers, diverters, and other devices to discourage through motor vehicle traffic but still allow easy passage for bicyclists. Palo Alto's early work showed that many bicyclists shifted their travel patterns to use the bicycle boulevard as opposed to the nearby arterial street.

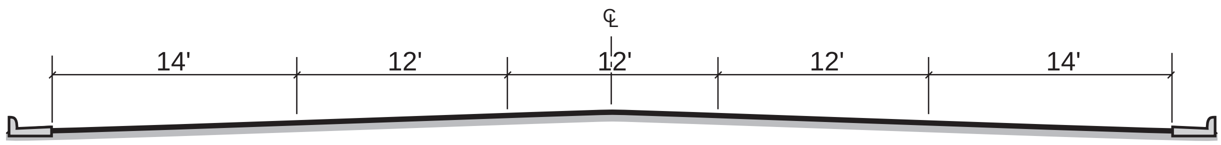
There are numerous ways to create a bicycle boulevard. The diagram below shows one approach. Another is to use intersection diverters that force motorists to turn right after one block of travel. While bicyclists often appreciate the installation of bicycle boulevards, it is important to coordinate any such project with the neighborhood involved. In fact, some cities only install bicycle boulevards in conjunction with traffic calming at the request of local residents.



Fortunately, many residents come to appreciate the benefits of traffic calmed bicycle boulevards, once they understand the idea and have seen one in operation. In the Palo Alto example, residents began improving their properties once the impacts of through auto traffic were removed and their neighborhood once again became a quiet refuge.

In summary, then, the purpose of a bicycle boulevard is two-fold:1) to provide bicyclists with a continuous low-volume alternative through a major travel corridor; and 2) to provide neighborhoods relief from the impacts of through motor vehicle traffic using residential streets as by-passes.

Wide curb lanes: A wide curb lane is an outside through lane to which extra space has been allocated. Typically, such a lane is between 14 feet and 15 feet wide (not including the gutter pan); this additional space allows motorists and bicyclists to share a travel lane more easily than would a standard 12-foot lane. Indeed, 14 feet is usually enough to allow a motorist to pass a cyclist without either coming too close to the rider or having to cross over into another lane.

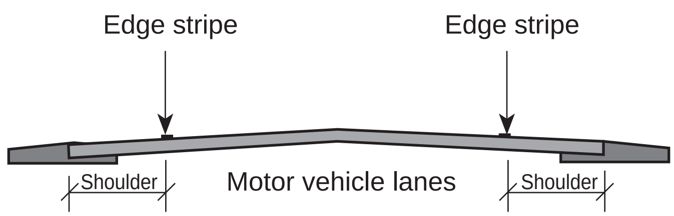


In general, wide curb lanes are applied on arterial and collector streets where traffic volumes require bicyclists to share lane space with many motorists in the course of their journeys. To differentiate between the application of wide curb lane solutions and bicycle lane solutions, the former tend to be used in more complex traffic settings where it would be difficult to apply a bicycle lane approach and users tend to be the more skilled Type A riders. Quiet residential streets are seldom considered candidates for curb lane widening; in fact few residential streets are even channelized to begin with.

When a wide curb lane reaches an intersection, space allocation depends on channelization. If there are right-turn-only lanes, for example, the extra space would be added to the right-most through lane, rather than to the turn lane. In this manner, through bicyclists would be encouraged to use the proper lane for their destination.

Summarizing, the basic purpose of a wide curb lane is to provide extra space for bicyclists and motorists to share. There is no marking separating the two types of users.

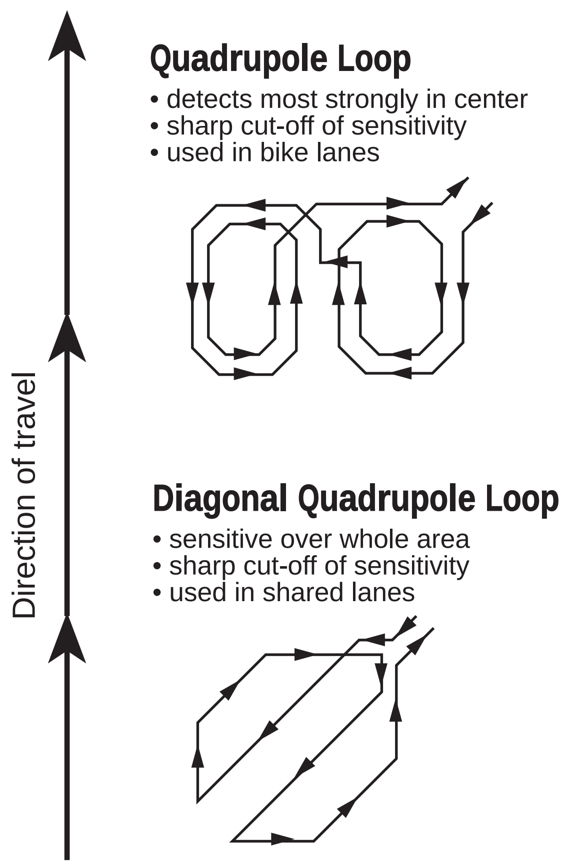
Paved shoulders: Typically, shoulders are level surfaces immediately adjacent to a roadway's travel lanes. While shoulders are often provided for motorist safety and roadway maintenance reasons, shoulders paved to the same standard as the adjacent roadway will often be used by bicyclists. This is particularly true in rural areas where traffic speeds are high and truck traffic common. While any space at all to the right of the edge line is usually welcome by bicyclists, shoulders at least 4 feet wide tend to give bicyclists a greater degree of comfort than do narrower shoulders.



Unfortunately, certain common shoulder conditions can reduce the benefit for bicyclists. Rumble strips, raised pavement markings, disjunctions between the roadway and shoulder, and rough pavement surfaces can all make a shoulder unrideable or hazardous. In areas where bicycling is encouraged, the benefits of such features are weighed seriously against their impacts on bicyclists.

Shoulder provision can provide a substantial benefit for bicyclists, particularly in rural or semi-rural areas. It can provide a refuge from fast traffic. In addition, several studies have shown that shoulders can reduce the incidence of motorists run-off-the-road crashes and reduce highway maintenance costs.

General improvements: Since bicyclists can be found upon almost any road, basic improvements to the street system, in general, can result in a more bicycle-friendly community, as well as reduced risk of bicycling crashes. Typical improvements include replacing parallel bar drainage grates with bicycle-safe models; sweeping debris from the right edge of the road; making traffic signals work for bikes (see diagram at right); eliminating hazardous potholes and cracks; cutting back sight obstructions at intersections; and correcting dangerous railroad crossing surfaces.



Each of these problems has at least one good solution that works for bicyclists. In general, however, they are simply applications perhaps with slight modifications of what public works or streets departments have been doing for years:such things as fixing potholes, making signals work, and cutting back fences at intersections.

The change is more one of attitude on the part of public officials: realizing that bicycle traffic matters and that it is worthwhile making these efforts. Typically, the mechanism is already in place for making general improvements for bicyclists. In most jurisdictions, citizen complaints about potholes, for example, help agencies identify pavement problems. Similarly, small changes in design standards can replace bicycle-unfriendly features with their bicycle-friendly counterparts over time.

In general, then, the purpose of making general improvements to the street system is to eliminate unnecessary bicycling hazards or problems. This can reduce the number of bicycle crashes and help agencies reduce their potential liability for such crashes.

Stage 3: General Policies to Promote Bicycle Use

Specific roadway or trail projects can help solve particular problems, like crossing Loop 289 or bypassing a busy stretch of Quaker Avenue. Similarly, they can capitalize on unique situations, like the Canyon Lakes area or the likely realignment of the Seagraves, Whiteface & Lubbock Railroad line west of town; and linear improvements along major bicycling routes can encourage commuting to school or work.

However, many bicycling trips are too local in nature to take advantage of particular special facilities. A trip that begins near Dupree Park and that ends at the South Plains Mall would not logically involve using a trail through MacKenzie Park. Nor would a trip from a home near Butler Park to Bozeman Elementary School require the use of a bicycle/pedestrian crossing of South Loop 289.

These trips do, however, require a base level of bicycle accommodation on the overall transportation network. And, because they can begin at any home and end at virtually any destination, this accommodation can best be provided through general "bicycle-friendly" policies that affect all roads. Such policies include providing the basic width required for combined car and bicycle use, making sure surface features, like railroad crossings, are relatively safe, and designing traffic controls that work for everyone.

The following sections discuss, in turn, proposed policies for the primary classes of roadways found in Lubbock: arterials or thoroughfares, expressways, collectors, residential streets, and farm to market rural roads. The intent is not to turn all streets into bikeways. Rather, it is to ensure that bicyclists can, at the very least, get where they need to go without feeling unnecessarily threatened.

Thoroughfare design

While bicycling on major thoroughfares, or arterial streets, is seldom an enjoyable experience, it is occasionally necessary. Certain corridors in Lubbock are served only by arterials. For instance, all streets that cross South Loop 289 are either Type T-1 or Type T-2 Thoroughfares. Similarly, certain specific destinations can only be reached by travelling on the arterials. For example, it would be difficult, if not impossible, to reach many of the numerous shops along 34th Street without riding on 34th, itself.

In addition, there are areas where alternative routes exist but using them results in greatly increased travel times and higher levels of inconvenience. For instance, while the area just south of Texas Tech is laced with an excellent grid of quiet through routes which can be used by bicyclists to great advantage, that network starts to break down south of 50th and almost disappears altogether south of the Loop. Using the curvilinear back streets in these areas can add significantly to travel time.

As a result of these factors, this plan suggests a two-pronged strategy of combining designated and improved alternative routes (using collector and, in some cases, residential streets) with basic safety improvements to the arterial street system. The arterial improvements are discussed under several topics: typical cross sections, intersection design, and signalization.

Typical cross sections

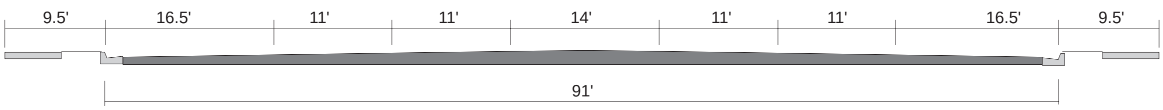
In general, the current Lubbock thoroughfare design standard provides too little *effective width* in the curb lane for safe and comfortable sharing between motorists and bicyclists, regardless of the bicyclist's skill level. The effective width of the lane is the actual width, less the width of the gutter pan since that area cannot be safely used by bicyclists. In the case of the Thoroughfare Standards, the effective width is 10.5 feet. Studies and experience from around the country suggest that 15 feet is a preferred outside lane width because it allows motorists to pass bicyclists without changing lanes and it gives bicyclists some breathing room. Further discussion of the problem of narrow lanes is contained in the Appendix.

New construction: *This plan proposes modifying the design standards for arterial streets to create a wide curb lane and to allow for the possibility of striping bicycle lanes on each side of the roadway, if desired. The proposed standards for T-1 and T-2 thoroughfares, along with the current standards, are shown below.*

Proposed Standards

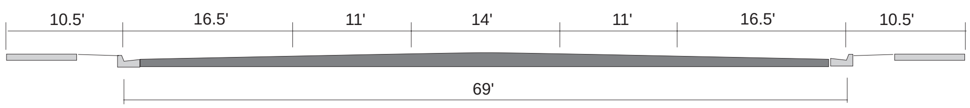
Type T-2 Thoroughfare

110' ROW



Type T-1 Thoroughfare

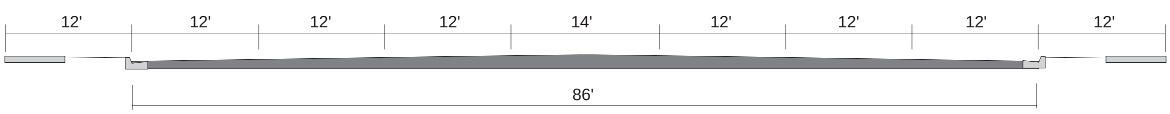
90' ROW



Current Standards

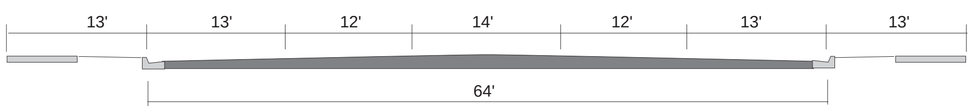
Type T-2 Thoroughfare

110' ROW



Type T-1 Thoroughfare

90' ROW



This change will provide an improved margin of safety for bicyclists who use the major thoroughfares. It will also improve conditions for motorists. A wide curb lane can reduce conflicts between motorists going straight and those either exiting or entering driveways. Typically, motorists waiting to leave a commercial driveway wait where they can see oncoming traffic. Often, if utility poles, mailboxes, and other objects block the view, this means stopping with the front end of the motor vehicle encroaching on the curb lane. In a narrow curb lane, this intrusion can reduce both capacity and safety.

Similarly, a motorist turning right into a commercial driveway will often interrupt the flow of traffic as he or she slows to a near stop in order to make the turn. This is especially true if entering the driveway requires negotiating a tight radius turn, as is often the case on Lubbock's major thoroughfares. For these reasons, we believe providing wide curb lanes will improve the traffic situation for both motorists and bicyclists.

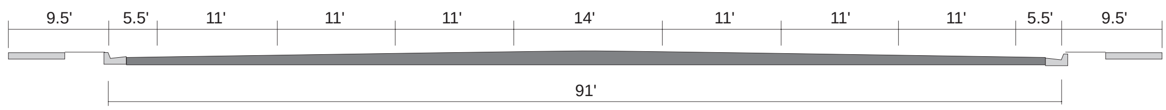
Because the modified cross section adds only 5 feet of paved width and no additional right-of-way to each of the T-1 and T-2 thoroughfare designs, the additional cost when done as part of new construction is anticipated to be approximately $62,000 per mile. Fortunately, a number of Lubbock's thoroughfares are identified for widening and reconstruction in the Lubbock Metropolitan Transportation Plan.

Bicycle lanes: *Where bicycle lanes on major thoroughfares are required for continuity with the designated bicycle route system, they should be designed as shown below.*

Proposed Standards

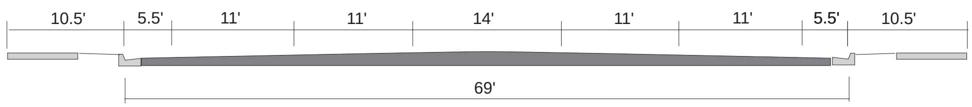
Type T-2 Thoroughfare with Bike Lanes

110' ROW



Type T-1 Thoroughfare with Bike Lanes

90' ROW

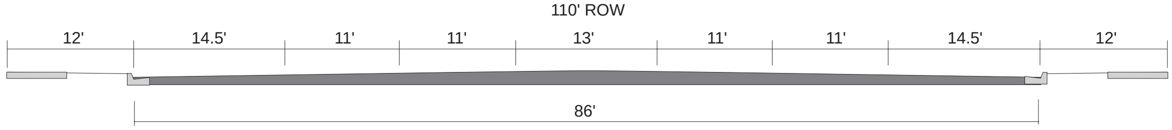


The above cross section complies with the requirements of the AASHTO Guide for the Development of Bicycle Facilities, which requires that the bike lane stripe be at least 4' from the edge of the gutter pan or 5' from the face of curb. In the case of Lubbock's standard 1.5' gutter pan, the 4' measurement governs. Adding the extra lane stripe, along with bike lane pavement markings, should cost approximately $4500 per mile.

Restriping: *On an existing roadway where major reconstruction is unlikely in the near term, restriping the travel lanes to provide a widened curb lane can give a marginal but noticeable improvement and should be done on all thoroughfares. The diagram below shows a proposed cross section.*

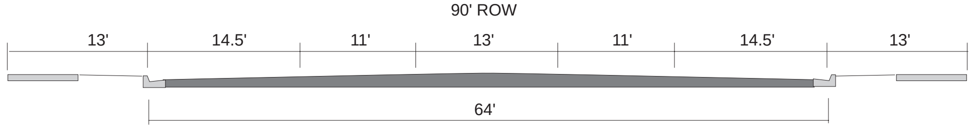
Type T-2 Thoroughfare

110' ROW



Type T-1 Thoroughfare

90' ROW



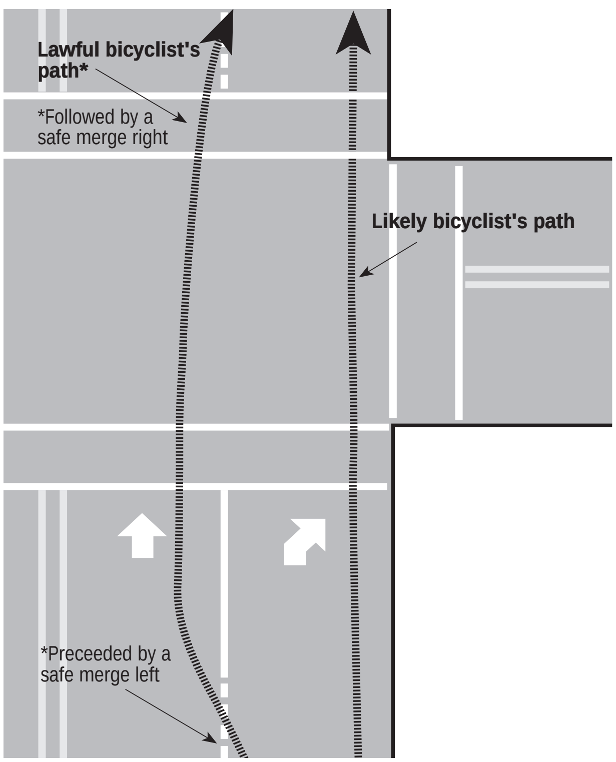
When the preferred cross section is impossible to attain, it is still possible to make some improvement for bicyclists on major thoroughfares. This is particularly important for roads that are already built and where curbs and gutters are in place; many sections of Type T-1 and T-2 Thoroughfare in Lubbock will not be widened or otherwise altered significantly in the foreseeable future. However, studies conducted by Maryland DOT suggest that even marginal additions to the width of the curb lane can help bicyclists. Thus, the two options shown above add two feet to each outside lane without altering the paved width of the roadways. In monetary terms, there should be no additional cost beyond what is normally expended on striping.

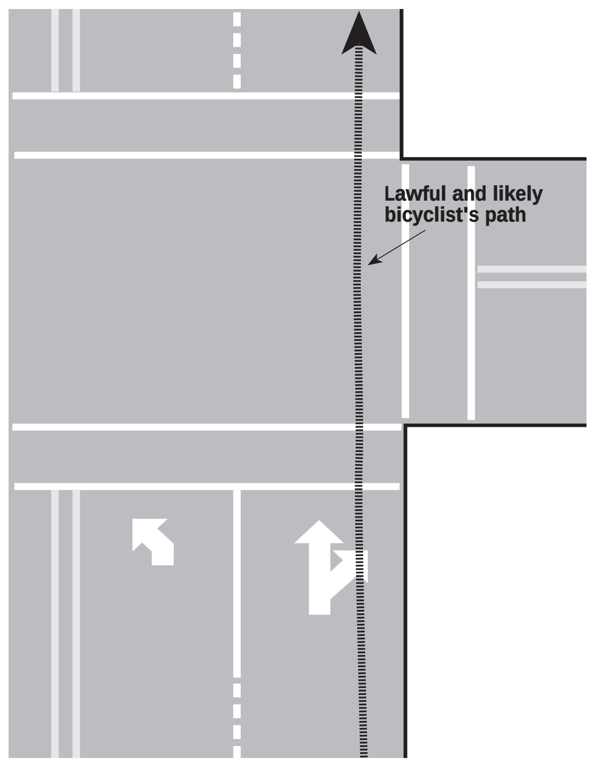
Intersection Design

While having adequate width in the outside travel lane is important to bicyclists, the configuration of intersections is equally important. The most critical factors involve the design of features that occur where bicyclists typically ride: the right side of the roadway. If the extra space at the right edge disappears at the intersections, then bicyclists will feel particularly threatened. Two features are of particular importance: standard right-turn lanes and interchanges.

Right turn lanes: *This plan recommends generally restricting the use of right-turn lanes to situations where traffic volumes require them. Left-turn lanes, combined with through-and-right-turn lanes typically work far better for bicyclists and should be used instead.*

For bicyclists it is usually best to keep the right lane as a combined right-and-through lane. When presented with a right-turn lane, bicyclists going straight must merge into the second lane over in order to lawfully continue their journey. Unfortunately, few riders have the skills or confidence to do this. And some aggressive motorists resent bicyclists making such moves. After a few confrontations, many bicyclists will unlawfully ride through the right-turn lane, as shown below. This is especially true on roadways with higher speed limits.

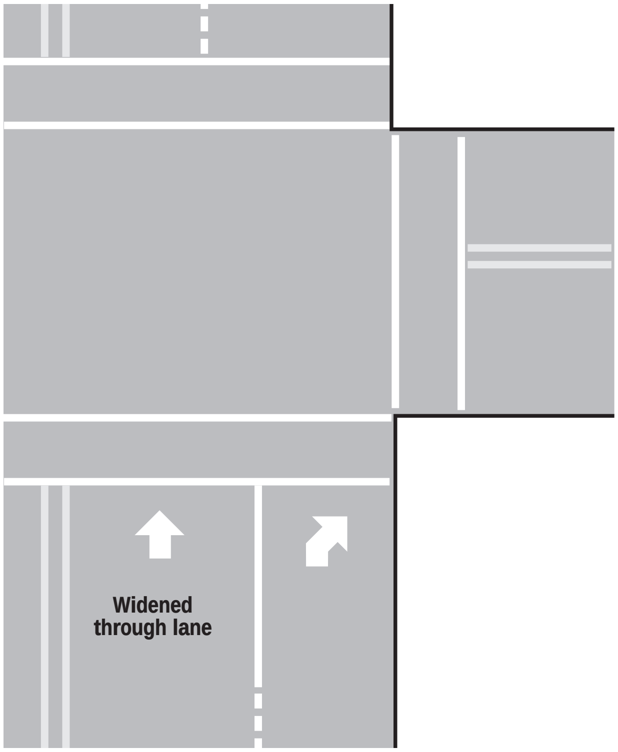


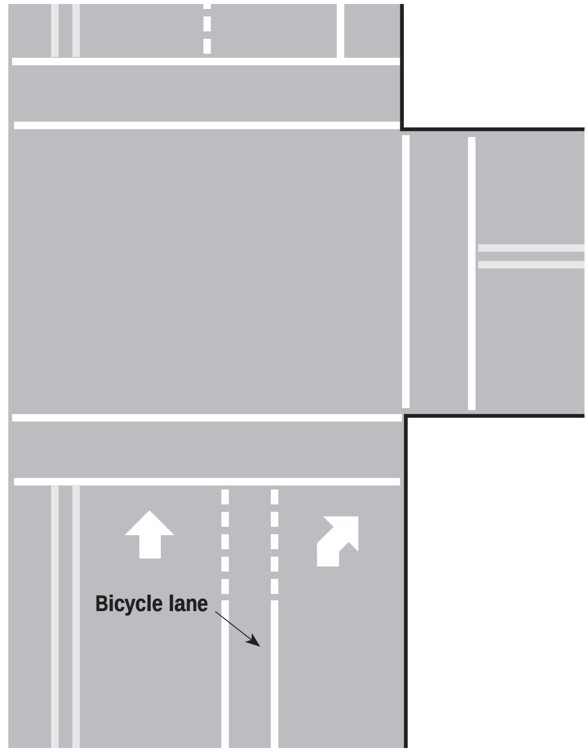


The following guidance is offered by the *Highway Capacity Manual* on when to use right-turn lanes: “Exclusive right-turn lanes are provided for many of the same reasons that left-turn lanes are used. Right turns are, however, generally more efficiently made than left-turn movements. Right turns may face a conflicting pedestrian flow, but do not face a conflicting vehicular flow. As a general suggestion, an exclusive right-turn lane should be considered when the right-turn volume exceeds 300vph and the adjacent main-lane volume also exceeds 300vphpl” (p. 9-64).

In terms of costs, altering the lane markings in the fashion described above should add little, if anything, to the routine cost of striping and marking.

On thoroughfares where right-turn lanes are needed, the right-most through lane should be widened to 14 or 15 feet. If bicycle lanes are used, they should merge across the turn lane and pick up between the right-most through lane and the right-turn lane. These two options are diagrammed below.



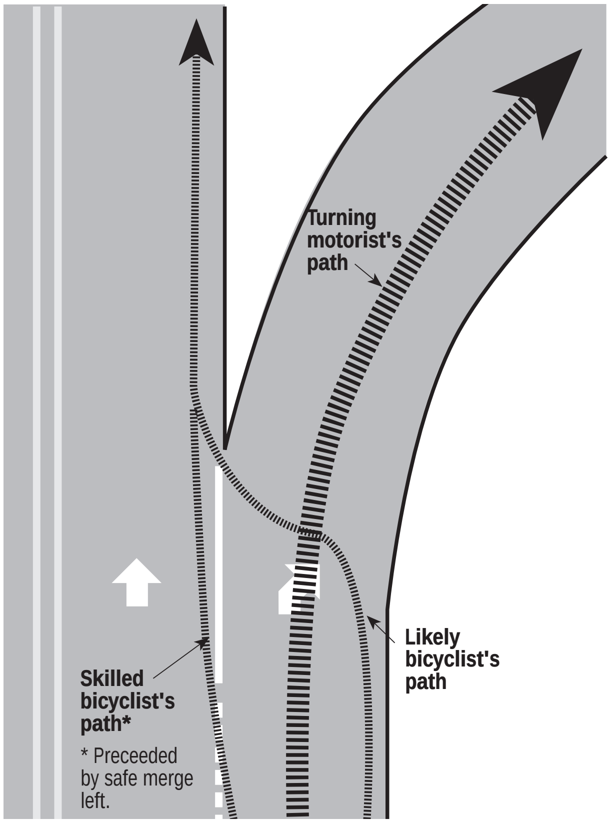


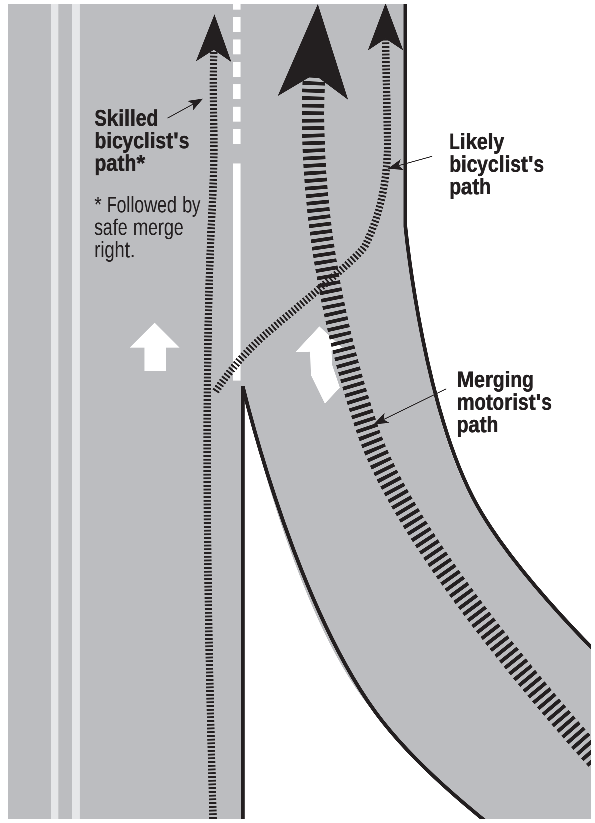
Interchanges: *The needs of through bicycle traffic on the surface streets and potentially on frontage roads should be considered when designing freeway interchanges. Where bicycle traffic may be anticipated, the junction between on- and off-ramps and the surface street should be designed to discourage high speed turns and merges. This may be accomplished by keeping the radius of the turn small and encouraging turning traffic to slow substantially before entering the new direction of travel.*

Interchanges can be more complicated versions of the right turn lane situation described previously. The added complexity, for the most part, comes about when high speed right turn lanes are used to take motorists onto or off of an interstate ramp or service road. If motorists exiting the surface street are encouraged to travel at high rates of speed, unsuspecting bicyclists may find themselves travelling to the right of fast-moving right-turning traffic.

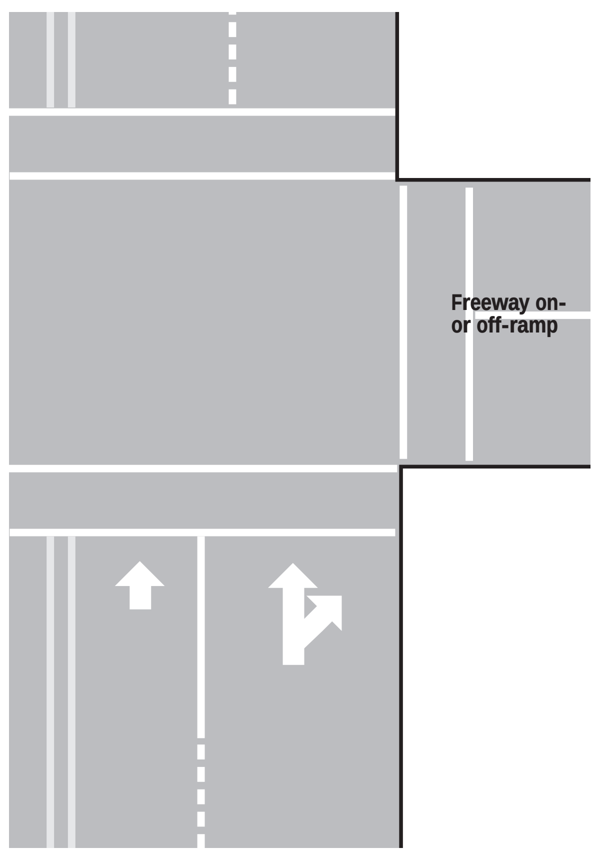
Similarly, if motorists entering the surface street do so on a relatively high speed merging lane, bicyclists may find themselves to the left of fast-moving through traffic. Both situations can be difficult for all but the most experienced riders, as shown in the diagram on the following page.

Early work in California attempted to stripe bicycle lanes through interchanges following the alignment shown below as “likely bicyclist’s path.” These attempts generally proved undesirable and have been largely abandoned because they encouraged bicyclists and motorists to cross each others’ paths where speeds were high and cross traffic was neither expected nor welcome. More recently, designers have handled existing high speed interchanges by either providing a more desirable alternative route or by carefully designing merging areas before and after the intersection. The latter approach requires very careful planning and design.





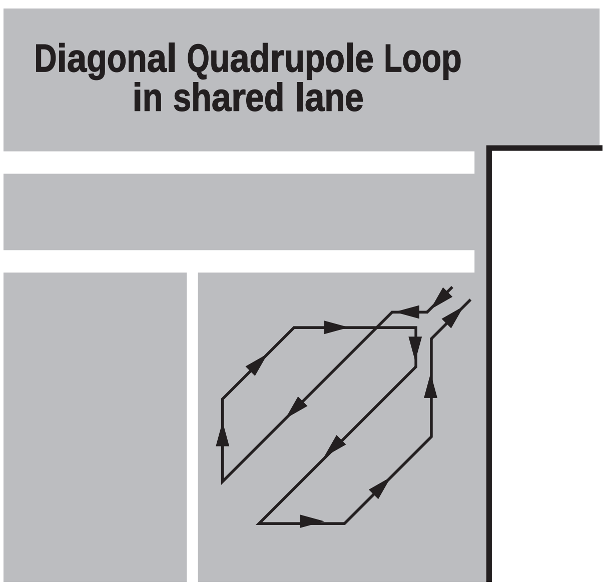
If possible, the desired approach to accommodate bicycling safely through an interchange is to make the connections between surface street and the service roads or the beginnings of the freeway entrances and exits more like standard right-angle intersections, as shown at right. Fortunately, because of the service road aspect, most interchanges in Lubbock are more like the diagram shown at right than the diagrams shown above. However, it is suggested that when the new East-West Freeway is built, the needs of bicyclists be taken into account when designing the connections with the surface streets.

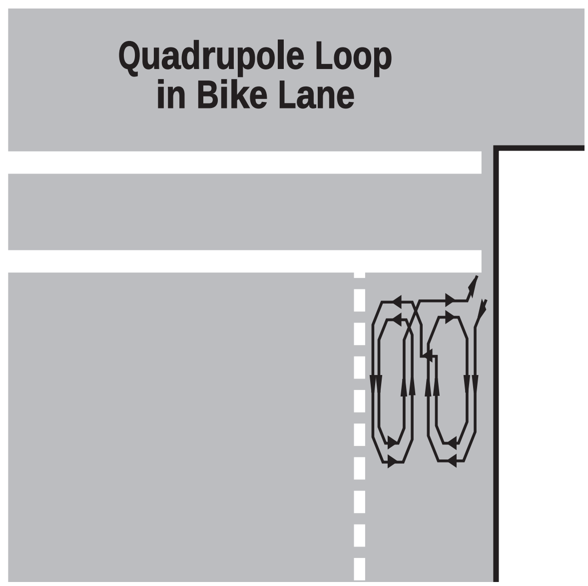


Signalization: *Whenever new actuated or semi-actuated signals are installed or existing installations are significantly modified, they should be made "bicycle-sensitive" through the use of either quadrupole or diagonal quadrupole loop detectors. If necessary, a pavement marking should show bicyclists the best location for reliable detection. And signal timing should be set to allow bicyclists to clear the intersection safely.*

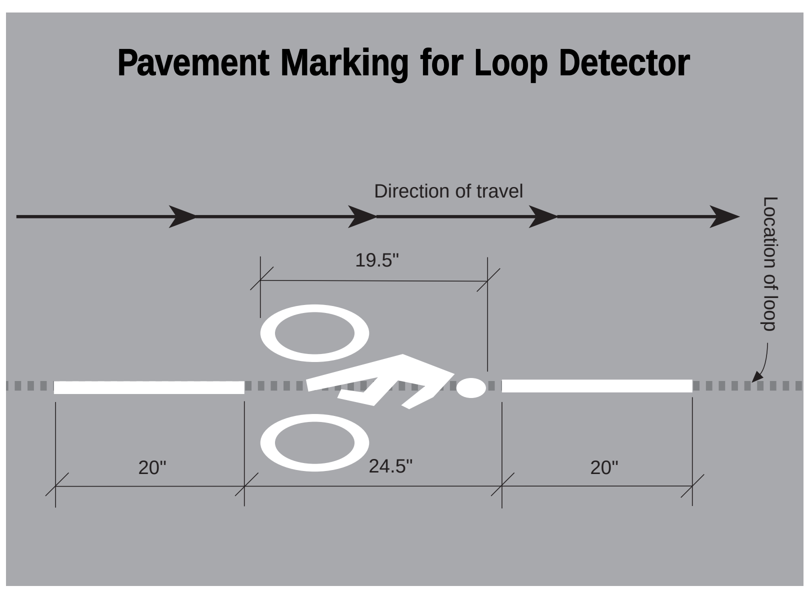
As has been discussed in a previous section of this report, many demand-actuated signal systems do not detect bicycles. Yet bicyclists are required by Texas law to operate as drivers of vehicles and obey the traffic laws. This conflict should be rectified in order to encourage lawful behavior on the part of bicyclists. Fortunately, solutions are readily available.

In shared-lane situations (e.g., a wide curb lane or a left-turn lane on an arterial street), a diagonal quadrupole loop works well. On the other hand, standard quadrupole loops work well in bicycle lane situations, where bicyclist's locations can be predicted with some reliability. If necessary, a pavement marking similar to that shown below should be used to tell bicyclists where to stop their bikes.





Costs for using a modified quadrupole instead of a standard rectangular loop are marginally greater. Adding a quadrupole detector in a bicycle lane would cost approximately $650 for both sides of an intersection. And installing a pavement marking like that shown at right would cost approximately $50 per loop.



In addition, when signal timing is adjusted, the following clearance intervals should be used to allow bicyclists to clear intersections without conflicting cross traffic.

Signal Timing Clearance Intervals for Bicycles *(yellow time + any all-around-red)*

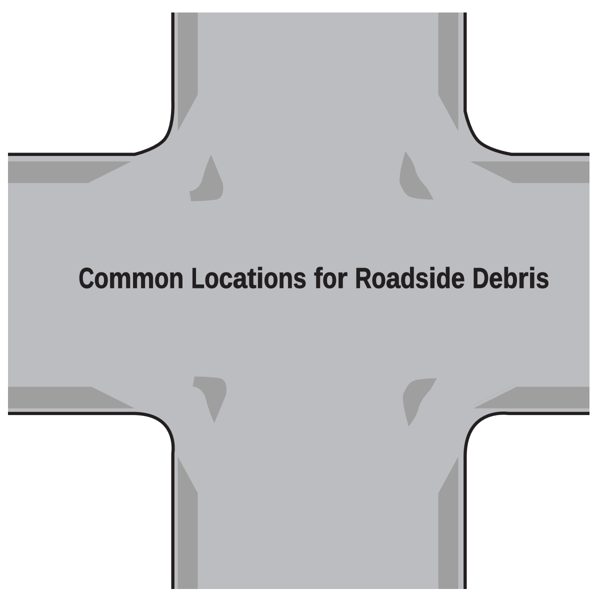
	V	*R*	*W*	*T*	*T+R*
Collector C1	14.7	2.5	46	3.2	5.7
Thoroughfare T-2	14.7	2.5	64	4.4	6.9
Thoroughfare T-2 modified**	14.7	2.5	69	4.7	7.2
Thoroughfare T-1	14.7	2.5	86	5.9	8.4
Thoroughfare T-1 modified**	14.7	2.5	91	6.2	8.7

*V = Bicycle's Speed (feet per second)**
*R = Bicyclist's Perception/Reaction/Braking time (seconds)**
W = Intersection Width (feet)
T = Time to Cross Intersection (seconds)
T + R = Necessary Clearance Time (seconds)

*Based on AASHTO Guide (1991)
**As per suggestions in this plan.

Maintenance: *Since bicyclists generally ride at the right edges of the roadway, these areas should receive as careful sweeping and repair attention as other parts of the roadway.*

Maintenance is a more serious issue for bicyclists than it is for motorists. However, the parts of the roadway that bicyclists use are sometimes maintained less carefully than are other areas. In terms of sweeping, gravel and other debris tends to collect out of the normal traffic stream. This can be as true at intersections as it is between them (see diagram at right). By paying attention to these areas as they work, sweeping crews can significantly improve roadway safety for bicyclists.



Another aspect of maintenance involves routine repairs. Potholes and excavations should be repaired smoothly, matching the elevation of the surrounding roadway as closely as possible. Utility covers should also be brought level with the roadway surface.

Overlay work should smoothly meet the gutter section. In some cases, this may involve paving to the curb face, however there are several problems with this approach. First, sequential overlays will reduce the height and, therefore, effectiveness of the curb. Second, asphalt placed over concrete tends to crack along joints. This can create a hazardous situation where the underlying roadway meets the concrete gutter. The best approach is to grind away excess pavement and feather the new surface into the gutter section.

Collector streets

Many of Lubbock's collector streets offer excellent service for bicyclists. They tend to carry relatively little traffic, particularly when compared with the arterial streets. They generally have adequate width. They often have stop sign protection at residential street intersections. And they typically cross arterials at signalized intersections. For these reasons, and because Type B and C bicyclists will likely never feel comfortable riding along Lubbock's major arterial streets, this plan emphasizes provisions for—and encouragement of—increased bicycle use on the collector street network.

Because the collector streets offer so much potential for bicycling, it is important that future development in the Lubbock area include a reasonably continuous network of collector streets. In some parts of the community, the pattern has fallen somewhat into disuse, forcing bicyclists to choose between two relatively unsatisfactory alternatives: 1) jog back and forth on the curvilinear residential street system, occasionally facing serious discontinuities; or 2) use the arterial street network. It is not surprising, therefore, that bicycle commuting is most common in the parts of town that have a viable collector street network (see the U.S. Census discussion, starting on page 8) and least common where this network disappears. The authors strongly recommend a renewed commitment to collector street development.

The network: *This plan recommends providing reasonably direct collector streets on the half-mile grid between all major arterial streets in all new developments. The existing collector street network should be kept intact and, where possible, expanded. Care should be taken, however, that the collector streets not become surrogate arterials, carrying high volumes of through motor vehicle traffic.*

In terms of design features, we recommend modifying the collectors in such a way as to draw bicyclists to them. The primary suggestions include modifying the typical cross section, making sure all signals work for bikes, and, in some cases, identifying collectors with destinational "bicycle route" signs (see page 61 for discussion of the Bike Route Network). Each of these topics will be discussed in turn.

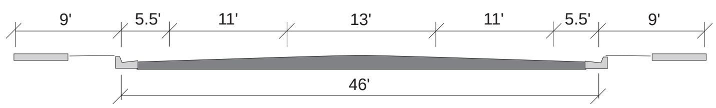
Typical cross sections

As is the case with the major thoroughfare design, the current Lubbock collector street design standard provides too little *effective width* in the curb lane for safe and comfortable sharing between motorists and bicyclists. As is true of the thoroughfare standards, the effective width of the outside lane of a collector street is 10.5 feet. However, unlike the thoroughfare standards, there is no center turn lane and the inside travel lane is relatively narrow as well. Thus, there is little margin for error when a motorist attempts to pass a bicyclist.

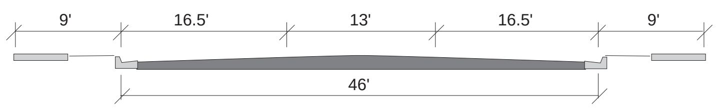
New construction: *This plan proposes modifying the design standard for collector streets to create a bicycle lane on either side and a center left turn lane. Alternatively, a wide curb lane option may be used, particularly if the collector street is not part of—or a logical extension of—the designated bicycle route system described elsewhere (see page 61). The proposed standard for Type C-1 Collectors, along with the current standard, are shown below.*

Proposed Standard

Type C-1 Collector with Bike Lanes
64' ROW

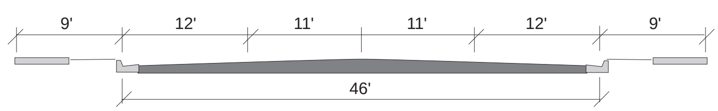


Type C-1 Collector with Wide Curb Lane
64' ROW



Current Standard

Type C-1 Collector
64' ROW



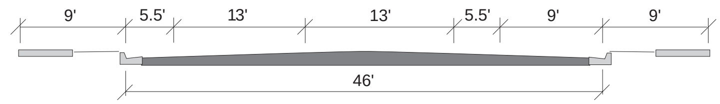
This proposed change substantially improves the collector street network's "bicycle friendliness" and it provides the backbone of the proposed Lubbock bicycle route network. It is anticipated that the changes proposed will draw bicyclists from nearby parallel routes, particularly arterial streets, and will encourage others to try bicycling around town.

One particular advantage of this approach is that it requires no additional paved width. As a result, it will cost little more than providing streets that conform to the current standard. And existing collector streets that do conform to that standard can be modified through striping alone. In each case, the additional cost will involve adding one lane stripe per side, appropriate pavement markings and signage.

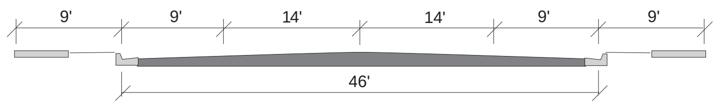
Restriping: *On existing two-way collector streets that are part of the proposed bicycle route system, stripe bicycle lanes on each side. Where insufficient room exists to add bicycle lanes, add as much space as possible to the curb lane. On one-way collector streets that are part of the proposed bicycle route system, add one-way bicycle lanes on the right side of the roadway. Where insufficient room exists to add a bicycle lane on a one-way collector, add as much space as possible to the right-most through lane. The diagram on the following page shows a proposed cross section.*

Possible Options

Type C-1 Collector with Bike Lanes & Parking One Side
64' ROW



Type C-1 Collector with Widened Lanes & Parking Both Sides
64' ROW



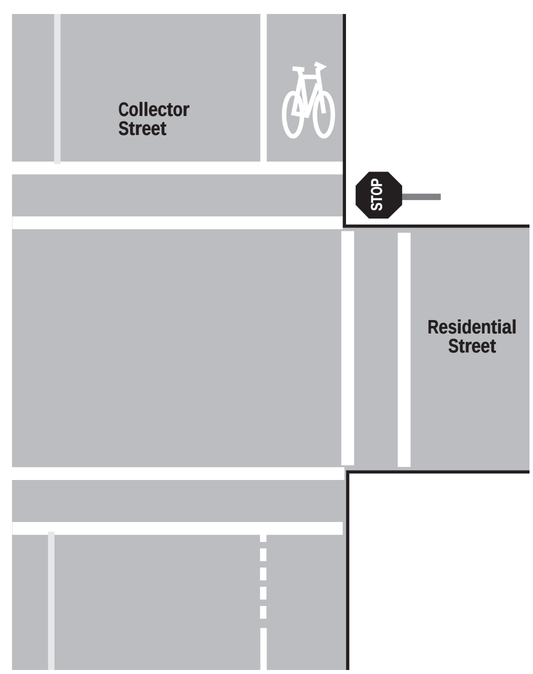
Many existing collector streets are striped with one travel lane in each direction. Some of these have sufficient width to add bicycle lanes or wide curb lanes without difficulty. In other cases, however, changes will need to be made to lane channelization and, to some extent, on-street parking provision. Fortunately, many collector streets already have limited parking. Parking needs will have to be evaluated on a case-by-case basis to determine whether removal is either necessary or acceptable.

Intersection Design

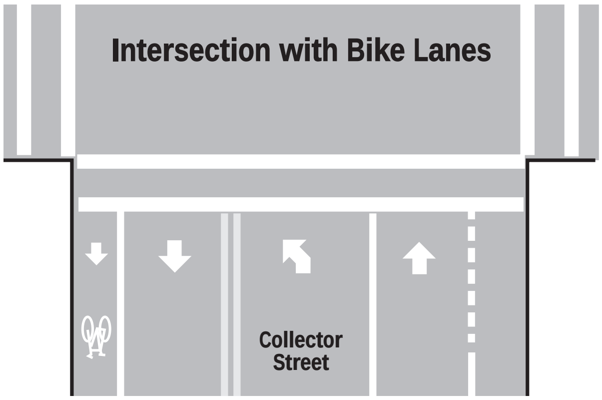
On the whole, collector street intersections are easier for bicyclists to negotiate than are intersections on arterial streets. The limited number of lanes, the lower traffic volumes, and the generally reduced speeds make for a less threatening situation. However, there are several important considerations for serving bicyclists at the various types of collector street intersections and they fall into the following categories: cross street protection, lane channelization, and signalization.

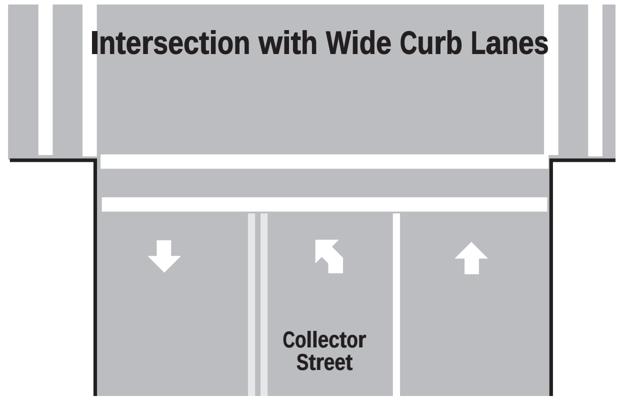
Cross street protection: *For safety and convenience reasons, collector streets should be protected from residential street traffic by stop signs. While this is already done for motoring considerations, it is even more important for bicyclists.*

One of the primary benefits of riding on collector streets is the priority assigned through stop sign installation. In general, traffic on residential streets must stop and yield at collector streets. This benefits motorists on the collector street but it also helps bicyclists riding there. Riding on residential streets, with their frequent stop signs, requires far more starting and stopping. And since bicyclists supply their own power, such starting and stopping is far more taxing for bicyclists than for motorists.



Lane channelization: *This plan recommends two primary options for lane channelization where collector streets meet other collectors or where they meet arterial streets: 1) On designated bicycle routes, preference should be given to striping two bicycle lanes, two through travel lanes, and one left turn lane. 2) On other collector streets, preference should be given to striping two wide curb lanes and one left turn lane. These options are shown below.*

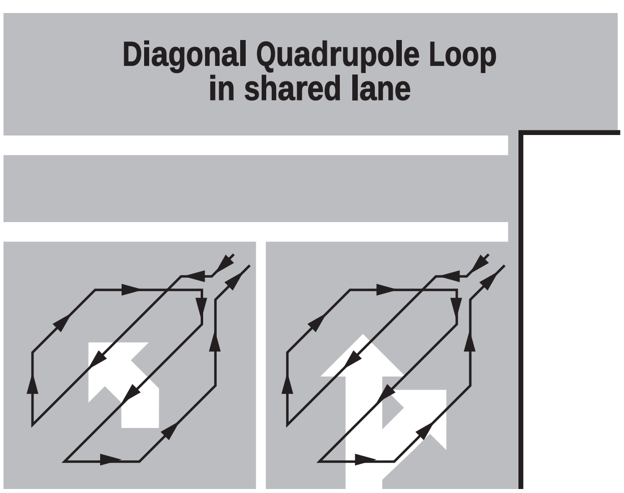


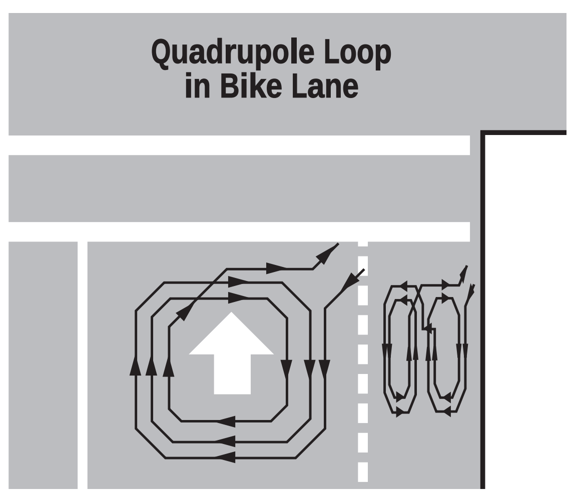


These proposed options share the bicycling benefits discussed earlier under thoroughfare intersection design. Much of the discussion found there, particularly with regard to right-turn lanes, is even more applicable on collector streets. In general, bicyclists fare better without right-turn lanes on collector streets.

Signalization: *As on major thoroughfares, actuated or semi-actuated signals should be made "bicycle-sensitive" through the use of either quadrupole or modified quadrupole loop detectors. If necessary, a pavement marking should show bicyclists the best location for reliable detection. And signal timing should be set to allow bicyclists to clear the intersection safely.*

In order to benefit from the lower traffic volumes of Lubbock's collector streets, bicyclists must be able to cross the major arterial streets. Because of the width and channelization of most arterials, the best way to cross is at a traffic light. While crossing the first half of an arterial and waiting in the center turn lane to cross the second half is an option at unsignalized intersections, it is generally not a very good option. A two-way turn lane, in which turning traffic can come from either direction, provides a relatively risky refuge for waiting bicycle traffic. A traffic signal that stops arterial street traffic is far better. The following diagram shows recommended placement for quadrupole and modified quadrupole detectors at collector street intersections. Modified quadrupole loops should be placed in shared through lanes, as well as shared left-turn lanes.





Maintenance: *As is true with arterial streets, the areas that bicyclists generally use should receive as careful sweeping and repair attention as other parts of the roadway. This is particularly true of any bicycle lanes.*

Maintaining the right edges of arterial streets is important because of the motor vehicle traffic volumes and speeds. However, maintaining the right edges of collector streets is important because of the higher volumes of bicycle traffic expected.

Bicycle lanes, in particular, should not become filled with gravel if they are to be used and if the designated bicycle route system is to thrive and benefit Lubbock's residents.

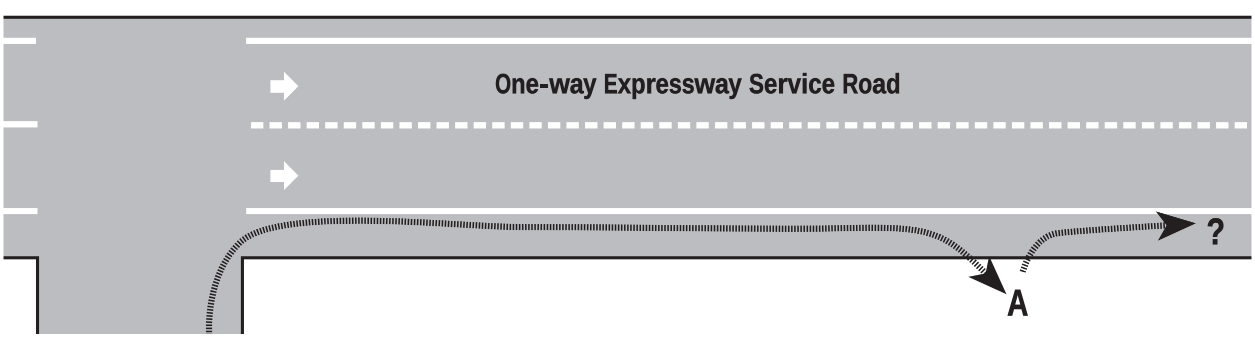
Expressways

Generally speaking, the expressway system is not an optimal environment for bicycling. It acts as a barrier to many local bicycle trips that must, as a result, involve use of the major arterial streets. And riding along either the main lanes or the service roads of an expressway and through the interchanges can often be a challenge.

For Type A riders, the highway itself may be useful for longer-distance trips (e.g., a 5 to 10 mile trip to work or the start for a lengthy training ride in the country). In particular, they will appreciate the E-2 Expressway's paved shoulders and reduced number of intersections; interchanges, however, remain a challenge. On the other hand, service roads provide access to the numerous businesses that may be found there.

For Type B and C riders, there is little benefit to riding on Expressways and many reasons to choose alternative routes. However, these riders, too, may need to get to the businesses located along the service roads. Therefore, the service roads are likely to get some bicycling traffic. One aspect of the service roads that reduces their utility for bicycling, at least in the urban area, is their one-way design. This is generally more troublesome than is the one-way designation of surface streets (e.g., Avenues T and S) because of the lack of a consistent grid in many areas.

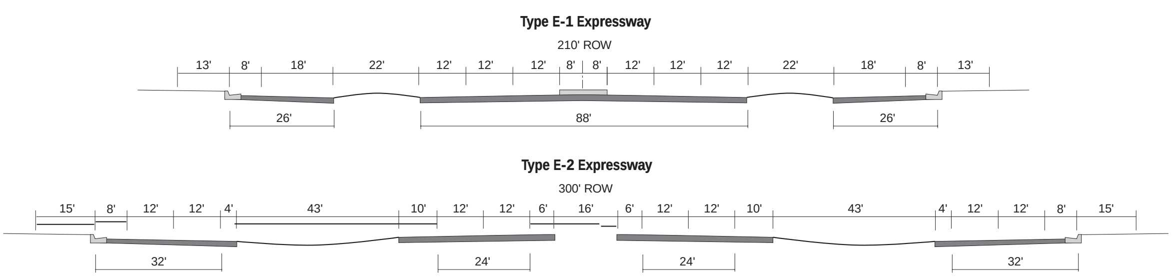
For example, bicyclists wishing to reach a shop at point A (see below) may have to travel a significant distance to get back home, depending on the nearby street system. If they are lucky, they will simply be able to ride a short distance farther on the service road, turn right, and return home on a residential street.



Alternatively, they may have to continue riding to the next interchange, cross the expressway, return on the opposite service road, reach an interchange, cross back over and then make their way home. In the best scenario, the extra distance travelled on the one-way service roads may be relatively short. However, in many cases, it could be substantial. The situation is similar for a bicyclist who lives beyond point A. He or she will need to find the correct point to enter the one-way service road in order to "come back" to A and, then, return home. In either case, the bicyclist may have to choose between adding a substantial distance to his or her trip and riding against traffic. While the former is the lawful choice, the latter may be a common choice. And understandably so; lawful use of the one-way service road system could easily add a mile or more to a short bicycle journey.

Service road shoulder striping: *Striping of shoulders should be done consistently on all expressway service roads, as per the standard design contained in the Transportation Plan (see below). In addition, where possible, on-street parking should be restricted on service roads in order to protect both their utility as breakdown lanes and their benefits for bicyclists.*

Current Standards



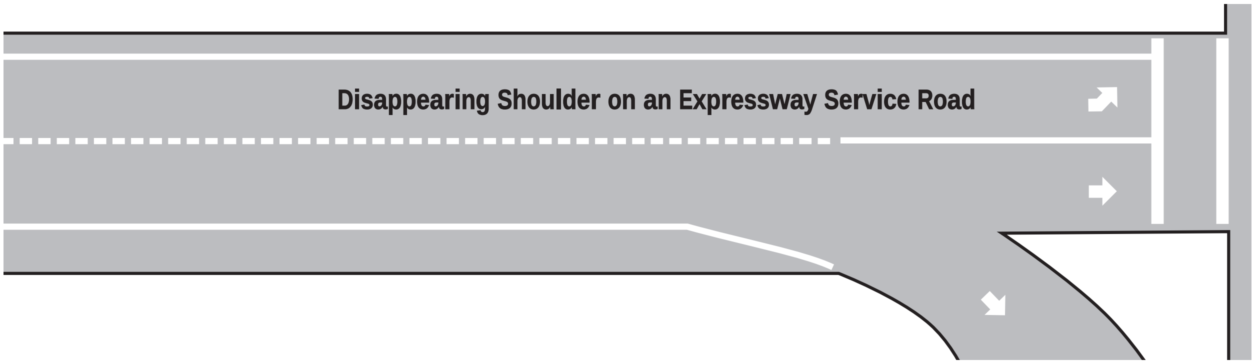
The striped well-paved shoulders on the service roads are their best features. Unfortunately, in some instances, the shoulder striping is missing. This results in an amorphous outside lane with a width of between 20 and 26 feet, depending on the expressway type. On the Type E-1 Expressway, the 26' lane is so wide, some motorists may think it is actually two lanes (but without the stripe) and may use it as such. Shoulder striping helps channelize motor vehicle traffic, reduce driving on shoulders, and provide a recognizable space for bicyclists.

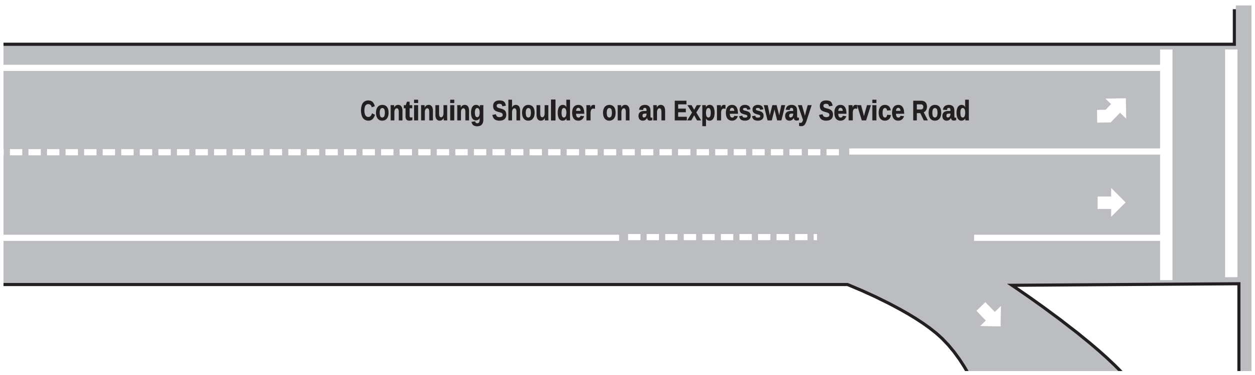
Shoulder continuity: *The extra width provided through shoulder striping should continue up to and through arterial street intersections.*

Another aspect of shoulder consistency has to do with what happens at intersections with major arterials. In many instances, the striped shoulder disappears entirely, to be replaced with a standard width through lane adjacent to the curb and a raised shoulder (see diagram on following page). In addition, at the approach to right-turn lanes, the shoulder stripe is often brought near the right edge of the paved surface and the curb.

Since people are taught generally not to cross a solid lane stripe, bicyclists riding on the shoulder could interpret this type of marking as suggesting they cannot proceed straight. In fact, the message would seem to be that they should hop the curb.

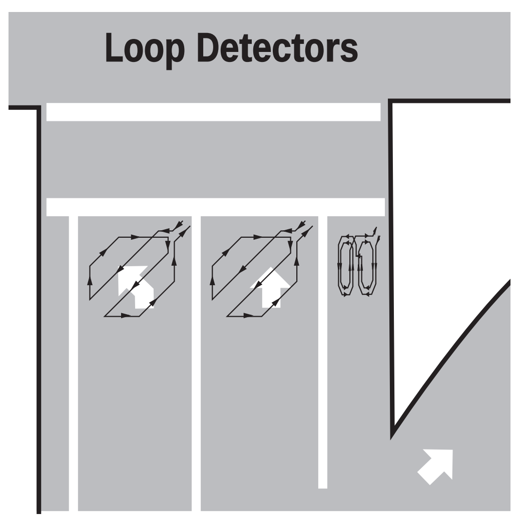
An alternative striping pattern is offered on the following page in order to solve this problem and address the needs of bicycle traffic at service road intersections.





Signalization: *As with arterial and collector street intersections, traffic signals at service road intersections should work for bicyclists. Quadrupole loops should be installed in the shoulder areas while modified quadrupole loops should be installed in the travel lanes. Signal timing should take bicyclists into account.*

Despite their several disadvantages, service roads can be useful in crossing major arterial streets, as long as the signals work for bicyclists. Using the appropriate loop detectors (see diagram at right) is the key.



We suggest using the quadrupole in the shoulder area because bicyclist location can be relatively well predicted there. We also suggest using the modified quadrupole in the other travel lanes, in case the bicyclist may be turning left or in the event that the shoulder is covered with gravel or debris.

In addition, signal timing should be checked. This is particularly important since the intersections involve crossing high volume and, possibly, high speed arterial street traffic. Being caught in such an intersection when the light changes could lead to very serious consequences.

Maintenance: *As is true with the surface street system, the shoulders on service roads should be routinely swept and maintained.*

If the shoulders are to be useful, they will need routine attention to maintenance concerns. Sweeping away debris and patching with care should be done on an “as needed” basis.

Residential streets

Residential streets, for the most part, do not serve through bicycle traffic well. Lacking the protected intersections found on collector and arterial streets, they typically require bicyclists to stop many times per mile. They meet collectors and arterials at stop signs (or not at all), and their often curvilinear nature can add miles to a bicyclist's trip.

However, residential streets are much more suitable for short-distance local bicycle trips: the quick ride to the park or to a friend's house. In some cases, neighborhood shops can also be reached using residential streets. According to the Nationwide Personal Transportation Survey, these are the most common bicycling trips—far more common than a bicycle journey to work. And they are the types of trips most often taken by Type B and C bicyclists: the less experienced adult riders and the child on a bike.

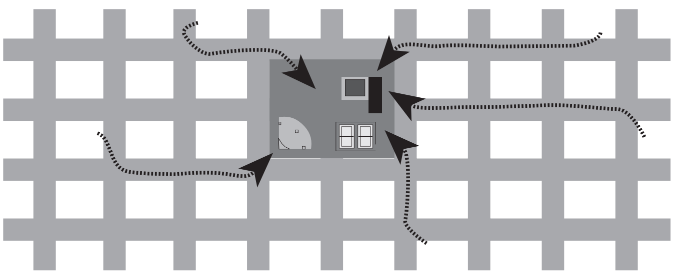
The network: *Wherever possible, bicyclists should be able to use residential streets for local trips. Block lengths should, ideally, be short enough to foster efficient bicycle travel to a variety of nearby destinations. Commercial and recreational uses near residential areas should be designed to foster safe non-motorized access without requiring bicyclists to use arterial streets.*

A growing body of research suggests that bicycle-friendly residential areas have certain important characteristics in common. One is a relatively fine-grained internal transportation network. Keeping in mind the short distances involved in most bicycle trips, it is easy to see that a neighborhood street system that adds to the length of a trip could easily discourage bicycling. A grid, like that found east and south of Texas Tech, is one way to foster bicycling, although not the only one. At the opposite end of the spectrum are neighborhoods with very long blocks and few connecting cross streets. The diagram on the following page shows the difference that long blocks can make in an otherwise short bicycling trip. On the other hand, a regular grid can encourage through traffic in a neighborhood. This is most likely to happen when the nearby arterial streets are taxed beyond their capacities and the residential streets are attractive alternatives. At the recent Goals for Lubbock hearing, for example, through traffic concerns were raised by a representative of the North Overton Neighborhood Association.

One improvement on a long block-style network is to provide non-motorized connecting paths that allow bicyclists and pedestrians to get around the neighborhood more easily than motorists can. Similarly, cul de sacs can be built with non-motorized connections. Using short sections of paths in this manner, an otherwise bicycle-unfriendly design can be substantially improved. These design approaches are most easily applied in developing areas. Existing areas, with houses, streets, and utilities in place are generally much harder to retrofit.

Access to nearby commercial and recreational areas is another key ingredient of a bicycle-friendly neighborhood. Many parts of Lubbock include parks within the neighborhoods and this makes it easy for people of all skill levels to ride to a recreational site. Continuing this pattern is an important part of making Lubbock even better for short bicycling trips.

Parks within neighborhoods encourage short bike trips

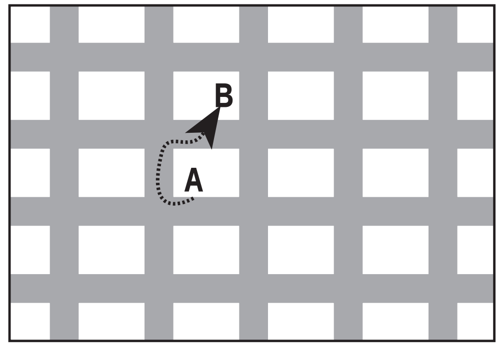


Commercial uses are equally important destinations for bicyclists, although some types are more important than others. Neighborhood-oriented shops like corner grocery stores, laundromats, and small cafes are sometimes found in older neighborhoods and these encourage bicycle trips.

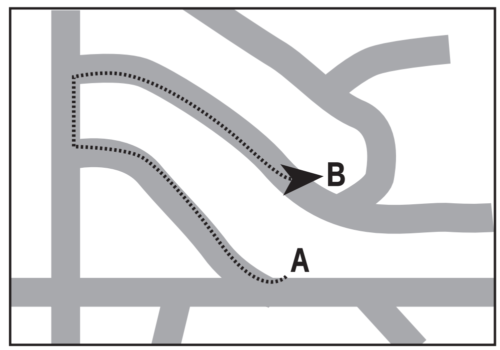
Unlike neighborhood parks, neighborhood commercial is relatively rare in Lubbock. One notable exception is the area near 26th St. and Boston Ave. The shops found there can be reached largely on residential streets, a boon for Type B and C bicyclists living nearby.

In newer parts of town, commercial uses are typically restricted to the arterial streets, in general, and to arterial street intersections, in particular. This pattern makes it more difficult for Type B and C bicyclists to reach shops without riding on major roads. However, in some cases access roads have been built into the neighborhoods. This approach, while perhaps not ideal, does help accomplish a desirable end: bicycle access to shops.

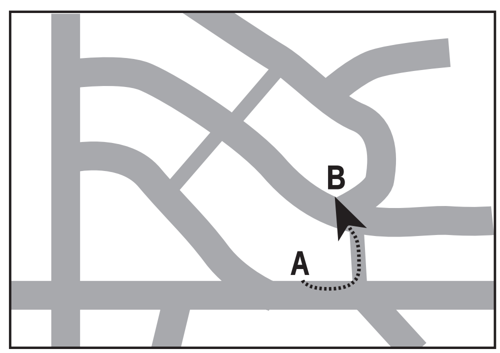
Fine-grained street grid



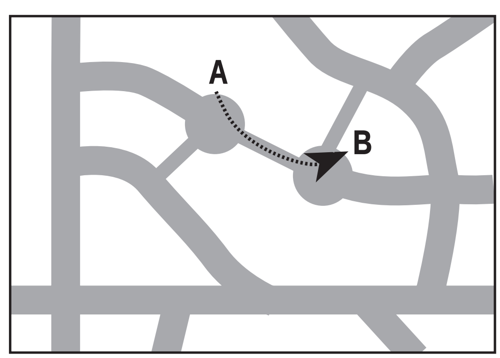
Long block street network



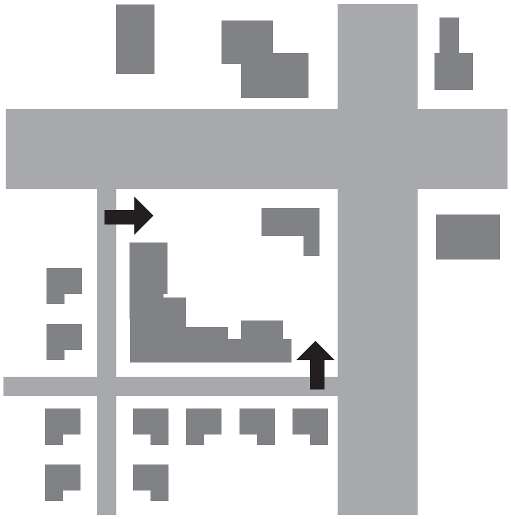
Modified long block network



Paths through cul de sacs



To facilitate non-motorized neighborhood access to commercial areas, it is also helpful to make sure there are entrances on side streets (see below).



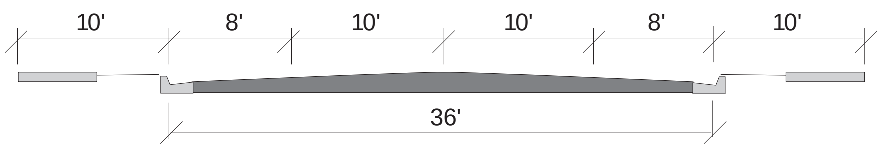
Typical cross sections

Given the typical traffic volumes found on Lubbock's residential streets, the current design standards are generally quite acceptable. With minimal through motor vehicle traffic, few bicyclists of any type will feel threatened. And motorists will easily be able to move left to pass a bicyclist, despite the narrow lane widths. The standards are reproduced below.

Current Standard

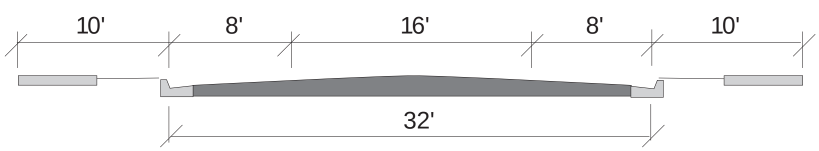
Type R-1 Residential

56' ROW



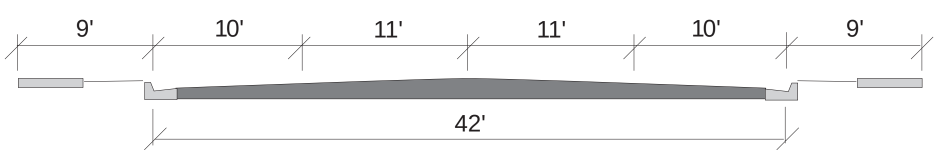
Type R-1A Residential

52' ROW



Type R-2 Residential

60' ROW



Intersection Design

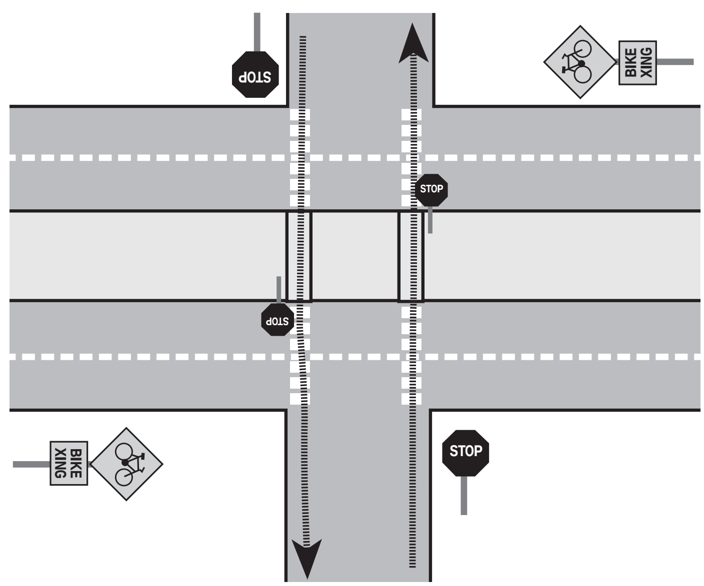
For the most part, residential street intersection design is not an issue for bicyclists. The one area of potential conflict concerns where residential streets meet major arterials. The primary issue is how to get across an arterial street from a residential street. Depending on the volume, speed, and cross section of the arterial, this can be a difficult task. While signalizing all such intersections is not a viable option, there are some solutions.

Arterial street crossings: *In order to make it easier for bicyclists to cross arterial streets, residential streets should feed into collector streets in such a way as to encourage crossing at these locations. In addition, raised medians should be carefully considered, particularly in areas with potential bicycle and pedestrian traffic. Such medians can provide protection for non-motorized travelers, allowing them to cross one half of the roadway at a time in relative safety. For this reason, consideration should be given to providing curb cuts and crossings for bicyclists at key locations.*

Generally, crossing an arterial street from a residential street is difficult for bicyclists. With roads designed to the T-1 or T-2 Thoroughfare standards, a bicyclist will have to judge traffic coming at relatively high speed in both directions in four or six lanes and, possibly approaching in the left turn lane from either direction. One strategy is to cross to the median turn lane when the first lanes are clear and then wait for traffic to clear in the remaining lanes. However, because of potential conflicts with left turning traffic, this approach is risky at best. As a result, the arterial network forms something of a barrier, particularly for Type B and C bicyclists.

The collector street network is one of the primary means of solving this problem. While in some ways an imperfect solution, in many locations the collector network does allow bicyclists to cross with signal protection using streets that have relatively light traffic. The primary limitation, as discussed previously, is the lack of continuity of the collector network.

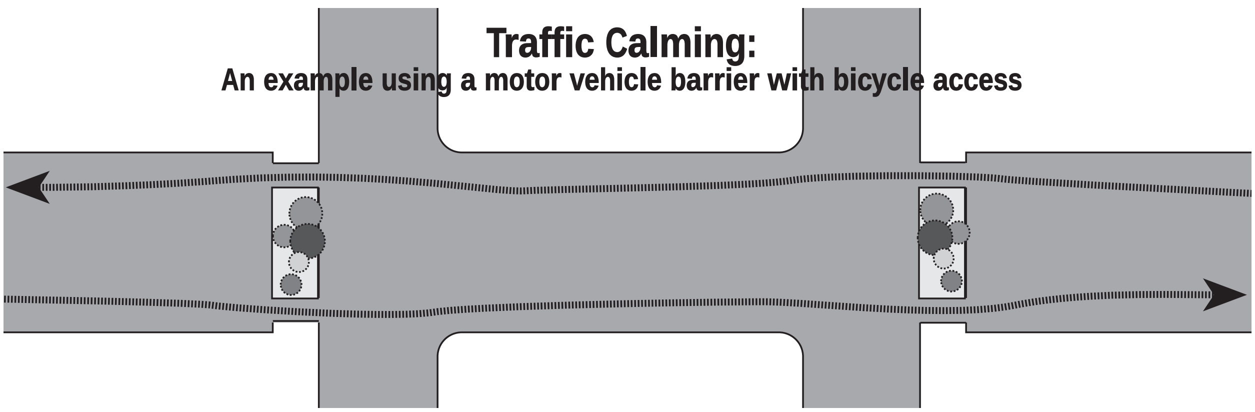
Another way to help bicyclists get across arterial streets is to make use of the raised median. While not every arterial has one, where they do exist, they should be exploited. One example is the section of Indiana Avenue between 19th St. and 34th St. In particular, the intersection of Indiana Ave. and 26th St. could be considered an excellent candidate for such a treatment (see diagram at right for example design).



Traffic calming: *Whenever neighborhood motor vehicle access is constrained for reasons of safety—through traffic calming measures like barriers, chicanes, choke points, or speed tables—bicycle access should be provided for.*

Lubbock has several examples of "traffic calming" measures in its residential neighborhoods. Near Tech Terrace Park, for instance, there are barriers that create several dead end streets. And many neighborhoods have cul de sac streets that end just short of the adjacent arterial streets. Several examples can be found along 82nd St. between Memphis Ave. and Indiana Ave.

In order to preserve residential street utility for bicyclists, barriers within the neighborhood should be designed to allow bicycle traffic to get through while restricting motor vehicle access. With barriers, for instance, this can be accomplished through the use of 5'-wide breaks for bicycle access. Note that the width, as specified in the AASHTO Guide for the Development of Bicycle Facilities, is intended to allow for the use of adult tricycles and bicycle trailers. The diagram below shows a generalized plan for barriers.



While it would be tempting to develop crossings at cul de sacs adjacent to arterial streets, as a general policy, it would not be prudent to do so. Without some form of crossing protection, such locations present unacceptable dangers for the majority of bicyclists and, given the typical cross sections and traffic volumes found on Lubbock's thoroughfares, crossing at such locations would be difficult as well.

Maintenance: *Routine maintenance of residential streets should consider bicyclists' needs. In particular, any bicycle-only gaps in barriers or short cut paths should be inspected and swept if necessary. Otherwise, general street maintenance practices should suffice.*

On most residential streets, traffic volumes are low enough that normal roadside debris presents a relatively insignificant hazard. Unlike on arterial streets, bicyclists can move around obstacles with little threat of being hit from behind.

Farm-to-market roads and rural highways

Farm to market roads and other rural roads in the Lubbock area provide key links for long-distance bicyclists, as well as for rural residents using the bicycle for short trips to nearby homes, schools, and other destinations. While bicycle traffic volumes are likely to be low, the high speed nature of rural roads makes it likely that any crash involving a motor vehicle and a bicycle will result in either serious injury or death.

Rural road shoulders: *Wherever possible, smoothly paved shoulders should be provided on both sides of rural roads and highways. At a minimum, 4 feet per side should be provided.*

Probably the most important feature for bicyclists using rural roads is a smoothly paved shoulder. While not particularly important to bicyclists on very lightly traveled FM roads, shoulders can become quite significant as both motor vehicle volumes and the percentage of truck traffic climb. On high volume rural roads, smoothly paved shoulders give the bicyclist a cushion of safety when passed by high speed traffic. This cushion not only reduces the potential for being hit from behind by motor vehicles; it also reduces the "wind blast" effect of passing trucks. As many bicyclists know, a passing truck first pushes the bicyclist away toward the side of the road. As it passes, the bicyclist can easily be pulled into the roadway, directly into the path of a following motor vehicle.

Fortunately, paved shoulders do more than help bicyclists. Studies have shown that providing a paved shoulder is a cost-effective means of reducing both motor vehicle run-off-the-road crashes and maintenance costs. For instance, one study conducted by the Texas Transportation Institute found that "wide paved shoulders are cost beneficial for AADT's above 1,500 vehicles per day" (Woods, Rollins, & Crane, 1989). Factors considered included "accidents, pavement edge maintenance, paved shoulder surface maintenance, tort liability losses, and travel time."

Planned projects

The best time to incorporate bicycle considerations into a roadway design is early in the planning and design process. The worst time is after construction. The *Lubbock Metropolitan Transportation Plan: 2015* includes a variety of projects that will affect the future of bicycling in the Lubbock Metropolitan Area. These projects present a golden opportunity to affect significant change.

Routine consideration: *As a general policy, this plan suggests incorporating consideration for bicyclists' needs into the transportation engineering and planning process. During development, each project should be looked at to determine whether potentially useful bicycle improvements may be included.*

During the life of the Transportation Plan, many projects will be initiated and many will be completed. The Plan includes many millions of dollars worth of transportation improvements. In order to get ahead of the curve, it is important to consider bicyclists' needs as part of the planning and design process in each of these projects.

Some projects will undoubtedly not lend themselves to the incorporation of bicycle features. However, many will and by including such things as widened outside lanes, striped bicycle lanes, bicycle-sensitive traffic signals, or shoulders on important overpasses, it is possible to gradually make the Lubbock Metropolitan Area more and more bicycle-friendly.

Management Systems

One of the requirements of ISTEA is the development of a set of management and monitoring systems. Included in the list required are:

Pavement Management System (PMS)
Bridge Management System (BMS)
Highway Safety Management System (SMS)
Traffic Congestion Management System (CMS)
Public Transportation Facilities and Equipment Management System (PTMS)
Intermodal Facilities and Systems Management System (IMS)
Traffic Monitoring System for Highways (TMS/H)

The intent of requiring these management and monitoring systems is to provide "a systematic process, designed to assist decision-makers in selecting cost-effective strategies/actions to improve the efficiency and safety of, and protect the investment in, the nation's transportation infrastructure" (23 CFR 500.103). The results of the management and monitoring systems are intended to be "considered in the development of metropolitan and statewide transportation plans and improvement programs and in making project selection decisions…"

The potential importance of management and monitoring systems in future planning for bicycle use can hardly be overstated. Historically, little has been known about bicycle use and bicycling conditions in virtually all U.S. communities, including Lubbock. As a result, few transportation planners know how much bicycling is done, who does it and for what purposes, where it happens, and what conditions impact either the amount or the safety of bicycling in their communities. While the management and monitoring systems cannot provide all the answers, they can add to our base of knowledge and, as a result, help us make informed decisions.

The following are recommendations for bicycle-related data that could be collected as part of the routine management and monitoring system procedures. Some of these may already be part of existing procedures but this should serve as a bicycle-friendly checklist.

Pavement Management System:

- *Width of outside travel lane, bike lane, and shoulder (if any)*
- *Condition of outside travel lane, bike lane, and shoulder (if any)*
- *Condition of the gutter pan and its joint with the roadway surface*

Bridge Management System:

- *Condition and type of deck surface*
- *Condition of expansion joints (if any)*
- *Width and condition of outside travel lane, bike lane, and shoulder (if any)*

Highway Safety Management System:

- *Reported bicycle crashes, their severity, types, and causative factors*
- *Age, sex, and other characteristics of bicyclist (and motorist, if any)*
- *Locations with multiple reported bicycle crashes*
- *Emergency room data on bicycle crashes and estimates of unreported serious crashes*

Traffic Congestion Management System:

- *Levels of Single Occupant Vehicle (SOV) travel*
- *Typical motor vehicle trip distances, purposes, and per household trip numbers for different parts of town*
- *Potential for converting certain types of SOV trips to bicycle trips*
- *Current levels, distances, purposes of bicycling trips for residents of different parts of town*

Public Transportation Management System:

- *Typical distances from users' homes to the nearest transit stop*
- *Bicycle ownership among transit users*
- *Potential for attracting new users through combined bus/bike programs*

Intermodal Facilities and Systems Management System:

- *Linkages between bicycle mode and other modes*
- *Situations where accommodations for other modes impacts potential for bicycle mode*

Traffic Monitoring System for Highways:

- *Levels of Single Occupant Vehicle (SOV) travel on Lubbock urbanized area highways*
- *Origins and destinations for trips using different parts of the highway system*
- *Vehicle characteristics for different parts of the highway system*

Stage 4: Lubbock Bicycle System

Introduction

The key element of the Lubbock Bicycle System is a basic network of through bicycling routes that reach most popular destinations. The proposed routes rely primarily on the collector street system. Where elements of this system are missing, alternative routes, sometimes using residential streets, occasionally using arterial streets, have been chosen. The following four main factors have been balanced in choosing potential routes:

> *Directness:* Streets that give bicyclists a direct route through a particular area were generally chosen over those that require bicyclists to follow a twisting and turning route. The more a route winds back and forth, the more distance it adds to any particular trip and the less likely it is to benefit bicyclists, aside from those on purely recreational journeys.
>
> *Continuity:* Except for special circumstances, streets that continue for several miles or more were generally preferred over streets that end after a short distance. In general, the longer a route is, the more homes of potential users and popular destinations it is likely to pass.
>
> *Traffic volumes:* For the most part, the highest volume streets were avoided. The typical geometrics of many of these thoroughfares make them unpleasant places to ride. Even when modified with special bicycle accommodations (e.g., bicycle lanes), high traffic volumes still present obstacles to—and raise the fears of—Types B and C bicyclists.
>
> *Advantageous crossings:* Streets that cross major arterial streets at traffic signals were preferred over streets that do not. Where potential routes cross arterials with raised medians, the most advantageous crossing, preferably without special turn or merge lanes within the median, was generally chosen. While relatively rare, low volume streets that cross expressways were preferred over either arterial streets that cross expressways or low volume streets that end at expressways. In addition, streets with few facing stop signs were generally preferred over streets with many facing stop signs.

One of the major factors discussed earlier in this report is the way in which expressways (e.g., South Loop 289) form barriers to bicycle travel. Unfortunately, in some areas there are no streets with reasonably low traffic volumes and/or adequate geometrics that cross these expressways. In these instances, we recommend both a short-term solution, a small-scale widening project through one of the Loop crossings, and a longer-term solution: the construction of separate non-motorized crossings that connect to lower volume roads. While such crossings may at first glance seem somewhat expensive, in fact they typically cost a small fraction of a similar facility for motor vehicles. This plan recommends constructing between a number such crossings in Lubbock over the life of this 20-year plan. The actual number would depend on the final details of the proposed East-West Freeway and the extent of future growth in the southwest section of the community.

The plan also includes recommendations for future trail development to complement the on-road network, to take advantage of off-road opportunities, and to encourage bicycling to recreational destinations. The primary component of the trail portion of the plan is the Canyon Lakes area, where unique topography and natural features create an excellent opportunity for bicycling.

The sections on the following pages comprise the major components of the recommended community-wide bicycle route network. These should be complemented by the policies and programs described elsewhere in this report.

Signed routes

In many cases, getting around Lubbock by bicycle is relatively easy. It's often a matter of knowing the best way to get from point A to point B. For someone used to driving around town, the first and seemingly most logical route choice is to use the same streets one takes in a car. However, for many bicyclists this is a bad choice. A few trips down certain stretches of 19th, 34th, University, Indiana, or Quaker will leave the novice bicyclist wondering why he or she thought bicycling was a good idea at all.

Improving these streets for bicyclists is one option and the Policy section of this report suggests some basic safety modifications that can and should be made over time. However, the main thrust of this plan is to show bicyclists how to get around without, for the most part, resorting to busy and relatively narrow arterials. Hence, the importance of signed routes.

Historically, route signing was a simply a matter of putting up lots of green "bike route" signs. The D11-1 plate, found in Part IX of the Manual on Uniform Traffic Control Devices (MUTCD), was the recommended choice (see figure at right). However, on its own, this sign does little for bicyclists.

One common comment is that the "bike route" sign alone is as informative as a sign that says "street." It does not tell you which route you are on, where it goes, or how far away its destinations are. Hence, the importance of subplates with auxiliary messages in making a bike route useful. However, at the intersection of several routes, three or four subplates may easily clutter the sign post and add to installation expense.

In this report, we offer an alternative and recommend using several modifications of the standard bike route sign. In the decision point sign, we suggest combining on one plate the "bike route" message with destination and distance information (see illustration at right). This sign should be used at intersections of routes. Along a route, we suggest the "standard sign" shown at the bottom right. At certain mile intervals, signs should give distance information as shown. However, most signs could just carry the destination and arrow.

While the amount of space for destinational text on these signs may be considered too small, by normal traffic sign standards, bicyclists generally travel both more slowly and closer to the curb than is typical of motorists. For bicyclists, 2" letters for destinations will be sufficiently readable; for motorists, the "Bike Route" message, alone, is important to discern.

D11-1
24" x 18"

D1-1b(L)
24" x 6"

Decision
Point Sign
24" x 24"

Standard
Sign
12" x 24"

Since these exact signs are not in the MUTCD, permission may be needed to use them on an experimental basis. At the same time, the concept is a logical extension of the standard signage approach. And, since the City of Lubbock Traffic Engineering Department is currently experimenting with a high visibility pedestrian crossing sign, it is expected that they will have little trouble complying with any necessary Federal regulations.

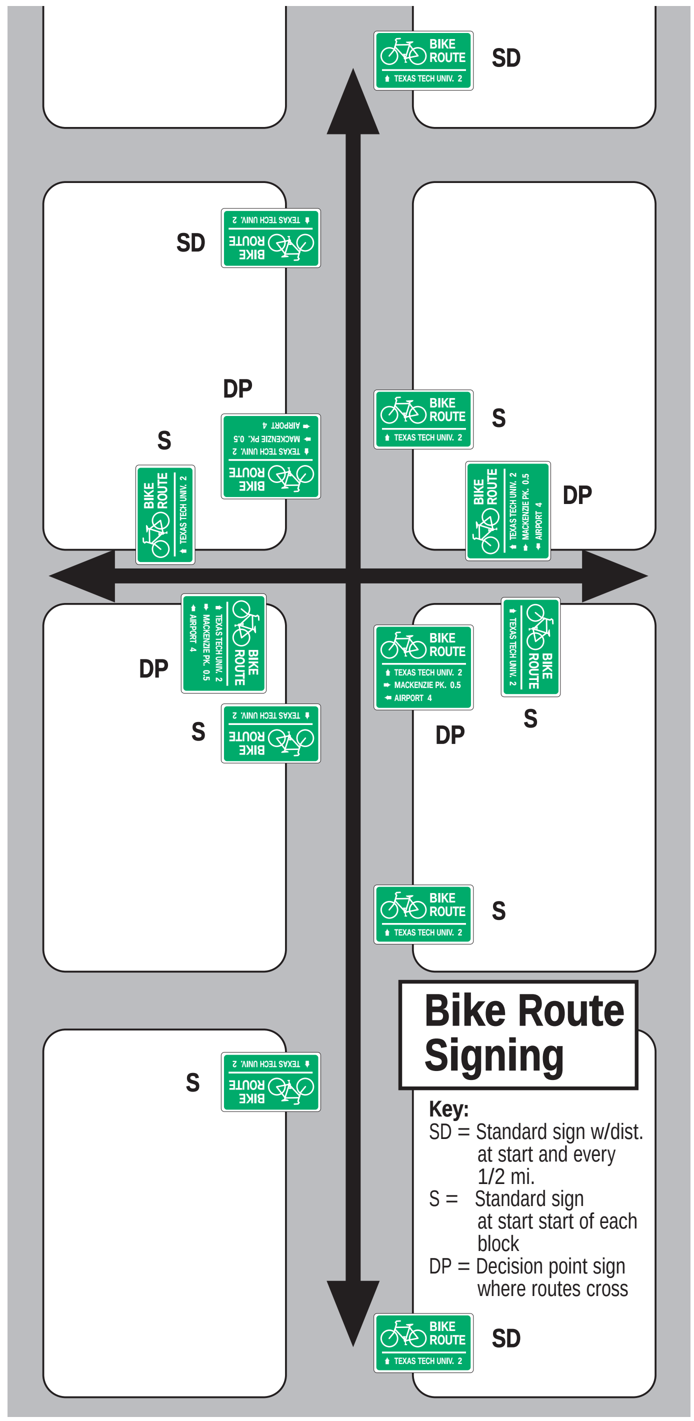
Signing approach: Signing should be done in a logical and consistent manner. First, there should be a standard sign at the start of a route. It should give the primary destination and distance. At the start of each subsequent block, there should be an additional sign (typically, a standard sign with no distance information).

At 1/2 mile intervals, the standard sign should include the distance to the route's primary destination. Where two routes cross, there should be a decision point sign on each route's approach to the intersection.

The decision point sign should include the primary destination of each route (in each direction if necessary), an arrow for each, and distance information. The diagram at right gives a compressed view of the general pattern for signing.

Experience in other communities suggests that route signing similar to that shown here costs between $50 per sign and $75 per sign, installed.

Additional maintenance costs due to vandalism or sign theft tends to be highest when the system is new and it falls over time to become negligible after several years. However, the generic look proposed for these signs, as compared to the custom graphic plates used in some cities, should reduce their attractiveness for sign collectors.



The network: The map accompanying this report gives the recommended bike route network. All together, there are approximately 121 miles of proposed bicycle routes, phased over the life of this plan.

courtesy of the Seattle Bicycle Program

In order to facilitate orderly implementation of the system, the proposed routes shown on the map are coded according to when they should be developed. The first phase includes approximately 15 miles of route. The second phase includes approximately 41 additional miles of route. The third phase includes about another 65 miles.

Within six to ten years, the entire route network should be signed. It is expected that experience will guide phases two and three of the project. As the streetscape changes with new highway projects, as agency personnel evaluate results, and as bicyclists gain experience with the growing network, it is likely that some fine tuning of route recommendations will occur. This should be expected and the process should be facilitated. The network should not be a static artifact but, rather, a growing and increasingly more useful system.

Costs for signing will be approximately $1600 per mile, based on the previously-mentioned cost of $50 per sign installed and roughly 32 signs per mile. An additional $100 per mile will cover marking loop detector locations at demand-actuated intersections. As a result, phase 1 of the route system will cost approximately $26,000. The second phase will be roughly $69,000; and the third and final phase will cost approximately $110,000.

Two categories of additional route candidates are also shown. The first includes routes that should be built when certain transportation projects contained in the Transportation Plan are completed. For instance, North Boston should become a designated bicycle route once the proposed East-West Freeway is built. Currently, the route would have to go through a private parking lot to reach 4th St. Similarly, Frankford Avenue should be designated once the various construction projects on that route have been completed. None of these projects are included in the phasing since their implementation depends on other projects. A second category of additional route candidates includes those that should be implemented as the community grows to encompass the relevant areas.

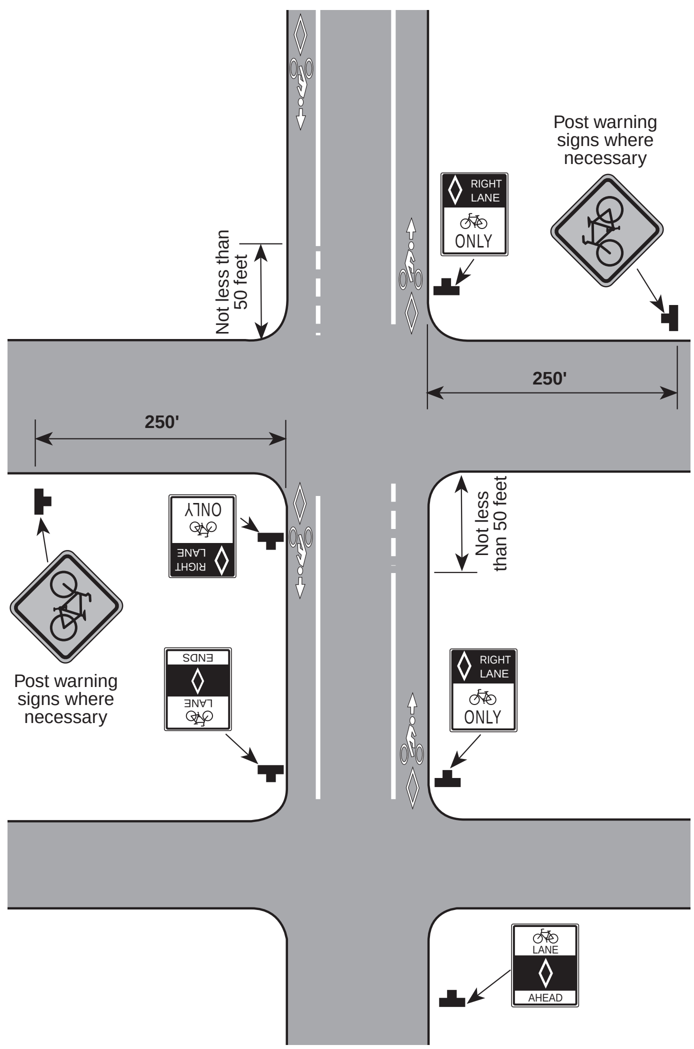
In addition, it is important to note that proposed routes on the Texas Tech campus will need to be reviewed for approval by all appropriate campus officials. Further, the utility of several of these suggested campus routes depends on the construction of the proposed East-West Freeway.

Other elements of the proposed route system, including striped bicycle lanes, grade separations, and trail options, are discussed in subsequent parts of this section.

Striped lanes

We recommend that a portion of the bicycle route network be striped with bicycle lanes. Generally speaking, bicycle lanes are proposed for use on the busier bicycle routes, typically found on collector streets. Striping lanes on quiet residential streets would have little utility, whereas striping collector streets will help draw bicyclists to these routes and give many riders a heightened sense of security. Approximately 40 miles of the bike route network is proposed for bicycle lane striping. The map accompanying this report shows the recommended candidate streets.

Lane designation approach: In addition to installing bike route signs, providing bicycle lanes requires painting lane stripes and pavement markings and installing regulatory signs. The diagram at right gives a simplified overview of what is needed. Both the AASHTO Guide for the Development of Bicycle Facilities and the Manual on Uniform Traffic Control Devices should be consulted for details.

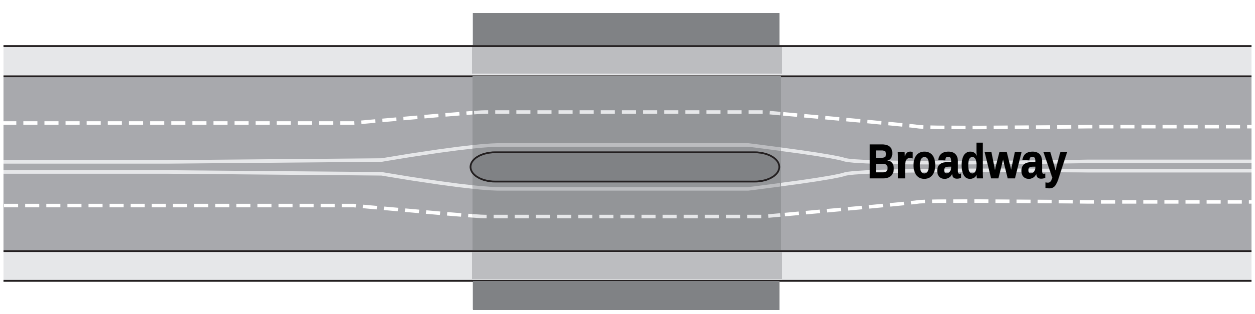


Estimates developed for the Lubbock Bicycle Plan suggest that bicycle lane development will require approximately $2640 per mile for striping (two sides), $800 per mile for pavement markings, and $1056 per mile for regulatory signs. The total per mile cost is approximately $4500. To designate the entire 40 miles will cost approximately $212,000.

In addition, maintaining the lane system must be considered. While striping will need to be reapplied as often as other roadway striping, pavement markings may last somewhat longer, due to reduced wear and tear from traffic. Signs should, once their uniqueness wears off, be subject to relatively little vandalism or theft.

The network: As with bike route designation, we suggest taking a phased approach to providing bicycle lanes in Lubbock. The three primary phases identified on the following map coincide with the three phases for bike route development. In the first phase, 15 miles are proposed for designation. Costs for this phase are estimated at $94,000. In the second phase, an additional 9 miles are identified for striping at a cost of approximately $48,000. In the third phase, the remaining approximately 13 miles are suggested for striping at a cost of roughly $70,000.

Broadway: One candidate street for bike lanes, Broadway, requires special attention in several locations east of Downtown. First, as the street climbs up from the park area towards Martin Luther King Blvd., it goes through a relatively narrow cut. In all likelihood, a small amount of construction will be needed in this section to add shoulders and make space for bike lanes. Second, at the location where Broadway goes under Interstate 27 and the Atcheson, Topeka, and Santa Fe Railway, the roadway becomes relatively narrow, with two travel lanes and a sidewalk on each side of a center support. Without major reconstruction of this new facility (the best solution for accommodating bicyclists), there is little that can be done to add extra space for bike lanes. Given the comparatively low traffic volumes on this stretch of Broadway, however, several inexpensive improvements can help. First, warning signs similar to that shown at right can be installed on either approach to the underpass. Second, as the roadway leaves the structure, the lane striping should be marginally offset to create a widened curb lane. (See diagram below). While this will not create the ultimate bicycle facility, it should work to improve the situation and render the rest of the facility more useful.



Martin Luther King Blvd: Another location that requires special attention is the railroad overpass on Martin Luther King Blvd. near 34th St. While much of Martin Luther King Blvd. could be, with little modification, be very good for bicycling, this overpass is particularly narrow, somewhat steep, and has relatively poor sight distance. This plan recommends two solutions. First, the proposed bike route system diverts around the location. However, the diversion adds distance to a bicycle trip and may not attract riders whose destination is straight down Martin Luther King Blvd. For this reason, the approaches to the overpass should be signed with warning signs and a message similar to that suggested for Broadway. Ultimately, it would be best to provide a structure with adequate width. Or, if at some time the rail lines are abandoned, the structure could be removed and replaced with a reasonably wide surface street.

South Loop 289: While this plan suggests constructing a South Loop 289 overpass at Memphis, such a project will require assembling a funding proposal for submission to the Texas Department of Transportation, as part of the support for Lubbock's transportation enhancement activities. As a result, the project may, in fact, be more of a long-term goal than a short-term objective. At the request of the Lubbock Metropolitan Planning Organization, this plan includes a shorter-term project using an existing crossing. The following suggestion appears to be the most realistic; however, it will require significantly more detailed planning and design than can be conducted within the scope of the Bicycle Plan development process.

The recommendation included in this plan is to focus on developing a crossing at Quaker. Quaker appears to be the best candidate street, in that there is sufficient space between the supports for the overpass and the lane configurations do not appear overly complex. Several other candidate streets, especially in the Southwest, do not have this extra space and so}e are bounded by more intense commercial development. While Quaker has its drawbacks, it appears to be the most suitable site. The design approach recommended here is to widen the roadway through the interchange, adding five feet of paving to each side. This space should be striped as a bike lane. In addition, the lane markings on Quaker as it approaches the underpass should be modified to continue the bike lanes until they reach the nearest crossing bicycle routes. This may require modifications or, at some locations, elimination of the center turn lane.

Two alternative designs were briefly considered and rejected. First, the possibility of building an off-road trail on one side of Quaker would lead to far too many crossing conflicts at intersections. In addition, the AASHTO Guide strongly recommends against such approach. And the trail would either dump bicyclists onto the one-way service roads or continue past several significant commercial driveways. Second, the possibility of using Quaker's roadway only through the underpass and then routing bicyclists onto the service roads suffers from similar problems. To make such a design useful, it would likely require two-way bicycle use on the one-way service roads; such use is a clear violation of Texas traffic law. In addition, one direction of bicycle traffic on the service roads would likely find themselves having to cross on- and off-ramp traffic, a serious hazard.

While the recommended approach is far from perfect, it at least conforms with AASHTO Guide recommendations and provides a reasonably safe means for bicyclists to cross South Loop 289.

Future bike lanes: Additional bike lane candidates are also shown on the map. One category includes bicycle lanes that should be designated when certain transportation projects contained in the Transportation Plan are completed. For instance, the striping of Memphis Avenue between 19th and 26th Streets should be accomplished when the Memphis Avenue crossing of the proposed East-West Freeway is completed. Similarly, Frankford Avenue should be striped once the various construction projects on that route have been completed. None of these projects are included in the bike lane phasing since their implementation depends on other projects. Similarly, several other possible candidate streets for bike lanes are shown on the map. These should be implemented as the community grows to encompass the relevant areas.

Finally,as is the case with bicycle routes discussed previously, proposed bike lanes on the Texas Tech campus will need to be reviewed for approval by all appropriate campus officials. Several of these lane projects are contingent on construction of the proposed East-West Freeway.

Grade separations

One of the major features of Lubbock's bicycling environment is the presence of several important barriers. As discussed on pages 15 through 18, such barriers can reduce the amount of bicycling done in a community and keep bicyclists from reaching important destinations. In many cases, the only alternative involves riding on busy and relatively narrow arterial streets. For the average bicyclist, this is no alternative at all.

At the present time, the two most important barriers in Lubbock are Loop 289 and Interstate 27. Many bicyclists identified these—especially the Loop—as major impediments to their use of the bicycle in getting around Lubbock. If and when the proposed East-West Freeway is built, it, too, may form a relatively impermeable barrier to bicycling trips, unless carefully implemented.

In order to break existing barriers and keep potential future barriers from barring bicycle access, we propose constructing a limited number of bicycle/pedestrian grade separated crossings in key parts of town over the next 20 years. The potential sites for these crossings have been carefully chosen in order to link with important parts of the bicycle route system.

Separation approach: The approach taken, in any particular case, depends on several factors. First, in locating the crossing, sites were chosen that form key links to the proposed bicycle route system. An excellent crossing will do little good if it does not connect with the greater network. Where possible, locations on collector streets were chosen.

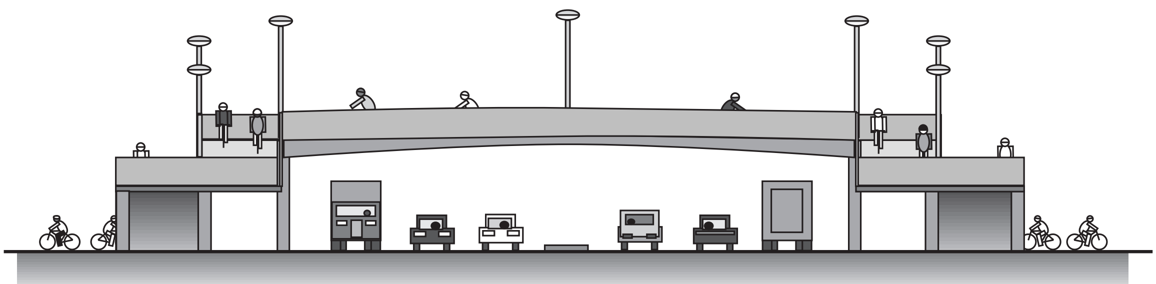
Next, whether a proposed structure goes over or under the roadway being crossed depends on the topography and the road's geometrics. If the roadway is elevated, with respect to the surrounding terrain, then an underpass would likely be the preferred option. If the roadway is at the same grade as nearby streets and property, an overpass would probably work best. If the roadway is below grade, then an overpass would be the only logical solution.

All other factors being equal, an underpass has the benefit of letting bicyclists descend first and then ascend. This allows them to simply lose momentum on the uphill section that they have gained virtually for free on the downhill. On the other hand, an overpass that takes bicyclists above grade requires them to first climb and then come back down; as a result, they must expend energy to get to the top and then get a "free ride" back down. It is also true that underpasses have the potential of being dark, dirty, and worrisome places if they are not sufficiently wide, well-lit, and well-maintained; overpasses, on the other hand, are often light and airy and are typically easy to monitor from a variety of locations. They may, however, offer vandals an opportunity to drop objects onto the roadway below.

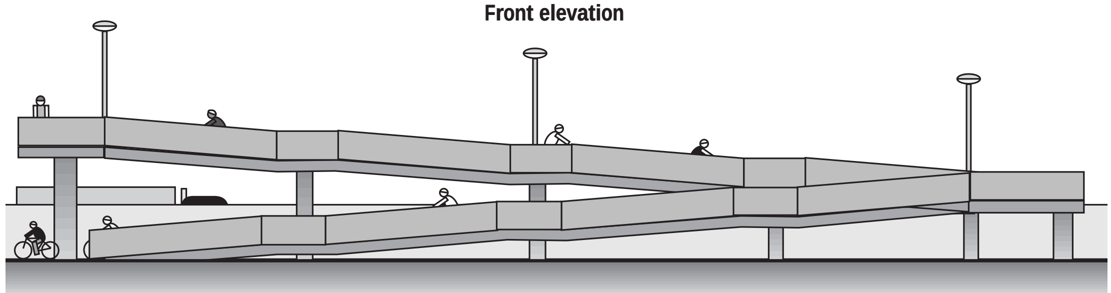
In choosing the proposed sites for crossing the expressways, we also attempted to avoid areas close to high speed on- and off-ramps. In so doing, we wished to avoid either the dangers of having bicyclists cross ramp traffic at grade before reaching the structure or the added expense of bridging the ramps and service roads in addition to the main lanes themselves. The suggested approach is to have the bicyclists cross the service road at a relatively simple location and enter a path that leads them to the structure. The example given below shows a possible solution at Memphis Avenue and South Loop 289.

Memphis Ave. Bike-Ped Overcrossing

Artist's conception

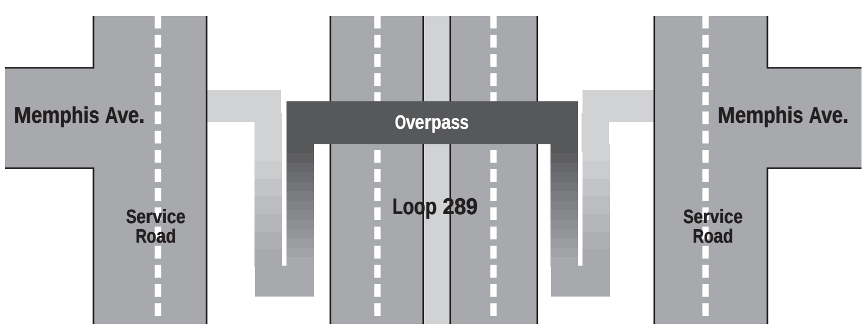


Front elevation



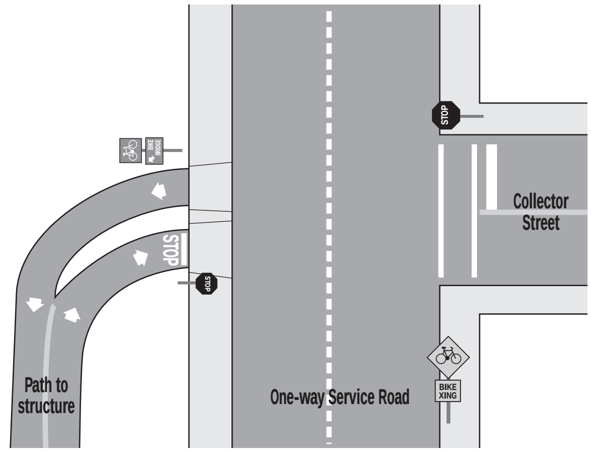
Side elevation

Not to scale

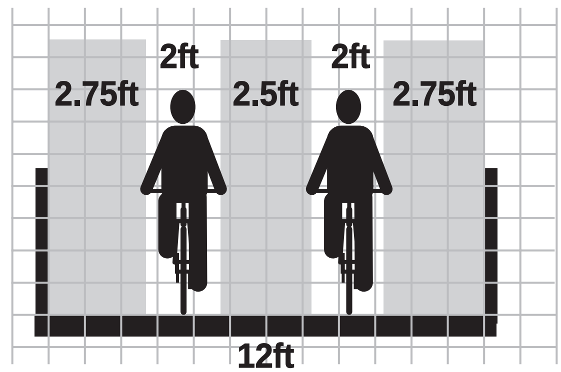


Site plan

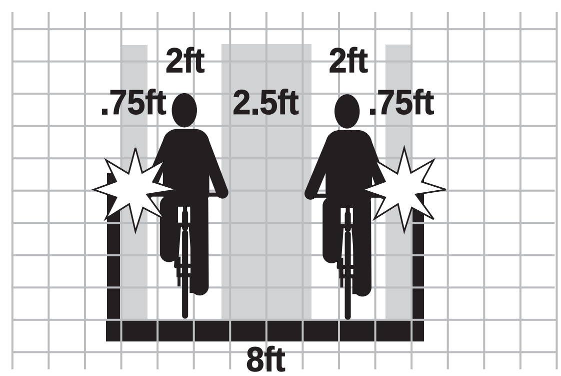
Once a site is chosen, entrances and exits must be designed to allow bicycle traffic to blend safely with roadway traffic. One important principle used in creating the bikeway/roadway interface is to design the bicycle facility as a non-motorized extension of the roadway system. The intersection should be designed to encourage bicyclists to behave like drivers of vehicles. An approach similar to that shown at right can help, whereas a path design that puts two-way bicycle traffic out onto a one-way service road, for instance, can do substantial harm.



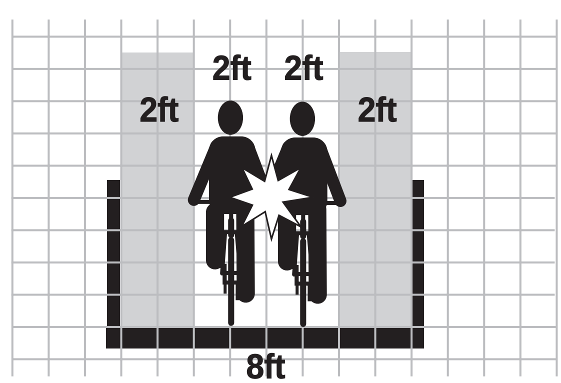
In addition, the structure, itself, must be designed to accommodate reasonable levels of bicycle traffic, as well as the occasional pedestrian and wheelchair user. One of the most critical decisions is determining the width of the structure. Often, inexperienced designers will err seriously at this point.



While few structures in this country serve enough bicycle traffic to require extra width on the basis of volume, it is important to allow two bicyclists to safely pass each other. The two diagrams at right show the difference between bicycling on a bridge with 12 feet of width and one with only 8 feet. In order for opposing bicyclists to maintain 2.5 feet of clearance in the middle (Bikeways: State of the Art 1974; FHWA) while riding on an 8-foot bridge, they must ride within a foot of the railings. In so doing, they would be in danger of colliding with the side of the bridge.

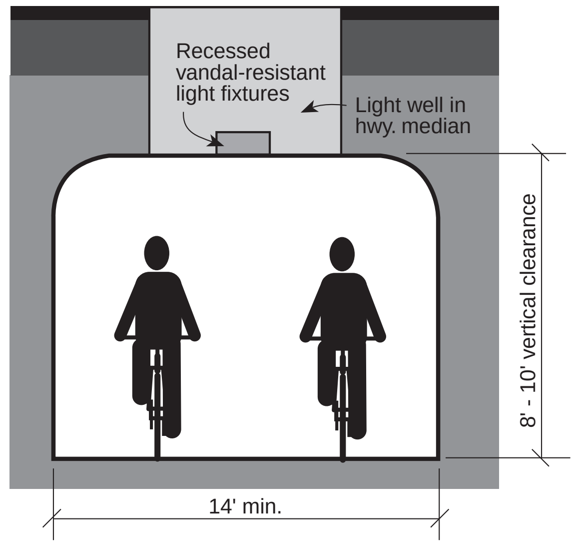


Alternatively, if the bicyclists maintain marginally adequate clearance to the railings, (AASHTO recommends 3 feet to static obstructions), there is no clearance between their handlebars. When one considers typical bicycling speeds of 10 to 20mph, the potential closing speeds for these bicyclists would be a lethal range of 20 to 40mph.



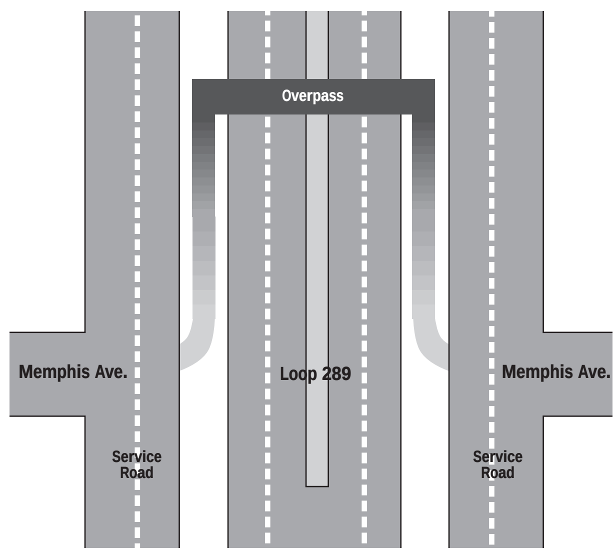
By contrast, a 12-foot structure gives nearly 3 feet of clearance between bicyclists and bridge railings, while maintaining the 2.5 feet of clearance between opposing traffic. This should be the minimum width for a structure, particularly considering that pedestrian traffic may, at times, be present.

For underpasses, we recommend a width of at least 14 feet. Underpasses need to be a bit wider than overpasses for two related reasons. First, being enclosed spaces, they will seem narrower than bridges of similar width. Second, because the ceilings typically arch inward, the effective width near the bicyclist's head will be less than with an overpass.



One additional factor that is most important to consider when designing a grade separation—whether it goes over or under—is the grade, itself. Under the Americans with Disability Acts, ramps intended for pedestrian use must be accessible and should climb at no more than a 1/12 slope. Further, after every thirty feet of run, a ten foot-long level platform is required to break the grade.

In the example shown for Memphis Avenue earlier, achieving a clearance of 16.5 feet between the expressway's paved surface and the bottom of the overpass would require ramping to climb approximately 20 feet. This climb would require eight 30-foot sections of ramp connected by seven 10-foot level platforms, for a total of 310 feet of ramping per side.



In some instances, the ramp could double back on itself, reducing costs. However, the median between the main lanes and the service road on some expressways is too narrow to allow this approach. In such a case, the ramps should continue straight (see diagram at right). Actually, this would be the preferred alternative anyway because it does not contain the tight curve radii otherwise found at the ramp's midpoint.

The network:

We propose implementing the grade separations in conjunction with the three main phases of the proposed Lubbock Bicycle System. The details are shown on the accompanying map. In the first phase of the Bicycle System plan, we recommend implementing one grade separation. This project involves constructing an overpass at Memphis and South Loop 289. Once this is completed, bicyclists from much of the community south and southwest of Loop 289 will be able to reach the heart of town without traveling on major arterial streets. Preliminary estimates put the cost of this project at approximately $300,000.

During Phase 2, we recommend one additional grade separation. This project would also be an overpass, to be constructed at Avenue U and South Loop 289. Approximately 2 miles east of the proposed Memphis Ave. crossing, this structure would allow bicyclists in the south central area south of the Loop a more direct connection to downtown. Costs would be comparable to the Memphis Ave. crossing.

There are no grade separations recommended specifically for Phase 3. However, there are two proposed grade separations to be considered as part of the East-West Freeway project. The first is proposed near where Ave. U currently crosses 4th St. This will require shifting the proposed north-south route from Avenues T and S to U until 5th St., where it can shift back to T and S. These two one-way streets are proposed for Phase 2 bike routes and they form a key north-south link in this part of the community. A second crossing is proposed where Zenith Ave. would otherwise end at the new freeway. This will keep intact a low-volume north-south route proposed in Phases 2 and 3 which allows Types B and C bicyclists living in the northeast part of town an alternative to riding on Martin Luther King Blvd. Costs for these crossings are difficult to determine without knowing the ultimate configuration of the East-West freeway at those locations. However, it is expected the costs would run between $300,000 and $700,000.

Finally, one additional grade separation is proposed in the event of significant new residential development in the southwest part of town, beyond the Loop. The suggested site is tentatively proposed just west of the South Plains Mall and would provide excellent service for bicyclists living in the direction of Wolfforth and would tie in with several routes, including the major east-west route on 58th St. Such a crossing could run between $200,000 and $500,000, depending on configuration. However, if built in conjunction with the Spur 327 project, significant cost savings may well be realized.

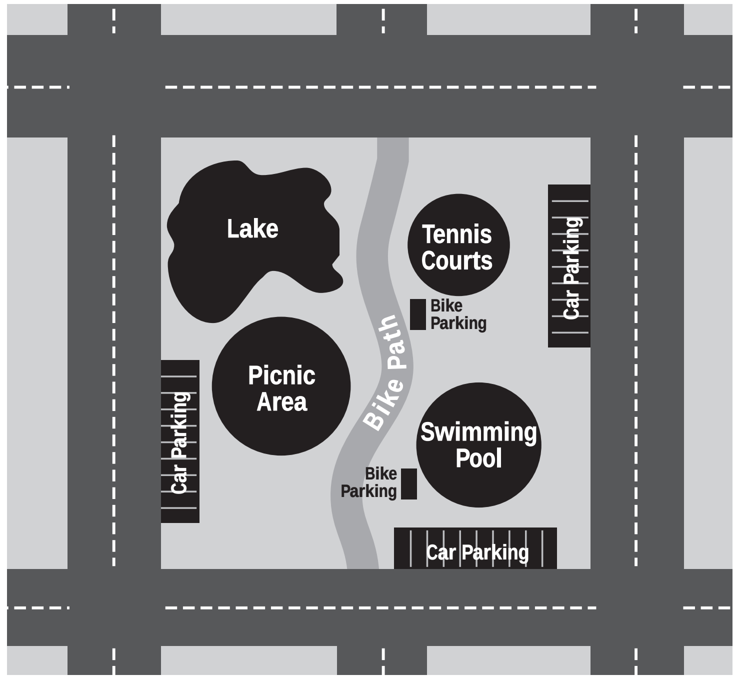
Short connector trails

To enhance the continuity of the route system, this plan proposes constructing several short connector trails. These are shown on the accompanying map. Such connectors would serve two primary purposes for Lubbock's bicyclists. First, they would allow bicyclists using the cross-town routes to avoid detouring around several parks. This would give bicyclists some advantage over motorists using the nearby streets. And it would reduce the number of turns and stops required on a journey.

Second, such connecting paths would serve as an encouragement for bicyclists to come to the parks. When coupled with appropriately located bicycle parking at specific park destinations (e.g., swimming pools and picnic areas, as well as basketball and tennis courts) and mention of the parks on the relevant route signs, these connectors would remind nearby residents that bicycling to the parks is an excellent family activity. Clearly, a greater proportion of park-bound recreationalists arriving on bicycle will reduce the need to pave additional parkland for automobile parking in the future. And, in one sense, the links forged between the route system and the parks could increase bicycling in the community, something that will help further several important goals, including increased physical fitness, greater awareness of the community environment, and an enhanced and more vibrant street life. It goes without saying that none of these goals are furthered by increased use of the automobile.

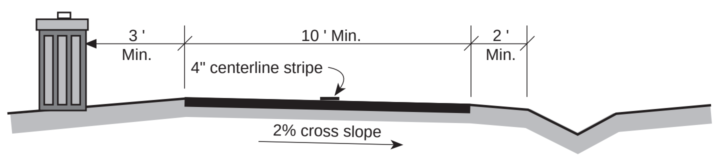
Creating connector trails would involve use of City parkland. For this reason, they must be analyzed in terms of how they fit with both current and proposed uses, as well as any long range park development plans and Parks and Recreation Department philosophy. Because of the largely transportational purpose of such trails—whether it be fostering long-distance bicycling across town or encouraging riding to park destinations—it is anticipated that some form of transportation money would be used for their development. Guidance from the Federal Highway Administration makes it clear that such facilities fit well within the scope of transportational use. We propose assembling connector trail candidates and any related improvements (e.g., bike parking) into packages for funding under the Transportation Enhancement Program. With paving costs running approximately $55,000 per mile for 10-foot-wide asphalt trails, and an approximate mileage total of 1/4 mile, it is anticipated that such a project could easily be done for less than $20,000, barring any unforeseen expenses. Depending on the results of this project, similar connecting trails could be built in other parks around the community.

Development approach: In developing connector trails, we suggest balancing two primary needs: 1) the need to enhance the park environment and harmonize with existing and proposed uses; and 2) the need to provide a safe bicycling environment. First, trails should not encroach on either sensitive environmental areas or areas where other activities would be disrupted by through bike traffic. For instance, trails through wetland areas associated with the playa lakes would be particularly inappropriate. Similarly, trails that go between play structures and a wading pool or through a Frisbee™ golf course would be ill-advised. Paths should go near important uses but not through them.



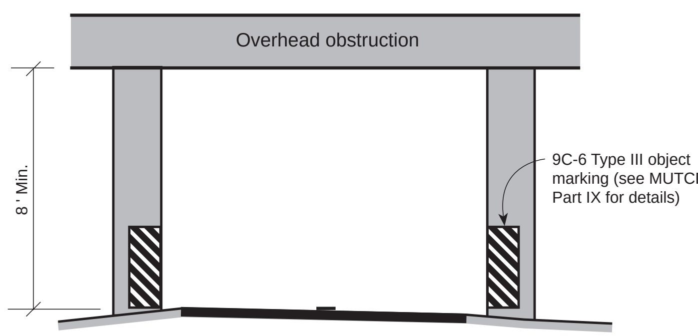
On the other hand, there are certain minimum requirements for safe bicycle use of park trails. In general, the AASHTO Guide offers the best design guidance.

First, adequate width and clearances are important. Experience in a wide variety of communities suggests that 10 feet is the minimum safe width for a bicycle trail, especially if any pedestrian traffic may be anticipated (see diagrams at right). This is the recommendation found in the AASHTO Guide.



Typical bicycle path cross section

In addition, there should be at least 2 feet of smooth shoulder on each side. Obstructions like benches and light standards should be at least 3 feet from the paved surface. If this clearance can't be maintained, then some form of warning may be appropriate. Overhead, there should be at least 8 feet of clearance to keep bicyclists from hitting their heads on obstacles.



Bicycle path with overhead and adjacent obstructions
(W5-4 "Bikeway Narrows" sign should be used at least 50 feet in advance of obstruction)

Next, curves should be designed with care. Adequate sight lines and radii are particularly important considerations. The charts found in the AASHTO Guide should be followed closely.

Finally, intersections with the roadways should resemble those shown on page 69 of the section on Grade Separations.

The network: This plan identifies only one short connector trail, to be constructed in Leroy Elmore Park during Phase 1 of the Bicycle Plan. This short section would tie in with a major east/west bike route and could be part of the proposed South Loop 289 project on Quaker. The map accompanying this report shows the proposed location.

Other possible projects for future consideration include a trail in Maxey Park around the lake and a possible trail in Dupree Park. This latter would provide a shortcut for the proposed 58th St. bike route. One other would be a very short path through McCullough Park, from Flint Ave. to Gary Ave. connecting 91st St.

An additional trail possibility would be more involved: tying the Canyon Lakes trail to both E. 19th St. and either Manhattan or 24th St. in the vicinity of Dunbar-Struggs Jr. & Senior High School. This could improve east/west bicycle access across the park, giving bicyclists living east of Martin Luther King Blvd. a low volume alternative to that major street. It would, additionally, provide non-motorized access to the park from two nearby neighborhoods. Care will need to be taken to keep grades on such a connector path to an acceptable range. This connector trail would also, in all likelihood, require construction of a bicycle-pedestrian bridge, preferably in the vicinity of Martin Luther King Blvd, where the waterway is narrowest.

Major trail corridors

While the major focus of this plan is on a network of on-road options (i.e., routes, lanes, and general improvements), mention must be made of trail possibilities. While this is not a “trails plan” per se, trails must be considered in the context of the overall plan. It is important to remember that independent trails can provide low-stress environments for bicycling, particularly for Types B and C riders. Not having to share space with large, fast, and heavy motor vehicles gives these bicyclists more opportunity to relax and enjoy the journey. In addition, the silence and openness of the bicycle fit well with scenic landscapes and provide a unique travel experience for the participant.

Probably more than any other type of bicycle facility, separate trails are popular among the majority of bicyclists, who tend to feel uncomfortable mixing with motorized traffic. In communities with extensive trail networks, such facilities see a tremendous amount of use. In some cases, trails are used by commuters on their way to work. In other cases, people drive significant distances with bikes on their cars in order to use the trails for recreational trips. In the typical case, however, trails are used for a wide variety of trip purposes.

Trails can also allow bicyclists to get through areas inaccessible for motorists. Because trail development is far less intrusive—requiring significantly less space for right-of-ways or easements, and causing less disruption from grading and clearing—than major roadway development, it is possible to build trails where roads simply cannot go.

There are at least three keys to successful trail development. First, adequate trail length will draw users who otherwise would be content riding in their own neighborhoods. For Types B and C riders, the trail would likely need to be at least three to ten miles long. A shorter trail would offer little opportunity to expand one’s horizons or to use different sections for different trips and, if popular, could lead to serious overcrowding. Some of the most successful trail networks include thirty to fifty miles; however, these systems generally started modestly, with the first stretches being between five and ten miles in length.

Second, trail amenities are important considerations. A simple straight-as-an-arrow paved trail will not attract users if there are no other reasons to be there. Nearby recreational opportunities, scenic vistas or natural amenities, interesting topography or adjacent land uses, unique design features, and access to historic sites are some of the things that can help make a trail work. In terms of topography, it is worth noting that gently rolling landscapes are often more suited to bicycling than are dramatic ups-and-downs. Few bicyclists are up to the rigors of climbing steep hills but many do appreciate slight variations in terrain. Fortunately, trail development, since it seldom involves much cut-and-fill can often take advantage of gentle climbs and descents.

Third, connections to the community must work. The most used trails are those that people can get to easily. If people must drive long distances to reach a trailhead, the utility of the trail will be reduced. Preferably, there should be multiple ways to get to a trail from nearby residential areas.

Development approach: We suggest a three-pronged approach to trail development in Lubbock. The first approach involves looking closely at the Canyon Lakes area, where some trail development has already occurred. We propose enhancing, integrating, and, where possible, extending the trail system along the corridor. At a minimum, we suggest bringing the current system up to the design standards found in the AASHTO Guide. The better this network works and the safer it is, the more use it will receive and the more impetus there will be for future trail development in other areas of the community. This trail element is shown on the accompanying map found in the back of this report.

Next, we offer a “broad brush” view of potential trail possibilities in the larger Lubbock metropolitan area. These should be considered as general ideas that could, with the necessary refinement, be worked into appropriate planning documents. While these trail ideas have not been worked out in detail, it is important to identify them in general terms in order to accommodate opportunities that may arise for implementation.

The primary concept is to develop a branching loop around the community, similar in some ways to Loop 289 but with links to the Canyon Lakes trails and to the primary bicycle route corridors. In the eventuality that an entire loop is ever built, the majority of users will not be long-distance bicyclists doing circles around the community; rather, they will be Types B and C riders using the trail to get from one part of the community to another nearby. For instance, such a loop could be useful for commuters riding from near Reese Air Force Base to Texas Instruments.

One possible trail development opportunity in the developing Southwest Lubbock would be to connect playa lake areas with greenbelt/trail systems. Such a possibility should be considered in areas that are as yet relatively undeveloped. Such greenbelt trails should be carefully designed to mesh with the existing and developing street system and land use patterns. Other opportunities exist and should be considered

In addition, the proposed East-West Freeway project presents an opportunity for possible rail-*and*-trail development on the west side of the community. As part of this project, the rail line that parallels Highway 62/82 will be relocated to the west. A bicycle trail could be incorporated into the new rail corridor, running along one side of the track or the other, depending on the details of the rail line project.

There is a growing number of examples nationwide of successful trail development adjacent to live railroad lines. In some cases, the path is separated from the rail line by a fence or vegetative buffer; in other cases, it is not. Which approach is taken depends on, among other things, the type, frequency, and speed of rail traffic, as well as legal requirements and liability concerns of the railroad company. Planning for such a trail now would help serve the west side of the community in the future, as projected residential development surrounds the corridor. Conceivably, a trail in this corridor could eventually link up with the Canyon Lakes trail near where Frankford Ave. and Highway 84 meet.

Finally, we suggest paying close attention to the possibility of future railroad abandonments, with an eye toward rail-trail conversion. We further suggest developing institutional goals and strategies for abandoned railroad acquisition. If and when such abandonments occur, it is critically important to be ready to act.

In some communities, abandoned rail lines have been converted to excellent trail systems at relatively low cost. Rail corridors are an often unique resource, in that they cut through developed parts of the community and have relatively few grade level crossings. But rail-trail development requires advance planning and the ability to act quickly if—and when—a rail line comes up for abandonment. If local agencies and citizens are caught off-guard, it is easy for the opportunity and the right-of-way to be lost. On the other hand, if they are prepared, a unique resource can be preserved and enhanced for future generations. The phrase "carpe diem" applies very much to rail trail development.

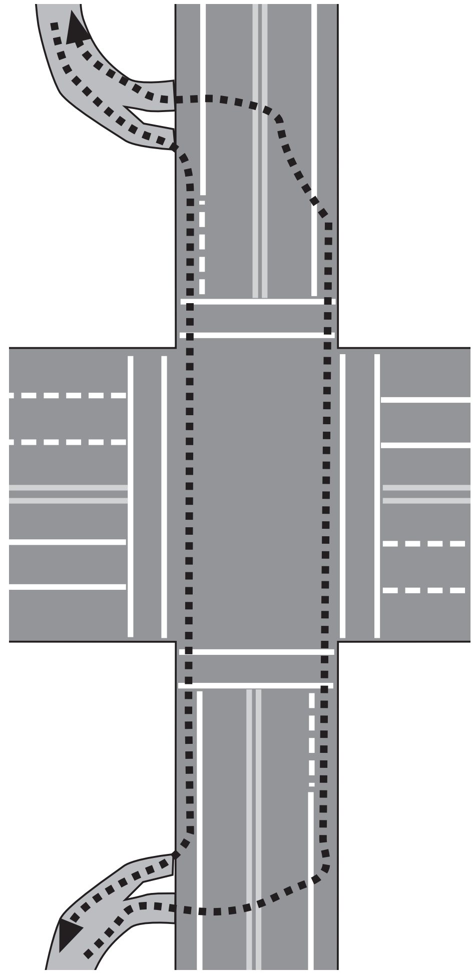
While the accompanying map identifies the Canyon Lakes trail corridor as the one specific project proposal, the schematic map on page 80 shows some of the more conceptual trail possibilities.

With respect to actual design, the primary source of guidance is, as is the case for much of the plan, the AASHTO *Guide for the Development of Bicycle Facilities.* In addition, the comments on widths, clearances, and curve design found in the previous section of this report are important considerations. Similarly, intersections with the road system should be handled in a fashion similar to that shown on page 69.

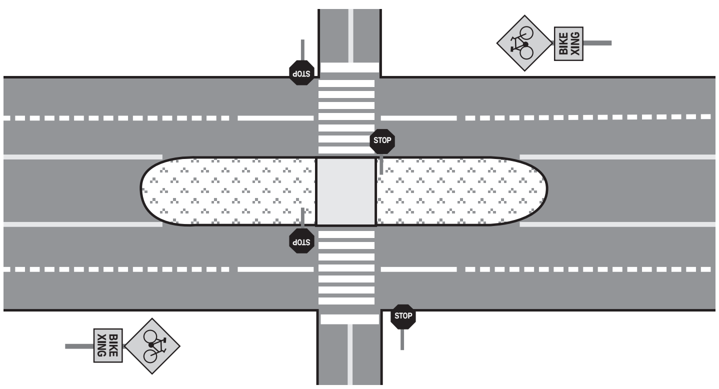
Finally, there is another, perhaps more critical aspect of intersection design that should be kept in mind. When trails cross major roads—as they must inevitably in a grid system—such crossings must be handled very carefully. In some communities, trails following waterways could pass beneath the roadway, bypassing the crossing problem all together. For the most part, however, this option is not available in Lubbock. Nor would it make sense to construct grade separations wherever trails meet arterial streets. Experience has shown that, while bicyclists may use grade separations to cross freeways, they are less likely to use structures that cross surface streets unless special circumstances make such use advantageous; and, with arterials occurring on a one-mile grid, the cost of providing such structures for a long trail would be far too high.

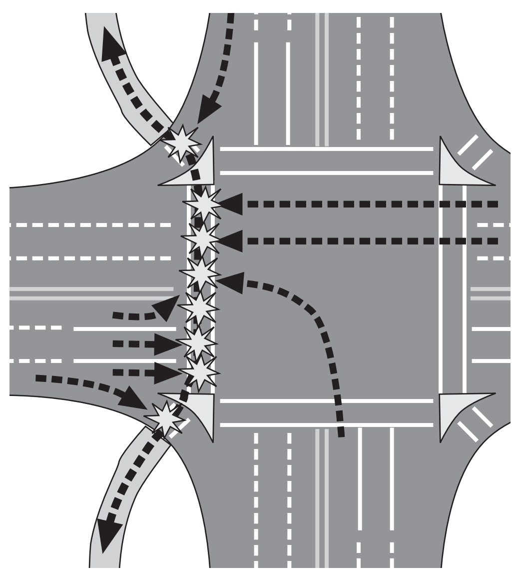
Alternatively, trails can intersect collector streets, which likely cross arterials at signalized intersections. In such cases, signing the route to show the continuation of the trail is very important, as is making the collector as "bicycle-friendly" as possible. Striping bicycle lanes on the collector, adding bicycle-sensitive signal actuation, setting the signal timing to allow sufficient time for crossing…these are some important features for use in such a situation. Even with such improvements, however, if a trail exited onto a collector every time it approached an arterial street, the continuity of the trail would be seriously compromised. In such cases, identifying another trail opportunity might be a better choice.

In some cases, it is possible to bring a trail into a major arterial street intersection such that the crossing occurs in or adjacent to a pedestrian crosswalk. While this can work, it is often unsatisfactory, particularly if cross-traffic conflicts cannot be eliminated. Some possible conflicts (shown below right) include crossing free-flowing right turn lanes, dealing with left turning traffic that has no phase of its own, and being caught in the intersection when the signal changes. None of these problems are absolutely insurmountable; however, they must be dealt with in order for such a crossing to work.



Finally, if the trail meets an arterial street in a more isolated location, it is possible to develop a crossing similar to that discussed on page 53 regarding residential street crossings. Such an installation would allow bicyclists to cross the first direction of arterial street traffic and then wait for traffic from the second direction from the safety of a median refuge. The design would look similar to the diagram shown below.





The network: The proposed trail network includes one primary phase of actual projects, in addition to suggested trail possibilities. See the accompanying Bicycle System Map for details. The actual project involves conducting a detailed analysis of the Canyon Lakes system and designing and implement specific improvements. These would include extensions to the current network, logical trail connections with nearby neighborhoods, and improvements to bring existing sections into compliance with the AASHTO Guide. Determining how best to increase trail width to 10 feet (min.) should be a top priority.

In order to take advantage of existing concrete sections, one possible approach might be to add at least 5 feet on one side of the path and to add a 4-inch yellow centerline stripe on top of the joint between the two directions of travel. Care should be taken to assure that the joint is even so as not to constitute a hazard. If the joint cannot be made smooth, the best approach would be to remove the existing concrete and start over. Where the path is discontinuous, connecting sections should be built to the 10-foot minimum width. Other improvements would be to add appropriate information, warning, and regulatory signage.

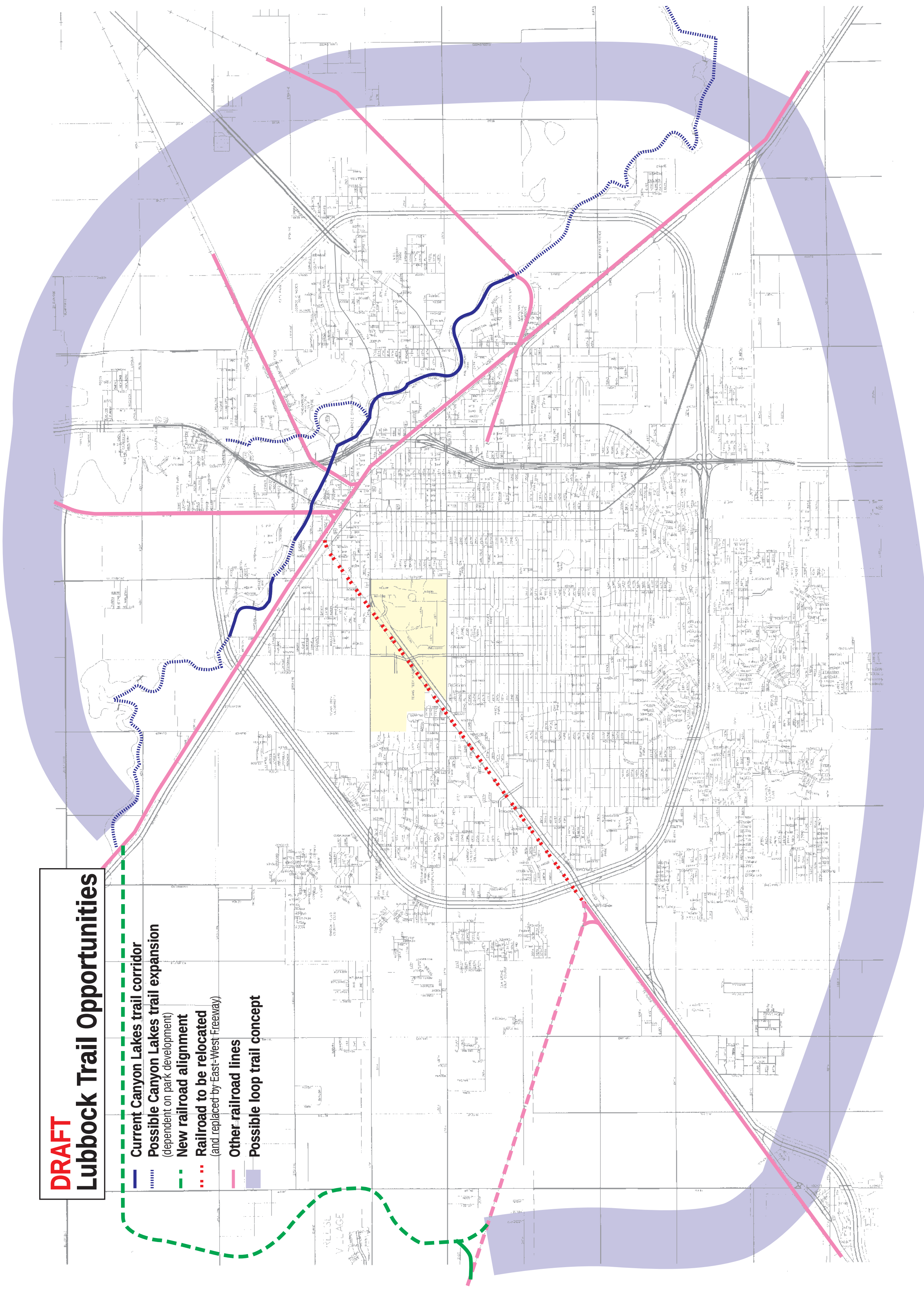
To determine costs of a revised trail network, it would be safest to assume complete replacement of existing sections. While this may not be necessary, using this approach will give a high estimate. With roughly 6 miles of trail corridor (including existing parks without trails yet), the overall cost to pave would be approximately $330,000 (at $55,000 per mile) if done in asphalt or $708,000 if concrete is required (at $118,000 per mile).

Other trail elements: One possibility worth investigating is to identify opportunities for expanding the Canyon Lakes trails to the northwest, the southeast, and up Blackwater Draw. Plans for future parks in any of these areas should include extensions to the trail network.

As discussed before, the possibility of a trail component in the new railroad realignment, accompanying the proposed East-West Freeway project, should also be investigated. With roughly 14 to 15 miles of corridor, actual trail construction would cost approximately $770,000 (at $55,000 per mile). Fencing, if required, would cost an additional $56,000 per mile, for a possible total of $784,000. Fencing and trail development together, therefore, would cost approximately $1.5 million to build 14 miles of trail. Conceivably, sections of trail that would likely see the most use could be built earlier; other sections could be added as demand increases and population density in the western part of the urbanized area increases. One way to reduce costs, particularly if fencing is not required might be to design the as a combined trail and maintenance road.

Finally, the conceptual map shown on page 80 includes the concept of a loop trail (shown as a broad line that surrounds most of the urbanized area. In a way, this proposal is a non-motorized version of the Loop 289 and the currently discussed outer loop. If adopted, in concept, it could be implemented through the development process as a continual greenbelt connecting much of Greater Lubbock. The broad line is not in any way intended to show alignment but, rather, simply the idea. Actual alignments would depend on detailed analysis in conjunction with the land use process.

Suffice it to say that most of the land surrounding the built-up Lubbock Urban Area is shown as proposed low density residential. And this type of land use would fit admirably with greenbelts and trail concepts. A recent survey conducted for the building industry by American Lives, Incorporated, showed that the three top features that consumers desired in new developments were: 1) community designs that deliver low traffic and quiet; 2) lots of open space; and 3) plenty of walking and biking trails.


DRAFT
Lubbock Trail Opportunities
Current Canyon Lakes trail corridor
Possible Canyon Lakes trail expansion
(dependent on park development)
New railroad alignment
Railroad to be relocated
(and replaced by East-West Freeway)
Other railroad lines
Possible loop trail concept

Support programs

The following pages detail important programs that support the goals and objectives of the Lubbock Metropolitan Area Comprehensive Bicycle Plan. They include parking improvements and transit connections, as well as education and awareness efforts.

Bicycle Parking Program

Providing secure bicycle parking is a key ingredient in efforts to encourage bicycling in Lubbock. Many bicycle journeys end somewhere other than the bicyclist's home and, as a result, the bicyclist must park his or her bicycle. And for those who live in apartment complexes, college dormitories, or other high density settings, the issue of where to leave a bike while home is also a serious one. Some residential complexes, for example, provide no secure place to store bicycles while, at the same time, forbidding residents to bring their bikes inside. It is a sad but true statement that at one time or another most bicyclists have experienced the frustration of finding no secure place to leave their bikes.

Some bicyclists have experienced the even greater frustration of returning to find their bicycles stolen. In fact, statistics compiled by the Federal Bureau of Investigation show that between 1988 and 1992, an average of approximately 450,000 bicycles were reported stolen each year nationwide. These figures are low, according to the Lock Smart Campaign, who estimate that roughly twice as many are stolen but never reported. They suggest that, with an average cost of $380 per bike, the financial loss to American bicyclists amounts to some $450 million dollars per year. While no specific data on bicycle theft were gathered as part of this project, many bicyclists participating in the public involvement process mentioned concerns about theft and knowledge of examples of bicycles being stolen. Some identified the Texas Tech campus as a location where bikes are often stolen.

While providing secure bicycle parking is not the entire solution to the problem of theft, it certainly can help and it can increase bicyclists' comfort in leaving their bicycles unattended. As a result, many bicycle owners may be encouraged to make bicycle trips they might otherwise might forego.

Public places and sidewalks: *This plan proposes the development of a program to annually install bicycle parking devices at public places and on sidewalks. For short-term parking and for sidewalk installations, we suggest using the generic "hitching rail" design. For long-term commuter parking, we suggest using either locked enclosures or bicycle lockers.* *See page 87 for examples.*

We propose budgeting $10,000 per year for bicycle parking installation in public places. For this amount, the agency could purchase and install approximately fifty 2-bike bicycle racks and four 1-bike bicycle lockers around the community per year. While the proposed rack installation process can make a significant contribution to bicycle security, the suggested locker installation, at four per year, is intended mostly as a "pump-priming" activity and others are expected to install their own lockers, once demand has been shown.

Potential public bicycle parking sites

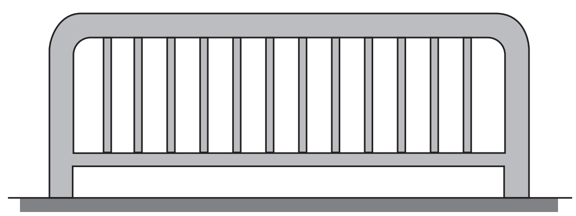
City hall and other municipal buildings
Court house
Post offices and other Federal and State buildings
Museums, coliseums, and stadiums
Parks (especially near activity centers like swimming pools)
Schools
Colleges
*Sidewalk sites in CBD-style business districts**

**Sidewalk installations work best when businesses and offices are adjacent to the sidewalk, rather than behind a parking lot.*

We suggest sending out a letter to public agencies, local media, business groups, and bicycle clubs asking for proposed public bicycle parking sites. Proposals may then be prioritized according to demonstration of existing need, potential future use, appropriateness of the site, as well as the level of interest and willingness shown by the applicants.

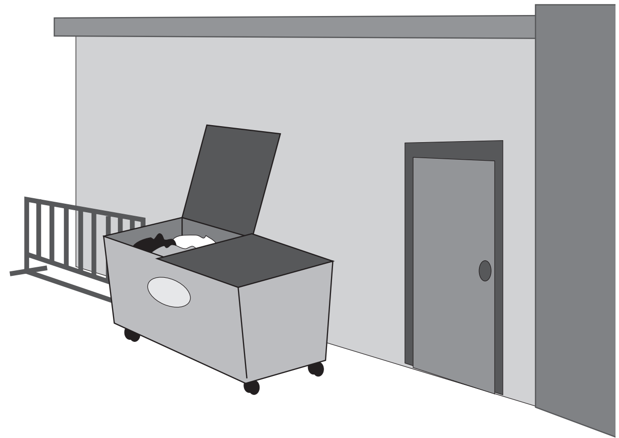
Private parking encouragement: *This plan further suggests assembling a collection of literature regarding the best available bicycle parking options. This literature should be offered for distribution to the private sector through a variety of channels, including local business groups, public agencies, and bicycle organizations.*

Often, owners of shopping centers, small shops, apartment complexes, and other commercial establishments want to provide parking but don't know where to get specific information, what to buy, or where to put it. Providing this information, complete with prices and vendor names and phone numbers, can help property owners overcome an important hurdle and avoid installing the wrong product in the wrong location.



One common mistake is to install "wheel bender' bike racks. These devices (see diagram at right) are designed to loosely hold either the front or rear wheel and are generally unsuited for use with high security locks. The only way bicyclists have found to secure their bicyclists to these racks is to hoist the front wheel over the top and run the lock through the wheel and rack to the frame. This works best if the bicyclist doesn't care about his or her frame. A proper design, by contrast, allows proper use of high security locks and is unlikely to lead to damaged property.

Another common mistake is to locate the bicycle parking far from logical building entrances. One popular location is near the dumpster behind the building. This type of location assures that few bicyclists will use the facility and those few who do will be putting their bicycles at risk The proper location combines convenience with security. Bike parking, just like automobile parking, should be near the proper entrance and highly visible. It should not, however, be simply installed in the parking lot. Such a location can lead to damage from passing or parking automobiles.



Literature commonly available in the bicycle field can help encourage and educate the property-owning public in the proper way to install bicycle parking, as well as the proper types of parking to install. Adventure Cycling Association's inexpensive Tech Note series (shown at right), for instance, includes tips on parking location, discussions of basic bike rack performance criteria, and hints on determining how much parking is needed.

Similarly, literature from manufacturers can help as well. Assembling a small collection of appropriate pieces can do much to upgrade the quality of parking provisions in the community.

New developments: *We recommend modifying Lubbock's off-street parking requirements to include bicycle parking. The specific approach used should be developed through a consensual process, involving, at a minimum, zoning administrators, transportation officials, commercial developers, and bicycling interests.*

Public bicycle parking provisions, combined with the distribution of literature can only do part of the job. In order to ensure bicycle parking provisions become a routine part of development, it is important to include

Sample off-street parking provisions*

Purpose

…

(d) Providing adequate and safe facilities for the storage of bicycles.

…

4. Bicycle parking facilities shall be provided as required for all new structures and uses established as provided in Sec. 28.11(2)(a)1. or to changes in uses as provided in Secs. 28.11(2)(a)2. and 3.; however, bicycle parking facilities shall not be required until the effective date of this paragraph. Notwithstanding Secs. 28.08(1)(i) and 28.09(5)(a), bicycle parking facilities shall be provided in all districts including districts in the Central Area.

…

1. In the residential district, accessory off-street parking facilities provided for uses listed herein shall be solely for the parking of passenger automobiles and bicycles of patrons, occupants or employees and not more than one truck limited to one (1) ton capacity.'

…

(e) Size. … Required bicycle parking spaces shall be at least 2 feet by 6 feet. An access aisle of at least 5 feet shall be provided in each bicycle parking facility. Such space shall have a vertical clearance of at least 6 feet.'

…

d. Bicycle Parking Facilities. Accessory off-street parking for bicycles shall include provision for secure storage of bicycles. Such facilities shall provide lockable enclosed lockers or racks or equivalent structures in or upon which the bicycle may be locked by the user. Structures that require a user-supplied locking device shall be designed to accommodate U-shaped locking devices. All lockers and racks must be securely anchored to the ground or the building structure to prevent the racks and lockers from being removed from the location. The surfacing of such facilities shall be designed and maintained to be mud and dust free.

…

3. Bicycle parking facilities shall be located in a clearly designated safe and convenient location. The design and location of such facility shall be harmonious with the surrounding environment. The facility location shall be at least as convenient as the majority of auto parking spaces provided.

…

1. Bicycle parking facility spaces shall be provided in adequate number as determined by the Zoning Administrator. In making the determination, the Zoning Administrator shall consider when appropriate, the number of dwelling units or lodging rooms, the number of students, the number of employees, and the number of auto parking spaces in accordance with the following guidelines (see chart at left).'

Off-Street Bicycle Parking Guidelines

Land Use	Bike Space
Dwellings/lodging rooms	1 per dwelling unit or 3 lodging rooms
Clubs/lodges	1 per lodging room plus 3% of person capacity
Fraternities/sororities	1 per 3 rooms
Hotels/lodging houses	1 per 20 employees
Galleries/museums/libraries	1 per 10 auto spaces
Colleges/universities/junior and high schools	1 per 4 employees plus 1 per 4 students
Nursery/elementary schools	1 per 10 employees plus students above second grade
Convalescent and nursing homes/institutions	1 per 20 employees
Hospitals	1 per 20 employees
Places of assembly, recreation, entertainment and amusement	1 per 10 auto spaces
Commercial/manufacturing	1 per 10 auto spaces
Miscellaneous/other	To be determined by the Zoning Administrator based on the guideline for the most similar use listed above

"a. In all cases where bicycle parking is required, no fewer than two (2) spaces shall be required.

"b. After the first fifty (50) bicycle parking spaces are provided, additional bicycle parking spaces required are 0.5 (one half) space per unit listed.

"c. Where the expected need for bicycle parking for a particular use is uncertain due to unknown or unusual operating characteristics of the use, the Zoning Administrator may authorize that construction and provision of not more than fifty (50) percent of the bicycle parking spaces be deferred. Land area required for provision of deferred bicycle parking spaces shall be maintained in reserve."

**Excerpt from the Madison, Wisconsin, City Code.*

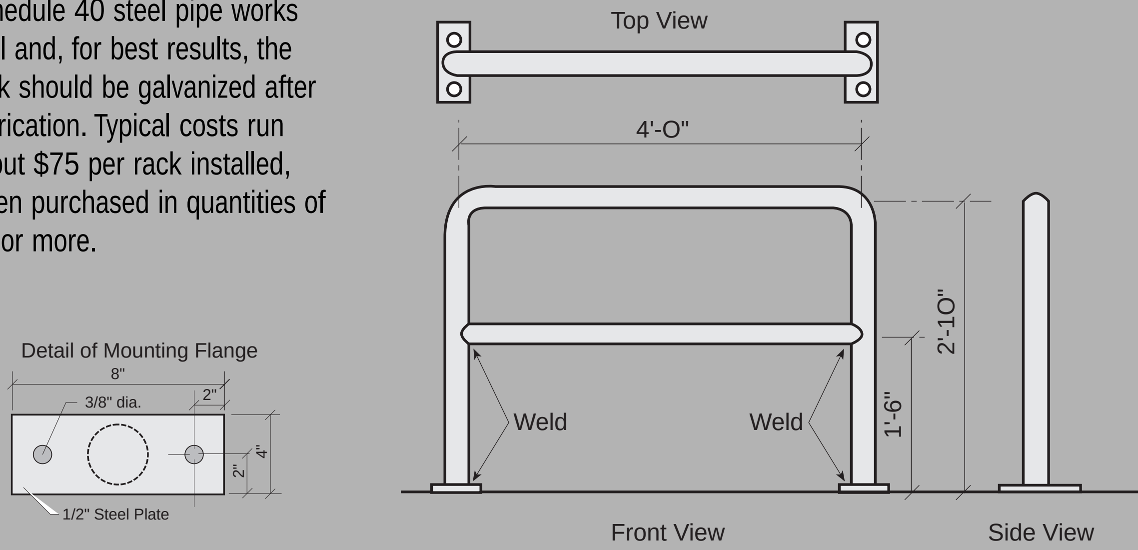
requirements in local laws governing off-street parking. A number of communities around the country have implemented such requirements and, as a result, bicycle racks and lockers have become routine provisions. The excerpt above is from the Madison, Wisconsin City Code. Other cities use similar approaches.

Whether a "carrot" or "stick" approach is used is a matter of local preference. A "carrot" approach might take the form of a relaxation of the automobile parking requirements in exchange for including bicycle parking. Typically, this involves allowing developers to eliminate one or two off-street car parking spaces in exchange for providing an approved bike rack. A "stick" approach would simply require developers to provide X number of bicycle spaces for every Y motor vehicle spaces. Which approach Lubbock takes is up to the appropriate agencies. While the "stick" approach is probably more effective in getting bicycle parking included in developers' plans, the "carrot" approach may be more easily implemented.

Proposed bicycle rack design

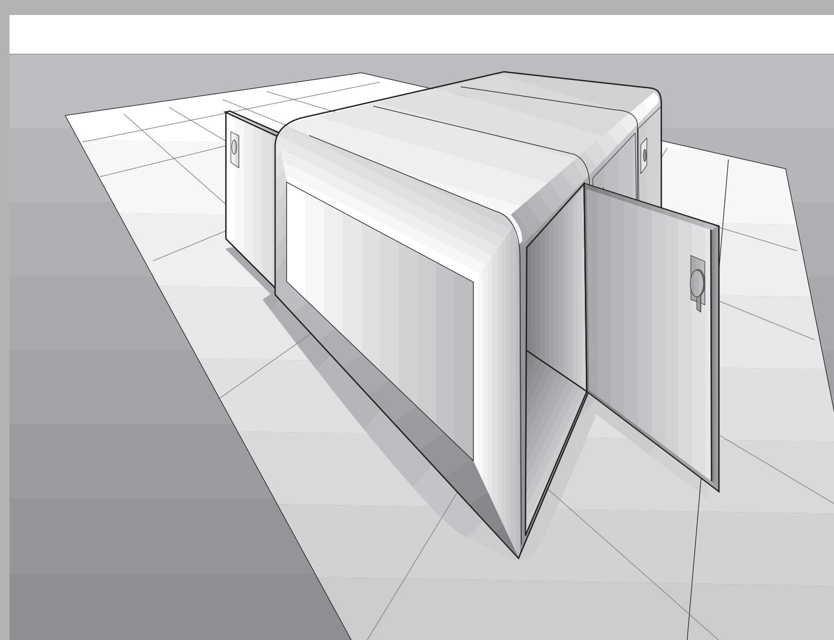
The design shown at right has proven popular and effective in numerous communities. It is inexpensive to fabricate locally, easy to install, vandal-resistant, and works well with the popular high-security bicycle locks. In addition, it can be installed singly, as on a sidewalk, or in quantity, as at a major recreational center.

Schedule 40 steel pipe works well and, for best results, the rack should be galvanized after fabrication. Typical costs run about $75 per rack installed, when purchased in quantities of 50 or more.



Typical bicycle locker installation

Bicycle lockers provide a higher level of security than bicycle racks do. They are the preferred option where long-term security is more important than short-term convenience. Work site locker installations for bike commuters are particularly welcome, as are installations at large residential complexes. Unlike racks, lockers provide protection for a bike's components, as well as the user's luggage and other belongings. Each locker unit is divided diagonally to allow separate storage for two bicycles.



Some agencies use coin operated units but the most popular approach is to rent the lockers on a monthly or quarterly basis or to provide them free. Lockers are generally installed in multiples of two or more units, since each installation requires a "starter unit," which is approximately twice the cost of subsequent units. Typical costs run $3300 for starter units and $1600 for add-on units. Each unit has two enclosures.

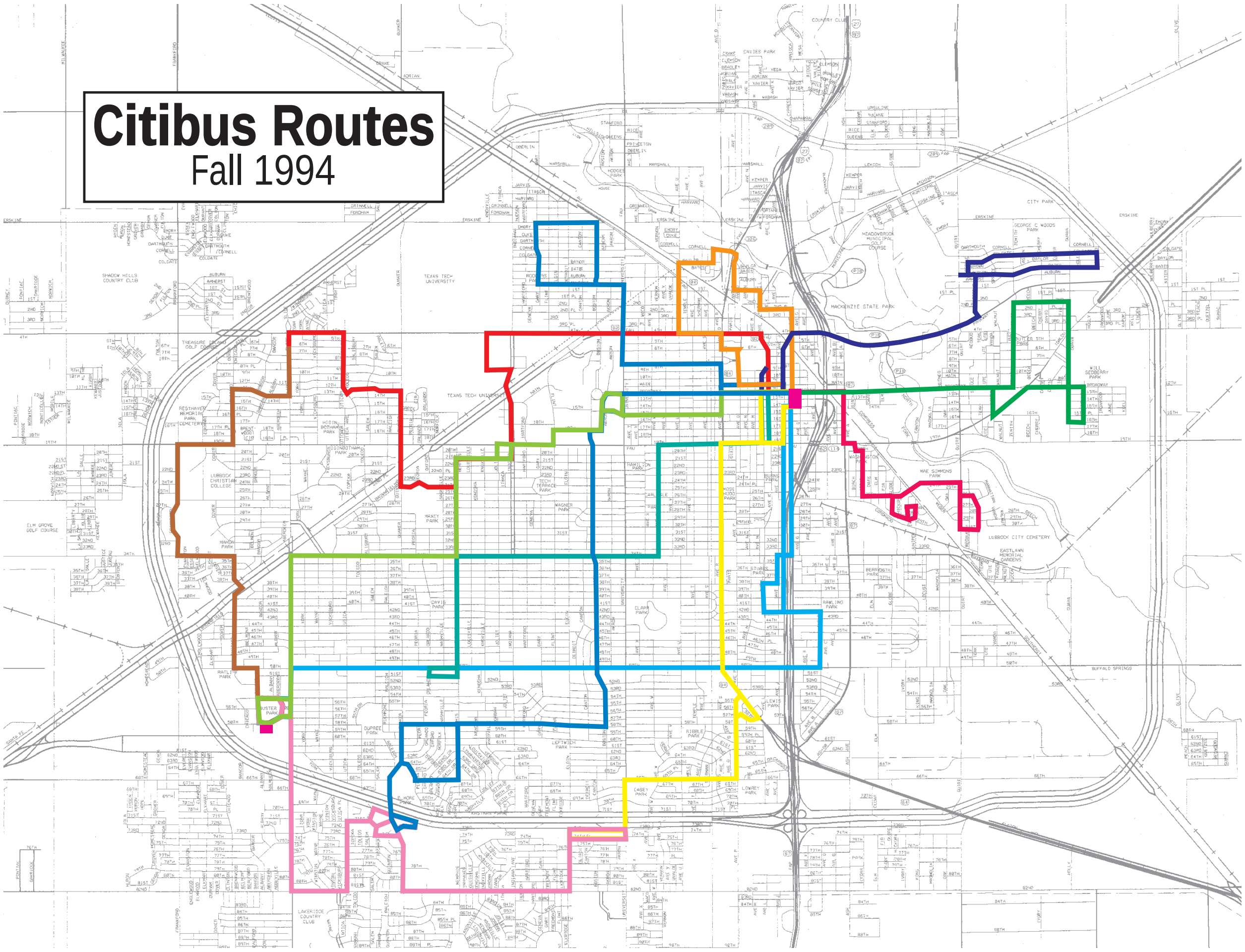
courtesy of Phoenix Street Transportation Dept.

Transit

Transit and bicycling can, under the right conditions, complement each other very well. A transit system can expand a bicyclist's access to the overall transportation system by bridging great distances and by carrying bicyclists over serious barriers. Most studies suggest that the average bicycle trip is approximately 2 miles in length. However, by riding to a transit stop, a bicyclist can combine that two mile bicycle trip with, for example, a ten mile bus trip and reach destinations twelve miles away with the same level of effort. In the context of Lubbock this could mean that a bicyclist living on Brownfield Drive near West Loop 289 could easily ride the 3/4 mile to catch the #3 bus on Slide Road and take it to the Texas Tech campus. Similarly, a bicyclist living on Magnolia could quickly ride the mile to Avenue D, catch the #6 to South Plains Mall to shop. The accompanying bus route map shows that virtually everyone living within Loop 289 and many living south of the Loop is within easy riding distance from a bus line.

The transit system can, itself, benefit from encouraging multi-modal bicycle-bus trips as well.Bicyclists typically travel at 8 to 15mph, between three and five times as fast as pedestrians. Thus, in the amount of time it takes a pedestrian to walk 1/4 mile to a bus stop, a bicyclist can easily ride a mile to the same destination, using less energy in the process. This simple fact means that the transit system's capture area can expand dramatically, reaching potential users who would be very unlikely to walk long distances to the bus stop.

There are two primary services that a transit operator can provide for bicycling customers: (1) secure parking at key transit stops and (2) the means to conveniently carry bikes on buses. These options are discussed in turn below.



Parking at bus stops: *This plan proposes a pilot project of building and installing bicycle parking at four high-volume transit stop locations to be determined in conjunction with the Citibus. In choosing specific locations, factors of convenient access to nearby residential areas and high visibility (e.g., near a small shopping center or popular public facility) should be considered. The locations and program should be publicized through Citibus' normal channels. Success of the pilot program should be considered in possible future expansion or continuation.*

Bicycle parking at transit stops is intended to attract potential transit users who may wish to ride their bicycles to a nearby bus stop, park their bikes, and take a bus to their destination. When they return, they will retrieve their bicycles and ride home.

Such users' destinations may be close to the Downtown Transfer Plaza or near the bus route itself. As a result, they may not need or want their bicycles at their destinations. Similarly, users continuing their bus trip on another line may not wish to deal with loading and unloading their bikes a second time when they transfer. Because their bicycles will likely be left for extended periods of time, security will be an important consideration. There are two primary means to address this need: (1) location; and (2) secure parking devices.

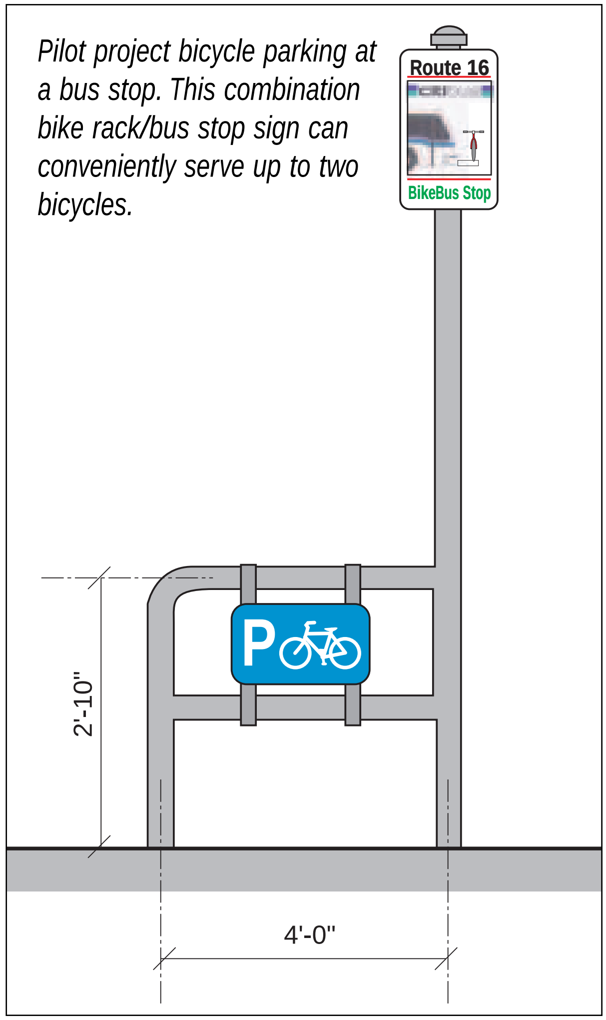
Location: Bicycle parking should be located near the bus stop itself and should be highly visible to reduce the likelihood of theft. If there is a business close by, parking should be visible to employees or customers. The bicycle parking should not to obstruct bus loading or unloading or the passage of pedestrians.

Secure parking devices: For the most part, we recommend using racks similar to those described in the Bicycle Parking section of this report. These "hitching rail" type devices provide an acceptable level of security, when used in a secure location and when users take routine precautions. A modification of this design is showed at right, combining a rack with a Citibus route sign.

Costs: It is estimated that a pilot project of installing four of the rack/signs shown at right would cost approximately $600. This small project could be combined with the following bus rack project in a Transportation Enhancement Activities (TEA) grant application.

Future expansion: Bus patrons should be encouraged to voice their opinions of the success of this pilot project. They should be further encouraged to suggest sites for new parking or expansion of existing parking. Expansion should take the form of standard hitching rail racks (shown in the previous section) or, where security needs are greater, bicycle lockers.

Pilot project bicycle parking at a bus stop. This combination bike rack/bus stop sign can conveniently serve up to two bicycles.



Bikes on buses: *This plan recommends that Citibus equip each of its fixed route coaches with bicycle racks similar to the Sportworks MT2 rack, which is being used in a growing number of communities. These racks accommodate two bicycles each.*

Currently, Citibus policy allows passengers to bring their bicycles on-board at the discretion of the driver. However, well-designed racks will encourage bicyclists to use the bus more without the challenge of bringing their bikes inside, possibly inconveniencing other passengers.

While it would be advantageous to phase implementation of a "bikes on buses" program, there is a major difficulty in such an approach, given that buses are currently rotated among routes. In this situation, it would be difficult for a bicyclist to know whether the bus he or she wished to take had a rack; in addition, a bus with a rack may be present on one route one week and another route the next. As a result, regular use would be difficult.

Clearly, the success of a "bikes on buses" program depends on ensuring regular and predictable service. For this reason, we suggest installing racks on all 34 buses at once. We also suggest publicizing the program in a highly visible manner. Posters on the buses, brochures on the program, even publicity through local media should be used to let people know the program exists and how it works.

courtesy of the Seattle Bicycle Program

Bus rack costs: Currently, the estimated cost of such a rack is $365 per unit. In addition to the rack itself, a special bracket is required to attach the rack to the bus; these cost between $145 and $200, depending on the type of bus. Brackets for Citibus' current fleet would cost approximately $175 each. Total cost per bus will be $540; the cost to equip the entire fleet of 34 fixed route coaches with racks is approximately $18,360, not including the labor to mount them. As the current fleet is replaced, new mounting brackets may be needed to transfer racks to new buses, depending on make and model.

Education and awareness

Education and awareness efforts are key ingredients to building a successful bicycle transportation system and fostering the growth of bicycle use in a community. One primary reason is the great amount of misinformation and mythology that currently abounds with respect to bicycling. Many, for instance, believe that bicyclists should travel against the flow of traffic or that they should stick to the sidewalks. Unfortunately, numerous studies have shown that both of these strategies are generally quite dangerous.

Such myths serve to hamper the growth of bicycling in a community by, on the one hand, increasing the actual dangers associated with riding and, on the other hand, increasing the perception of bicycling as an inherently dangerous activity. While it is true that bad bicycling practices are dangerous and lead to many crashes, it is also true that riding correctly can be quite safe and can help one avoid danger.

Primary audiences

There are four primary and, to some extent, overlapping audiences for education and awareness efforts: young bicyclists, parents of young bicyclists, adult bicyclists, and motorists. It is possible to generalize about the educational needs of these four groups in the following way: young bicyclists typically make basic mistakes because they do not understand the traffic system and are physically and psychologically immature. In addition, the very youngest riders are just learning basic control of their bicycles.

Parents of young bicyclists often misunderstand basic bicycling concepts. This is a particular concern because they pass these misunderstandings along to their children. As a result, a bicycling education program directed at youngsters may be undermined by contradictory messages coming from those individuals that children trust the most.

Adult bicyclists typically do understand the basics of the traffic system. In many cases, however, they do not understand how to operate a bicycle within that system; nor do they always understand the reasons for doing so lawfully. Some develop a cynical attitude towards traffic law, at least partly as the result of their experiences in, for example, not being able to trip traffic lights and being threatened by aggressive motorists.

Finally, motorists often harbor a variety of misconceptions regarding bicycling. They share some of the same attitudes described above under parents and adult bicyclists. In addition, many also believe that bicyclists have no right to use the public thoroughfares. Some even carry this attitude a step further, harassing and endangering bicyclists.

For each of these groups, certain messages are especially important and particular strategies are very useful in getting those messages across. The table below summarizes both elements.

Bicycle safety education

Important audiences, messages, skills, and strategies

Young bicyclists

Primary messages and important skills: Riding a straight line without wobbling or swerving; stopping, looking, and yielding before entering or crossing a roadway; riding with traffic; looking back for traffic before moving left or turning left; the importance of helmet use;

Primary strategies: Programs using the Safety City site and/or school playgrounds; programs through recreation program outlets; printed materials distributed through schools and other outlets; annual safety event highlighting the most important safety messages; TV, radio, and print PSAs and feature stories.

Parents of young bicyclists

Primary messages: Ages and developmental factors in bicycle safety; common crash problems; riding with traffic; driveway ride-out problems; the importance of helmet use;

Primary strategies: Direct involvement in safety programs through PTAs and other youth-oriented groups; literature sent home from schools and other youth-oriented outlets; pediatrician office literature; videos and literature at parent nights at schools, TV, radio, and print PSAs and feature stories.

Adult bicyclists

Primary messages and important skills: Bicycles as vehicles; riding with traffic; riding a straight line without swerving; importance of helmet use, use of lights at night; the basic emergency maneuvers (panic stops, quick turns, rock dodges); basic traffic riding concepts (road positioning by destination, speed, roadway geometrics and conditions).

Primary strategies: On-bike/on-road programs taught through schools and recreation programs; literature distributed through schools and major work centers; TV, radio, and print PSAs and feature stories.

Motorists

Primary messages and important skills: Bicycles as vehicles, sharing the road, what bicyclists are expected to do according to law; what motorists are expected to do when around bicyclists.

Primary strategies: Bicycle content added to driver training in schools and included with drivers' testing package; TV, radio, and print PSAs and feature stories; posters on buses.

First steps in education and awareness

In the long-term, it may be possible to implement a wide variety of programs reaching all relevant groups. In the near-term, it is important to implement several key features. We recommend limiting the focus to three main ingredients: a young bicyclist and parent program, an adult rider program, and a motorist awareness program.

We further recommend consolidating these elements into one grant application for Section 402 funding, available through the State highway safety office. Experience suggests that the three projects can be accomplished with a total budget of between $50,000 and $90,000.

Young bicyclist and parent program: *Work with the Safety City staff and key school officials to ensure that all Lubbock children in grades 3 and 4 receive proper bicycle safety training and support materials. Further, distribute literature to children of other ages, as well as all parents.*

The program should, at a minimum, cover the points discussed in the table on the previous page and should include on-bike training for youngsters at the Safety City site. While the target ages are not all-inclusive, they are the ages where bicyclist training can be most readily accomplished and the ages just prior to the greatest involvement in serious bicycle crashes. In short, grades 3 and 4 are good places to start.

Interested bicycle club members should be recruited to help teach technical bicycling skills and to help run the program. Parents should also be heavily recruited, both to help operate the program and to help build bicycle safety awareness among key PTA members. In addition, literature should be sent home to parents to help them understand the primary messages and to encourage them to help support the effort.

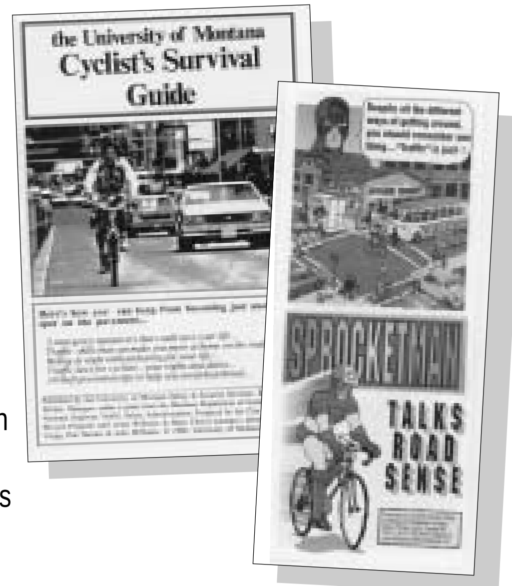
The emphasis of the program should be on improving basic bicycle handling, communicating with others, and enhancing decision making skills. Memorization of “bicycle safety rules” is less important and, as a result, should receive less emphasis.

For instance, it is less important to teach youngsters the skill of looking “left, right, left” before crossing a street than it is to teach them to look back and forth as often as needed and for as long as it takes for traffic to clear and for them to cross safely. To understand the difference, it may be helpful to review works like the Bicycle Federation of America’s “Basics of Bicycling” video-supported program.

Adult rider program: *Start a pilot project on adult bicyclist education. The program should include a training component, a series of PSAs, and a set of age-appropriate safety literature. The local bicycling clubs should be closely involved in development and operation.*

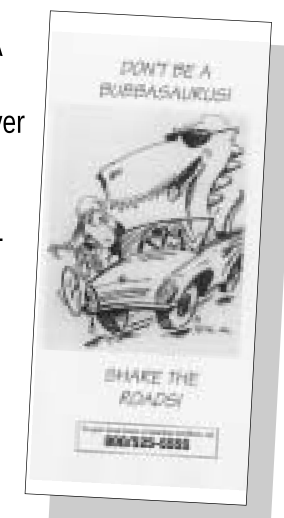
Working with key members of the local bicycling groups and college staff and students, implement an adult bicyclist on-bike/on-road training program through at least one school’s recreation program. The program should be similar in content to an abbreviated version of the Effective Cycling program run by the League of American Bicyclists. In addition, the program should be packaged in a manner acceptable to other local educational institutions; the concept would be to eventually make it available throughout the community.

In addition to the training element, at least one publication aimed at adult riders should be developed or modified from existing materials and widely distributed. Several samples are shown at right. In two very different formats, these pieces offer sophisticated bicycling advice to adult bicyclists.



Beyond these efforts, several public service announcements should be developed using television, radio, and local print media. They should focus on those topics listed in the table given earlier in this section. Working closely with the local media, it is quite possible to develop excellent products at quite reasonable costs. In several communities, for instance, fifteen and thirty second TV spots were produced for between $100 and $250 each. The key is to develop a good working relationship with the media.

Motorist awareness program: *Work with the police, bicycle clubs, drivers' license testing centers, and driver training instructors to increase motorists' awareness of their duties with respect to bicyclists. Get materials featuring the basic "share the road" message into a variety of media in an effort to reach the largest possible percentage of the target audience.*



The program should be based on points covered in the excellent brochure "Don't Be A Bubbasaurus," produced by the Texas Department of Transportation, the Texas Department of Public Safety, and the Texas Bicycle Coalition (see sample at right). Driver training instructors should be encouraged to include a discussion of sharing the road with bicyclists in their courses. Driver testing centers should include copies of the brochure with literature they distribute. The Police and the traffic courts should distribute copies of the brochure on a routine basis. Other outlets should be identified and used as well. And, finally, the media should be enlisted to help get the basic concept across.

While sharing the road with bicyclists is the primary message, for fairness and effectiveness it is important to balance this with a similar message directed at bicyclists. In other words, the *overall* message should be that bicyclists have rights to the road and they have duties and responsibilities as well. In addition, more specific concepts, like passing with care and saving the horn for emergencies, should be included as subsidiary messages.

Conclusion

These three components—a young bicyclist and parent program, an adult rider program, and a motorist awareness program—can go a long way to helping Lubbock's bicyclists and motorists learn to coexist more effectively and more congenially, thereby creating a more bicycle-friendly atmosphere. This atmosphere is critical to encouraging greater use of the bicycle in the Lubbock area.

Regional Implementation Policies

The Lubbock Metropolitan Area Comprehensive Bicycle Plan provides a blueprint for developing a network of bikeways in the region — the Lubbock Bicycle System — which will help Lubbock become a place where people choose to bicycle for both transportation and recreation.

However, the plan is just a starting point. Implementation of the network over the next 20 years will depend on the actions of the cities of Lubbock and Wolfforth, Lubbock County, Citibus, the Texas Department of Transportation, the development community, and the general public. A number of policies and actions have been identified as critical to the eventual implementation of the Comprehensive Bicycle Plan and the completion of the Lubbock Bicycle System.

Lubbock MPO Actions

The Lubbock MPO should assume a leadership role in promoting implementation of the Lubbock Bicycle System, using the approach developed in the Comprehensive Bicycle Plan. The following actions are recommended.

A-1. Establish a permanent regional Bicycle Advisory Committee to oversee and coordinate implementation of the Comprehensive Bicycle Plan. Membership of the BAC should include staff from the relevant local and state agencies and departments as well as representatives from bicycle user groups, bicycle shop owners, the health community and the city and county police departments.

A-2. Identify a minimum level of funding for improvements to the existing highway system. Over the life of this plan, a minimum of $1.5 million over the next 20 years should be made available to City and County agencies to implement bikeway projects and programs that improve the existing highway system for bicyclists.

The transportation enhancements program should be the primary source of funding for the development of the Lubbock Bicycle System and also for the programs recommended in Actions 6 and 7 below.

A-3. Encourage the development of bicycle facilities in conjunction with highway construction, reconstruction, and improvement projects through the Transportation Improvement Program process. The criteria used by the MPO to rank projects for inclusion in the annual Transportation Improvement Program should be amended to favor those projects and programs which incorporate improvements for bicyclists as part of their design. For example, the proposed grade separation for bicyclists that would be part of the Spur 327 project would improve the ranking of that project by virtue of the improvement it would create for bicyclists.

A-4. Promote uniform, state- of-the-practice facility design and implementation throughout the region. The MPO should ensure that facilities developed as part of the Lubbock Bicycle System conform to the current guidelines and standards. The AASHTO Guide for the Development of Bicycle Facilities and the recommendations in stages 2 and 3 of the Comprehensive Bicycle Plan should be adopted as a minimum set of guidelines to follow. The MPO should also provide opportunities for planners, engineers, developers and consultants in the region to receive ongoing training in the development of bicycle facilities.

A-5. Develop planning tools to prioritize bicycle facility development. The MPO should use information collected for the ISTEA Management Systems to rate the suitability of highways in the region for bicycling, based on the facility selection criteria developed for the Comprehensive Bicycle Plan. The resulting map should be used to identify key gaps in the existing network of suitable routes for bicyclists, which can in turn be used to prioritize bicycle facility development in these areas.

City of Lubbock Actions

A-6. Appoint a bicycle coordinator to coordinate and implement the Lubbock Bicycle System. A bicycle coordinator is an essential element to the successful implementation of the Lubbock Bicycle System.

A-7. Institute a "Bicycle Spot Improvement" program to make low-cost safety improvements to the existing highway system. The City and County should make it a priority to respond to safety and operational problems identified by bicyclists and other highway users. Similar programs around the country have been very effective in improving surface conditions, providing low-cost improvements such as bicycle parking racks, and fixing missing signs, lane stripes, and other traffic control devices. Such programs have been very popular with bicycle user groups and have helped develop more cooperative relationships between public agencies and citizens.

A-8. Review and recommend changes to the development regulations to ensure that streets and highways built by developers incorporate adequate facilities and space for safe and efficient bicycle travel.

A-9. Review and recommend changes to local parking ordinances to ensure a minimum level of bicycle parking is provided in all new developments.

A-10. Actively support promotional and safety events in the region. To help overcome the low status of bicyclist and bicycling in the region, the City, County, and MPO should support the work of local bicycling groups to promote bicycle events such as Bike to Work Week. The City should develop and/or provide safety literature and promotional information about bicycling for bicyclists and motorists. Tourist information developed by the City should include information about the opportunities for bicycling and tips for bicyclists and motorists on how to safely coexist.

Other Agencies

A-11. Citibus should work with the bicycle community to establish a program to better integrate bicycling with the transit system. Citibus and the bicycle community should work together to identify opportunities to better integrate the two modes in the following key areas:

a) Identifying high-volume transit stops at which to launch a pilot bicycle access and parking program

b) Provision of racks to carry bike on all 34 Citibus vehicles and, possibly, on new buses

A-12. Every agency involved in implementing the Comprehensive Bicycle Plan should themselves become model employers for those wishing to commute by bicycle. As part of the regional effort to reduce air pollution from single occupant commuting trips, each of the agencies involved in implementing parts of the Comprehensive Bicycle Plan should encourage their own employees to bicycle to and from work, and during the course of work, by providing a range of services, facilities, and incentives such as:

a) secure bicycle parking

b) access to shower, changing, and locker facilities

c) free and preferential car parking on a limited number of days when bicycling may not be feasible because of bad weather or other constraints

d) ride-matching and route-finding services

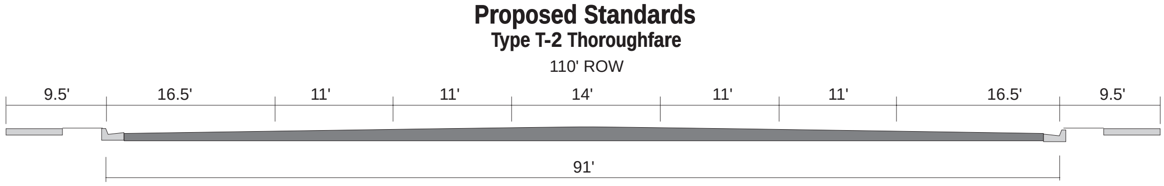
e) other incentives at least equal to those offered to ride-sharers

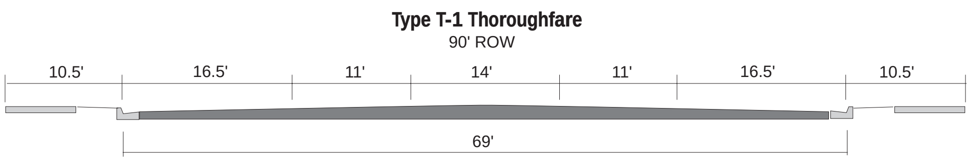
Appendices

Appendix 1: Lubbock's Thoroughfare Standards

The primary problem with the current design standard involves the 12-foot width for the outside through lane (see diagram below). To understand why this design is problematic, it is important to differentiate between physical width and usable width. According to the AASHTO Guide for the Development of Bicycle Facilities, the gutter pan should not be used in determining the usable width for safe bicycling. This is because the joint between the roadway and the gutter may be uneven. And an uneven joint may easily divert a bicyclist's front wheel and cause a crash. With an 18" gutter pan, the usable width of the outside lane in the T-2 standard is therefore reduced from 12' to 10.5' (12' - 1.5' = 10.5'). This results in a particularly narrow lane for sharing between bicycles and automobiles.

Proposed Standards





In addition, according to the Highway Capacity Manual (TRB, 1985), the effect of a bicycle in a lane equal to or narrower than 11' is 1.0 Passenger Car Equivalents in an unopposed situation; as a consequence, the bicyclist in a narrow travel lane can pose a noticeable interruption in motor vehicle traffic flow. This result confirms the impressions of many Lubbock bicyclists who feel seriously threatened in such narrow lanes. The Transportation Research Board further states that "the impact of bicycles sharing vehicular lanes increases as lane width decreases. When lane widths are 14 feet or greater, bicycles tend to use a portion of the lane as a bike lane, and have little impact on vehicular flow" (p. 14.2).

Another way to analyze the situation has recently been developed at the Traffic Institute (Sorton & Walsh, 1993). By considering outside lane width, peak hour volumes, and traffic speeds, the authors have been able to produce "stress levels" and resulting estimated Levels of Service for bicyclists. For the three factors, the following stress levels are assigned. A higher number corresponds with a more stressful situation.

Curb Lane Volume		Curb Lane Width*		Motor Vehicle Speed	
Veh/hr/lane	Stress level	in Feet	Stress level	in MPH	Stress level
≤50	1	≥15	1	≤25	1
150	2	14	2	30	2
250	3	13	3	35	3
350	4	12	4	40	4
≤450	5	≤11	5	≤45	5

*Not counting curb and gutter

To estimate the bicyclist's Level of Service, the authors then add the individual stress levels, average the them and convert to Level of Service, using the following table:

Stress level	Level of service
1	A
2	B
3	C
4	D
5	E

Using the Traffic Institute's analytical framework, the standard T-2 Thoroughfare was analyzed using three different traffic speeds: 35mph, 40mph, and 45mph. Average daily traffic was assumed to be 25,000 cars per day, a relatively typical volume for a Lubbock arterial roadway. The bicyclists' level of service was found to be D for the two lower speed cases and E for the higher speed case. The following table summarizes the results.

Bicyclist's level of service for typical Lubbock thoroughfare

ADT	*PHV*	*Curb Lane PHV*	*Stress Level (1-5)*	*Width*	*Stress Level (1-5)*	*Speed*	*Stress Level (1-5)*	*LOS*
25,000	2500	417	4	10.5	5	35mph	3	D
25,000	2500	417	4	10.5	5	40mph	4	D
25,000	2500	417	4	10.5	5	45mph	5	E

Traffic counts provided by the City of Lubbock's Traffic Engineering Department identify a number of sections of T-2 Thoroughfare, particularly in Southwest Lubbock currently carrying significantly more traffic than this. Such sections with 45mph speeds would clearly rate a bicycling LOS of E; however, a section with 40mph speeds would as well.

This analysis again confirms the perception of many Lubbock bicyclists: that the arterial network seems particularly hostile. It is likely that this common perception leads to a depressed level of utilitarian bicycling, compared to other communities with large colleges or universities.

Overall bikeway system costs per phase

Phase 1	Phase 2	Phase 3
$543,873.40	$767,868.60	$201,396.40

Cost details

Bike Routes

	Miles	*Signs/mile*	*Loop detector markings/mi.**	*Per phase*
Phase 1	15.3	$1,600.00	$100.00	$26,010.00
Phase 2	40.9	$1,600.00	$100.00	$69,530.00
Phase 3	65	$1,600.00	$100.00	$110,500.00
Dev. dependent	25.6	$1,600.00	$100.00	$43,520.00
Proj. dependent	3.7	$1,600.00	$100.00	$6,290.00

**Assuming no loop modifications needed.*

Bike Lanes

		Signs		*Striping*		*Markings*		*Loop detectors*		*Lane total*	
	Miles	*Per mile*	*Per phase*	*Per mile*	*Per phase*	*Per mile*	*Per phase*	*per mile***	*Per phase*	*Per mile*	*Per phase*
Phase 1	18	$1,056.00	$18,902.40	$2,640.00	$47,256.00	$900.00	$16,110.00	$650.00	$11,635.00	$5,246.00	$93,903.40
Phase 2	9	$1,056.00	$9,609.60	$2,640.00	$24,024.00	$900.00	$8,190.00	$650.00	$5,915.00	$5,246.00	$47,738.60
Phase 3	13	$1,056.00	$14,150.40	$2,640.00	$35,376.00	$900.00	$12,060.00	$650.00	$8,710.00	$5,246.00	$70,296.40
Dev. depend.	29	$1,056.00	$30,307.20	$2,640.00	$75,768.00	$900.00	$25,830.00	$650.00	$18,655.00	$5,246.00	$150,560.20
Proj. depend.	8	$1,056.00	$8,448.00	$2,640.00	$21,120.00	$900.00	$7,200.00	$650.00	$5,200.00	$5,246.00	$41,968.00

**Assuming 1 intersection per mile and no marking needed.

Grade separations

	Number	*Location*	*Type*	*Cost*
Phase 1	1	Memphis/S289	Overpass	$300,000.00
Phase 2	1	Ave U/S289	Overpass	$300,000.00
Phase 3				
Dev. dependent	2	Ave U	to be determined	$300-700,000
		Zenith	to be determined	$300-700,000
Proj. dependent	1	S Plains Mall	to be determined	$300-700,000

Connector trails

	Miles	*Location*	*Cost*
Phase 1	0.25	Leroy Elmore Park	$20,000.00
Phase 2			
Phase 3			

Major trail corridors

	Miles	*Location*	*Per mile*	*Cost*
Phase 1				
Phase 2	6	Canyon Lakes	$55,000.00	$330,000.00
Phase 3				

Bicycle parking program

	Racks			**Lockers**		
	No. of racks	*Cost per rack*	*Total*	*Number*	*Cost per locker*	*Total costs*
Phase 1	50	$75.00	$3,750.00	4	1562.5	$10,000.00
Phase 2	50	$75.00	$3,750.00	4	1562.5	$10,000.00
Phase 3	50	$75.00	$3,750.00	4	1562.5	$10,000.00

Bus/Bike Connections

	Racks on buses			**Parking pilot project**	
	No. of buses	*cost per bus*	*Total cost*	*No. of racks*	*Cost*
Phase 1	34	$540.00	$18,360.00	4	$600.00
Phase 2				4	$600.00
Phase 3				4	$600.00

Awareness/education programs

	Program	*Cost*
Phase 1	Young kids/parents	$31,500.00
	Adult rider program	$28,500.00
	Motorist awareness program	$15,000.00
Phase 2	Program maintenance	$10,000.00
Phase 3	Program maintenance	$10,000.00