




SELF-PROPELLED LEAWOOD

A PEDESTRIAN AND BICYCLE MASTER PLAN

September 2014

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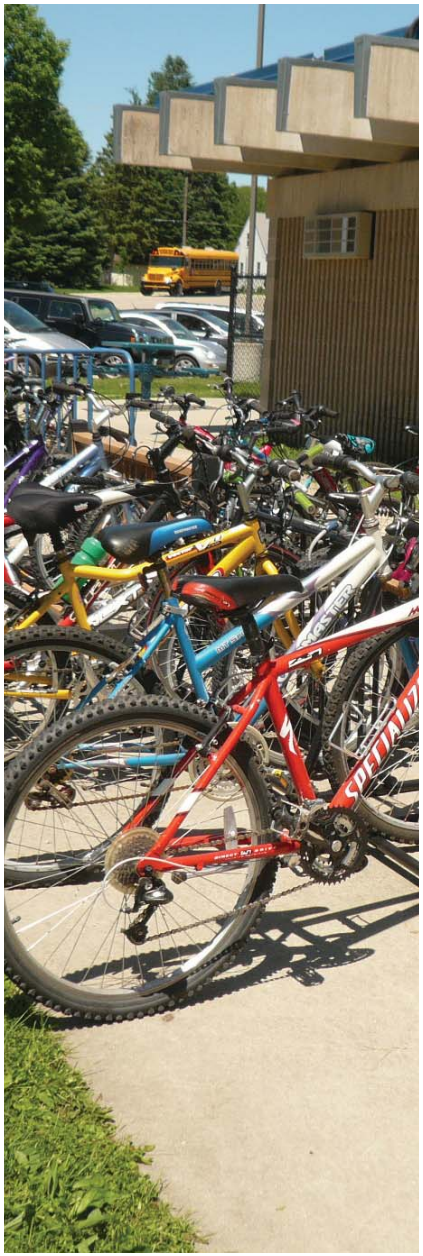
TABLE OF CONTENTS



INTRODUCTION

How we move is important to how well we live and affects many dimensions of health, both our own and that of our cities and our environment. We have been blessed with the ability to travel effectively under our own power. Many of us can walk or run for great periods of time and cover substantial distances, all the while thinking and taking delight in our beautiful setting. We can travel even farther and faster by bicycle, a remarkable vehicle that we can easily lift, travels at half the speed of a contemporary car in city traffic, gets the equivalent of 1,500 to 2,000 miles per gallon, produces zero emissions, makes almost no noise, can be parked outside the door of our destinations or even inside our homes or offices, and makes us healthier. Our ability and efficiency to transport ourselves is indeed a gift.

It is also a gift that makes economic sense. Infrastructure for people on foot or bike costs much less per mile than for motor vehicles. Pedestrians and cyclists travel by mechanisms that put almost no stress on sidewalks, streets, and trails. These same mechanisms have no impact on the environment, do not emit greenhouse gases or contribute to climate change. And they are inherently enjoyable, encouraging us to see each other as people and the gardens, houses, streets, yards, schools, and centers of our cities as a delight.

So now let's consider Leawood, a city that has a strong sense of its place in the metropolitan area and a strong commitment to healthy and creative living. In Leawood, 25 percent of all trips are made within a mile of the home; 40 percent of all trips are made within two miles of the home; 50 percent of the working population commutes five miles or less to work. These short trips are ideally suited to the modes that we call "active transportation." The average cyclist can travel three miles in only 15 minutes.

Leawood as a community understands these possibilities and has acted on this understanding by:

- Building new bike lanes on 123rd and 127th Streets, and soon, 143rd Street
- Developing and maintaining an excellent system of regional trails
- Holding bicycle rodeos and other special events
- Providing Bicycle Officers on its police force
- Encouraging safety and wellbeing by furnishing bicycle helmets at cost for resale to the public
- Establishing a Bicycle Friendly Citizen Committee

Walking and biking are very much parts of life in Leawood and people of all ages and capabilities use active transportation modes. Leawood has the opportunity to integrate enjoyable, healthy, active transportation into the everyday lives of its citizens. This master plan, ***Self-Propelled Leawood,*** is dedicated to making Leawood a place that encourages its citizens to use these healthy, low-impact, and intrinsically fun forms of transportation as a greater part of their routine lives.

This plan will propose a program that knits the city's neighborhoods and major destinations together with a network of facilities that is safe, pleasant, and comfortable for all groups. In doing so, it also recognizes that this network must be practical and affordable to the community, and must deliver benefits far in excess of its costs.

Living ***self-propelled*** is profoundly satisfying, and gives us the opportunity to experience the city, to be part of its pulse, and to see our fellow citizens on a personal basis. While we know that most trips will continue to be made by car, the city's transportation system should offer choices, including the option to feel safe and comfortable using the healthy, sustainable, and socially satisfying means of mobility that the bicycle and walking offer.

WHY ACTIVE TRANSPORTATION?

Goals of this Plan

Leawood has completed major projects that are both important recreational assets and the basis for a broader bicycle and pedestrian transportation system. ***Self-Propelled Leawood*** is a plan designed to help the city achieve the following goals:

Goal One: ***Increase the number of people who use walking and biking for transportation as well as recreation.*** Leawood's multi-use trails are well utilized and have a transportation function, but the overwhelming majority of users are recreational cyclists and pedestrians. A measurement of the success of this plan will be significantly increasing the percentage of trips for a variety of purposes. Chapter Two includes estimates of current and future utilization of a bikeway system.

Goal Two: ***Improve bicycle and pedestrian access to key community destinations.*** A bicycle transportation system should get people comfortably and safely to where they want to go. Therefore, Leawood's system should be destination-based, providing clear and direct connections to key community features. Also, intersections, gaps in sidewalks, and other barriers can discourage people from walking along Leawood's streets and trails. Removing these barriers and creating more comfortable environments are important objectives of this plan.

Goal Three: ***Improve access to the city's pathway system by providing connecting links from neighborhoods to trails.*** Leawood's trails are the arteries of its bikeway system, and will continue to serve the majority of bicycle trips, particularly when crossing beneath the Interstate. But the city's emerging trail system can be connected to more neighborhoods by judiciously using the street system (and other development opportunities) as linkages.

Goal Four: ***Use walking and bicycling as part of an effort to make Leawood more sustainable at three levels: global, community, and individual.*** Trips made by bicycle promote community sustainability in three ways:

- **Global sustainability.** Bicycle transportation reduces fossil fuel use and greenhouse gas emissions, helping the city reduce its impact on the global environment. A more walkable and bikeable Leawood will not save the planet. But as a great sage said about 2,000 years ago, "It's not your job to finish the task, but you are not free to walk away from it."

- **Community sustainability.** A complete and heavily used bicycle transportation system can help reduce the cost of government by marginally reducing the need for more expensive projects. In Portland, Oregon, for example, spending 2 percent of the city's overall transportation budget on active modes of transportation since 1996 has caused bicycling to increase from 1 to 6 percent of all commuter trips – an excellent return on investment. Reducing emissions also helps ensure that Leawood will maintain its status as a healthy environment for its citizens. On a social level, bicycling builds community by enhancing the quality of civic life, helping us interact with each other as people. Places that lead in bicycle transportation also tend to attract people because of their community quality.

- **Individual sustainability.** This is a very important objective which promotes community health through better individual health. Incorporating physical activity into the normal routine of daily life for everyone from kids to seniors makes all of us healthier, reduces overweight and obesity rates, improves wellness, and lowers overall health care costs.

Goal Five: ***Receiving a GOLD level Bicycle Friendly Community status from the League of American Bicyclists (LAB).*** The Sustainability Advisory Board (SAB), a citizen committee encouraging green initiatives in Leawood, identified a goal of improving green mobility. Seeking designation form LAB places metrics on policies, programs, and actions to becoming a city that seeks to improve mobility options and health in Leawood for the betterment of the city's future. The results from the 2009 application identified a number of actions for the city. The preparation of this plan becomes a roadmap for Leawood's future application.

Goal Six: ***Increase safety on the road for motorists, bicyclists, and pedestrians.*** Improved safety is a critical goal for any transportation improvement, and is fundamental to efforts to increase the number of people who walk and bike in the city. In addition, national research indicates a strong relationship between the number of cyclists and motorists crash rates. (Jacobson, Injury Prevention 9:205-209 [2003]) Infrastructure must also be supported by education, enforcement, and encouragement programs, and its effectiveness measured by evaluation.

Goal Seven: ***Capitalize on the development benefits of a destination-based bicycle transportation system.*** Leawood has many great features that appeal to residents and businesses. It has become increasingly clear, though, that walkability and bikeability are highly valued by a new generation of homeowners and investors. The dramatic impact of projects such as Atlanta's Belt Line, Minneapolis' Midtown Greenway, Indianapolis' Culture Trail, and the investments made by cities large (like New York and Chicago), medium sized (like Portland), and small underlines the importance of active transportation to the continued growth and prosperity. Leawood as a pedestrian and bicycle-friendly community will maintain its status as one of America's great places to live , work, play, and shop.

MEASURES OF SUCCESS:

Guiding Criteria for an Effective Transportation Network

The design of bicycle and pedestrian transportation systems should be guided by criteria that can be used to evaluate individual components and the effectiveness of the entire network. We elaborate on these criteria in Chapter Three, which are based on the work of the Netherlands' Centre for Research and Contract Standardization in Civil and Traffic Engineering (C.R.O.W.), one of the world's leading authorities in the design of bicycle-friendly infrastructure. These same criteria also apply to pedestrian networks. Drawing on C.R.O.W.'s work in its excellent design manual, ***Sign Up for the Bike***, Leawood's bicycle and pedestrian network should be guided by six basic requirements:

- **Integrity (or, in C.R.O.W.'s term, Coherence)**: Leawood's bikeway network should, at all points in its evolution, form a coherent system that links starting points with destinations. The network should be understandable to its users and fulfill a responsibility to convey them continuously on their paths.
- **Directness**: Leawood's bikeway network should offer cyclists as direct a route as possible, with minimum detours or misdirections.
- **Safety**: Leawood's bikeway network should maximize the safety of using the bicycle for transportation, minimize or improve hazardous conditions and barriers, and in the process improve safety for pedestrians and motorists.
- **Comfort**: Most bicyclists should view the network as being within their capabilities and not imposing unusual mental or physical stress. As the system grows, more types of users will find that it meets their needs comfortably.

- **Experience**: The Leawood bicycle network should offer its users a pleasant and positive experience that capitalizes on the city's built and natural environments.

- **Feasibility**: The Leawood bicycle network should provide a high ratio of benefits to costs and should be viewed as a wise investment of resources. It is capable of being developed in phases and growing over time.

PLAN METHODOLOGY AND STAKEHOLDER INVOLVEMENT

It was extremely important to structure a planning process that maximized both public involvement and our understanding of the physical structure and community character of Leawood. A Master Plan Committee, representing city staff, bicycle and walking community members, the private sector, and other community interests met throughout the planning process, with an initial meeting in September 2013. Major public involvement events included:

- **Field reconnaissance and stakeholder groups.** These visits included initial field work on bicycle and interest/ stakeholder group discussions, helping us become familiar with issues and the overall structure of Leawood's neighborhoods and street system. During this process, we rode every mile of every street in the city and took over 1,500 of photographs.
- **Bicycle and Pedestrian Survey.** This survey, explored the characteristics of Leawood residents interested in bicycling and measured their level of comfort with different types of facilities. The survey attracted 185 responses and produced information to help frame the direction of this plan.
- **Area Charrettes.** The charrettes were a central part of the planning process. The city was divided into three sections: north, central, and south. Each charrette included extensive field work on bicycle during the days, and public meetings in the evening to discuss results and concepts.
- **Home Owner's Association meeting.** On February 27, 2014, the principal recommendations of the Bicycle and Pedestrian Plan were presented at the Home Owner's Association Meeting.

The results of this process are used throughout the plan, and Chapter Two presents the results and implications of the survey in detail.

ORGANIZATION OF THE PLAN

The Leawood Bicycle and Pedestrian Master Plan presents its analysis and recommendations in the following chapters:

1. **Chapter One: Active Transportation Environment.** Chapter One examines existing conditions in the city pertinent to walking and bicycling, including determinants of a future bikeway system such as destinations, existing facilities, and opportunities.

2. **Chapter Two: The Market for Active Transportation.** Chapter Two estimates current pedestrian and bicycle demand and the potential future market. It also reviews the Leawood Bicycle and Pedestrian Survey, which provides extensive information about people interested in urban bicycling in Leawood and their needs, concerns, and preferences.

3. **Chapter Three: The Active Transportation Network: Principles and Structure.** Chapter Three uses the analysis of Chapters One and Two to establish over-all principles that guide the proposed Leawood network. It also elaborates on the measurement criteria previously presented to help guide the system's components. Finally, it presents a complete conceptual system of pedestrian and bicycle facilities.

4. **Chapter Four: On Foot in Leawood.** Chapter Four analyzes the city's pedestrian environment, based again on extensive field research. It develops a strategic program for improving the web of sidewalks, paths, and other infrastructure, and examines ways of addressing and redesigning barriers that tend to discourage people from walking for enjoyment or transportation.

5. **Chapter Five: Bicycle Infrastructure Design Concepts and Guidelines.** Chapter Five presents the vocabulary of facilities and street adaptations proposed for the Leawood network, based on the Leawood's specific design contexts and street characteristics. It concludes by applying the infrastructure types to the conceptual bikeway network and its various routes.

6. **Chapter Six: Route Details and Sequencing.** Chapter Six includes a detailed, route-by-route facility program, showing proposed design solutions for each segment of the system. It discusses criteria for determining the sequence of development and presents a phased implementation program, along with probable costs for different infrastructure types. Finally, it proposes an initial pilot network, based on serving all parts of the city and early feasibility.

7. **Chapter Seven: Support Programs.** The League of American Bicyclists describes five "E's" as components of a bicycle-friendly community (BFC) program and judges BFC applications accordingly. These program categories are Engineering, Education, Encouragement, Enforcement, and Evaluation. Chapters One through Five largely address the Engineering component; Chapter Seven recommends initiatives that support these infrastructure investments to achieve bicycle transportation's full potential as part of Leawood's access environment.

CHAPTER 1

ACTIVE TRANSPORTATION ENVIRONMENT

THIS CHAPTER OUTLINES THE EXISTING CONDITIONS IN THE CITY PERTINENT TO WALKING AND BICYCLING. These conditions include determinants of a future bikeway system such as destinations, existing facilities, and opportunities as well as a broader understanding has to how the city has developed and grown from land use and motor vehicle transportation aspects.

Figure 1.1: Existing Land Use

The Existing Land Use Map from the Leawood comprehensive plan illustrates the distribution of development in the city. Notable aspects of the map include commercial clusters along major streets, residential development throughout, and a series of recreation open spaces following drainage areas. This pattern is very favorable for establishing a base-level market for pedestrians and bicyclists.

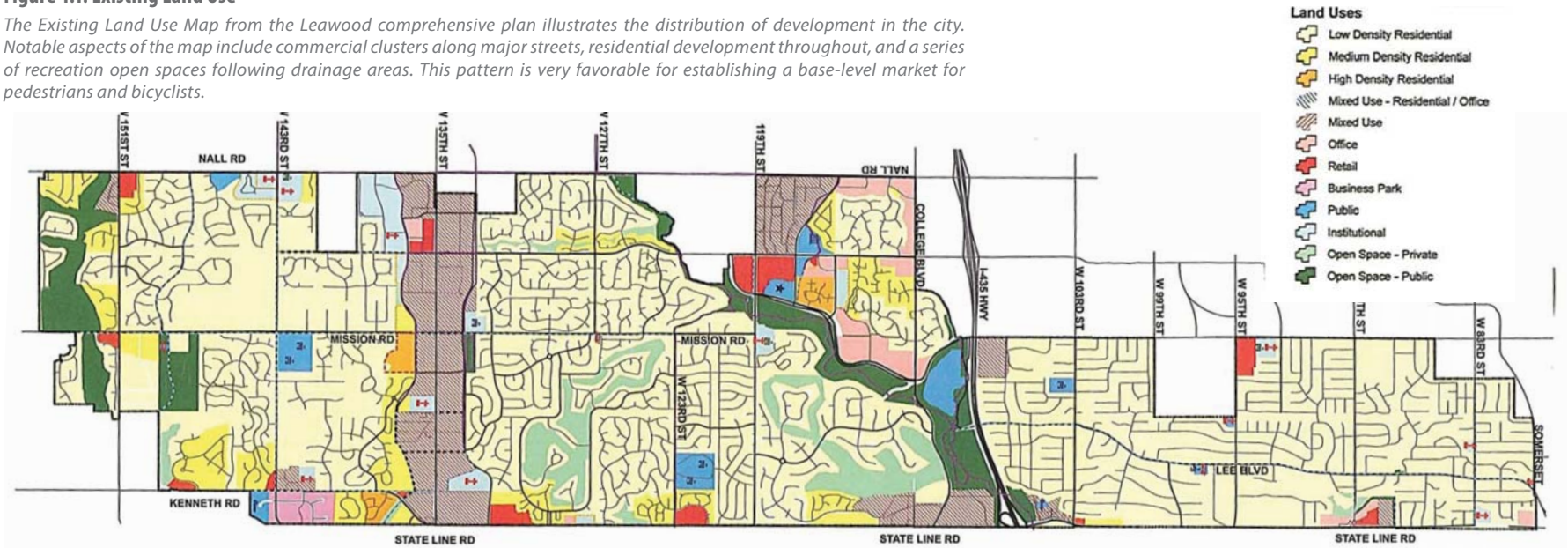


Figure 1.2: Trail and Open Space Study from Leawood Comprehensive Plan

The Comprehensive Plan included a trail and open space concept that provides a starting point for the analysis and ideas included in this much more complete document.

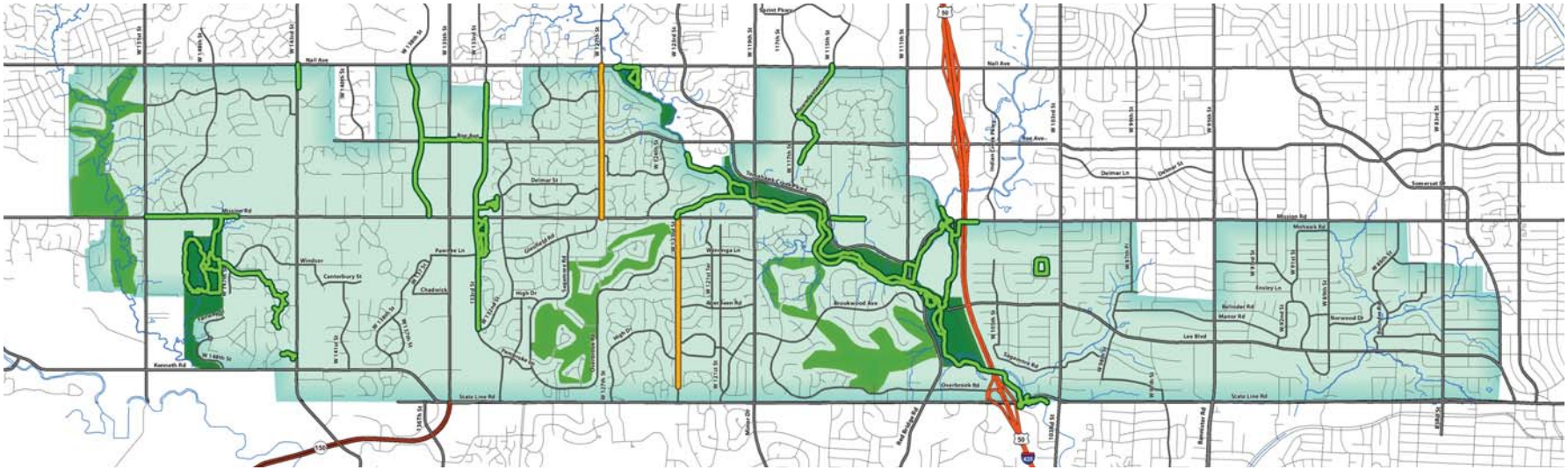


Figure 1.3: Transit Service in Leawood, 2013

Transit services provide the opportunity for dual mode trips or for contingency plans for commuters in bad weather. The city has poor bus coverage.

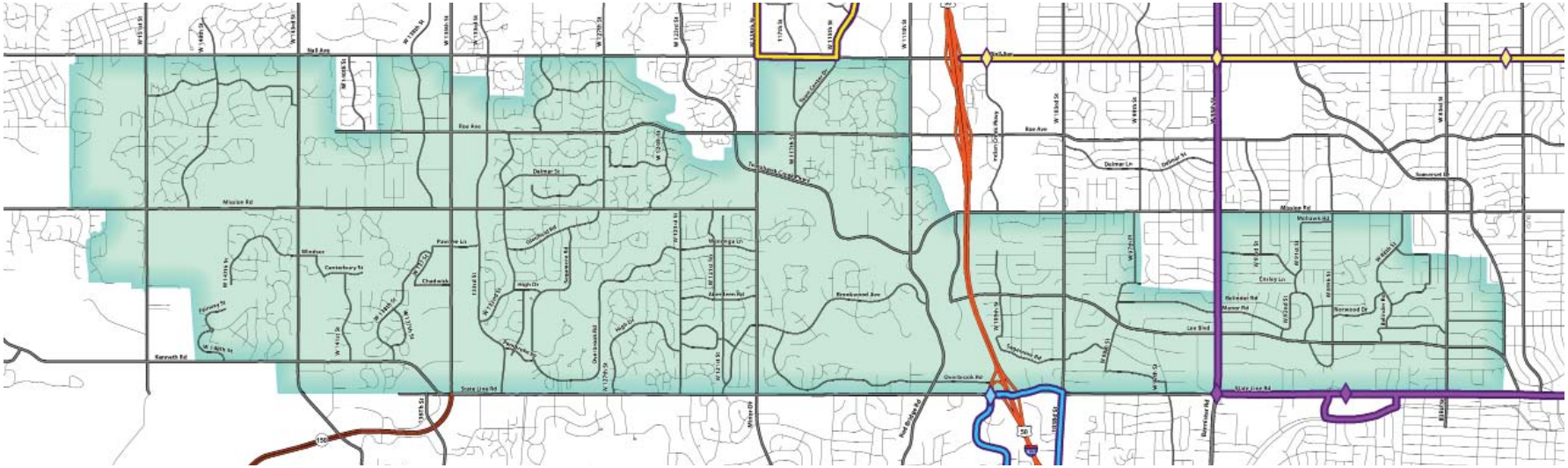
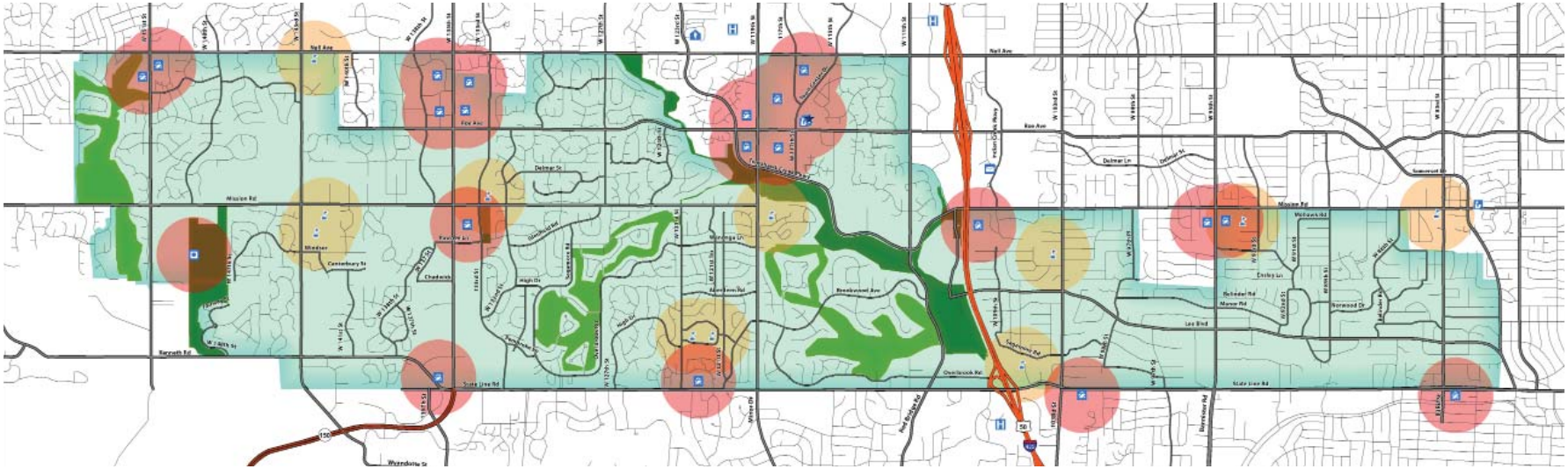


Figure 1.4: Destinations

A bicycle and pedestrian transportation system should provide practical service to destinations. This map displays the layout of logical places that can be served by multi-modal transportation.



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CHAPTER 2

MARKETS FOR ACTIVE TRANSPORTATION

THIS CHAPTER INVESTIGATES THE MARKET FOR BICYCLING IN LEAWOOD – THE NUMBER OF POTENTIAL CYCLISTS AND THE PREFERENCES OF THAT POTENTIAL MARKET. It draws heavily on new and recent census information, national trends, and the 185 citizens who responded to the Leawood Bicycle and Pedestrian Survey.

Before building a major shopping center or apartment project, a developer usually commissions a market analysis, designed to determine whether enough people will shop or live there to support the effort and to define the features that will appeal to customers. Similarly, an active transportation master plan should also evaluate the size and character of the potential market. This helps assess the impact of a bicycle and pedestrian transportation program on factors such as motor vehicle traffic and emissions. It also helps us understand what the existing and potential bicycling community wants of the program, in turn increasing the chances that bicycling can reach its potential in Leawood.

This market study uses two major instruments:

- **Estimates of existing and future pedestrian and bicycling demand**: Using a demand model developed by Alta Planning & Design that is clear, straightforward, and easy to track for future measurement.
- **The results of the Leawood Bikeways survey**: This survey was completed by 185 people, a high participation rate for a community of this size, and provides valuable information about the city's potential active transportation community.

EXISTING PEDESTRIAN AND BICYCLE DEMAND

Tables 2.1 and 2.2 use the Alta model to estimate existing and potential pedestrian and bicycle demand. Primary sources of information include the 2008-2012 average computations of the American Community Survey (ACS), developed by the Bureau of the Census, and 2010 Census data released to date. The model makes certain assumptions about transportation choices of populations such as K-12 and college students. The sources of these assumptions are included in the table.

Leawood now has an estimated 8,769 daily pedestrian trips and just over 2,750 daily bicycle trips for all purposes (including recreational activity). Bicycling has a 0.8 percent commuter mode share – that is, 0.8 percent of all commuters travel by bicycle, well above the national share of about 0.5 percent. This contrasts with Minneapolis with a bicycling mode share of about 3.9 percent, one of the highest in the nation. However, Leawood's share is relatively high for a city with limited commuting infrastructure.

Midpoint Demand

Tables 2.1 and 2.2 provide both projections of trips made by pedestrians and bicyclists at 50 percent and 100 percent completion of the proposed system, based on a 20 year implementation schedule. At the midpoint, enough infrastructure has been put in place to have a significant impact on transportation choices. This midpoint model paints a picture of what Leawood's transportation could be 10 years from now with gradual implementation of an improved pedestrian and bicycle system. It assumes that:

- Walk-to-work commuters increase from about 0.6 to 0.9 percent of all workers, a very modest increase.
- Transit's share of the modal mix increases from 0% to a modest 0.8 percent.
- Bicycle commuting, encouraged by new infrastructure, could increase to about 1.2 percent – a level equivalent to the more bicycle-friendly cities in the nation but well below top performers like Portland and Minneapolis.

20 percent of K-8 students will walk to school, about double the current level. This is still far lower than the 60 percent of students who walked to school 30 years ago.

Applying these changes increases daily pedestrian trips from about 8,700 to about 14,700, a gain of almost 50 percent in 10 years. Bicycle trips increase from about 2,700 to about 5,900, about a 300 percent increase. These very attainable changes begin to have a real impact on the overall transportation picture in Leawood. This model assumes that 9.5 percent of commuting trips are made by "active transportation" modes – bus, foot, and bicycle – in line with the 10 percent goal established by a number of cities.

2030 Potential Demand

Tables 2.1 and 2.2 project full implementation in Leawood of the complete pedestrian and bikeway system, along with supporting education and encouragement programs. This projection assumes that Leawood will grow at an average annual rate of 0.57 percent during the next 20 years. It also projects that active modes will claim a 13 percent mode share within 20 years and that 2 percent of Leawood residents will cycle to work. The number of students walking to school will increase to 30 percent, still far below levels experienced twenty years ago. These assumptions result in an increase of weekday pedestrian trips from 8,700 today to about 22,400; and an increase in weekday bicycle trips from about 2,700 to about 9,600.

Achieving this level and assuming that 60 percent of these trips are currently being made by car saves 19,200 auto trips per weekday and about 7 million trips per year. If each trip averages three miles, Leawood residents drive 21 million fewer miles per year, saving 840,000 gallons of gasoline assuming an average of 25 mpg. Given uncertainties during the next 20 years, these projections could well prove conservative. But even these calculations indicate that citizens collectively will save the equivalent of $2,500,000 annually in gasoline purchases.

Active transportation also can have significant health benefits. Assuming that the average bicycle trip is about two miles and the average pedestrian trip is 0.5 miles, the projected number of trips made by active transportation adds 14,000 bicycle miles (or 1,100 hours at 12 mph) and 6,800 pedestrian miles (or 2,300 hours at 3 mph). The impact of this level of physical activity and calorie consumption can be highly beneficial to the city's residents.

It is also important to note that these projections do not include technological change that can make bicycling even more widespread. Many observers believe that the introduction of e-bikes, which use a small electric motor to assist pedal-driven bicycles, will broaden the appeal of bicycling for transportation. On-street infrastructure is particularly well-suited to accommodating these more capable vehicles.

Comparative Cities' Mode Share

City	Total Number of Commuters	Walk %	Bike %
Alexandria, VA	87,335	3.81	0.99
Anchorage, AK	151,634	2.67	1.13
Arvada, CO	54,067	0.75	0.56
Beaverton, OR	45,088	5.26	1.25
Bellevue, WA	62,816	4.62	0.52
Bellingham, WA	39,549	8.20	3.99
Bethesda, MD	31,273	6.18	2.00
Burlington, VT	22,102	20.31	4.98
Cedar Falls, IA	20,434	11.80	0.71
Des Moines, IA	100,648	2.75	0.43
Duluth, MN	41,863	5.15	0.82
Edina, MN	22,799	1.95	0.96
Evanston, IL	35,618	11.64	3.01
Fargo, ND	62,074	4.44	1.08
Fitchburg, WI	13,166	1.63	0.90
Gresham, OR	46,692	2.31	0.46
Hopkins, MN	9,595	2.53	0.67
Lee's Summit, MO	46,219	0.52	0.02
Lincoln, NE	138,108	3.13	1.54
Montclair, NJ*	18,486	4.02	0.34
Shorewood, WI	7,575	9.19	3.60
Sioux Falls, SD	84,504	2.19	0.52
Wauwatosa, WI	24,799	2.31	0.59
Wheat Ridge, CO	14,724	2.00	0.92

Source: 2012 ACS 5 Year Estimates
**Source: 2009 ACS 5 Year Estimates*

Table 2.1: Existing and Projected PEDESTRIAN Transportation Trips, 2010-2030

Pedestrian Trips in Leawood	2012	2012 Mode Share (%)	2020	2020 Mode Share (%)	2030	2030 Mode Share (%)	Assumptions/Sources
Population	32,233		33.697		35,527		2012: ACS; 2020 and 2030: Comprehensive Plan Projections: +0.57% annual growth
Total Commuting to Work	15,094		15,780		17,689		46.8% of Leawood population commutes to work, ACS 2012
Walking to Work (%)	.6%		.9%		1.2%		
Walking to Work (#)	91		142		212		
Work at Home	1,389		1,452		1,628		9.2% of Leawood workers work at home, ACS 2012
Work at Home Pedestrian Trips	347	25% make one ped trip	465	32%	651	40%	Assumption that percentage of trips increases over decades with improved facilities.
Take Transit to Work (#)	0	0% take transit	126	0.8%	265	1.5%	
Walk to Transit	0	90% walk to transit	114	90%	239	90%	
School Population (K-8)	5,202		3,524		3,613		K-8 students = 16.2% of Leawood population, ACS 2012
School (K-8) Pedestrian Trips	572	11% walk to school	1,088	20%	1,720	30%	Safe Routes to School National Partnership, 2009. 13% of children walk OR bike to school
School Population (9-12)	1,935		2,023		2,133		9-12 students = 6% of Leawood population, ACS 2012
School (9-12) Pedestrian Trips	106	5.5% walk to school	111	5.5%	117	5.5%	
College	1,172		1,225		1,292		College Students=3.6% of Leawood population, ACS 2012
College Pedestrian Trips	59		61	5%	65	5%	5% walk to school
Total Pedestrian Commuters	1,175		1,980		3,004		
Total Pedestrian Commuter Trips (Commuters x2)	2,351		3,961		6,008		2 trips for each commuter
Other Trips Ratio (commuter to non-commuter trips)	2.73		2.73		2.73		U.S. DOT, Federal Highway Administration, 2001 National Household Travel Survey, via Alta Planning & Design
Other Pedestrian Trips	6,418		10,813		16,403		Commuter Trips x Other Trips Ratio
Total Daily Pedestrian Trips	8,769		14,774		22,411		Commuter Trips + Other Trips

Table 2.2: Existing and Projected BICYCLE Transportation Trips, 2010-2030

Bicycle Trips in Leawood	2012	2012 Mode Share (%)	2020	2020 Mode Share (%)	2030	2030 Mode Share (%)	Assumptions/Sources
Population	32,233		33,697		35,527		2012: ACS; 2020 and 2030: Comprehensive Plan Projections: +0.57% annual growth
Total Commuting to Work	15,094		15,780		17,689		46.8% of Leawood population commutes to work, ACS 2012
Biking to Work (%)	0.8%		1.2%		1.8%		Assumption that there is an increase from 0.8% to 1.8% with improved facilities.
Biking to Work (#)	118		189		283		
Work at Home	1,389		1,452		1,628		9.2% of Leawood workers work at home, ACS 2012
Work at Home Bike Trips	69	5% make one bike trip	87	6%	114	7%	Moderate increase with improved facilities.
Take Transit to Work (#)	0	0%	126	0.8%	265	1.5%	
Bike to Transit	0	0%	5	4%	13	5%	Moderate increase with improved facilities.
School Population (K-8)	5,202		5,438		5,734		K-8 students = 16.2% of Leawood population, ACS 2012
School (K-8) Bike Trips	104	2%	326	6%	573	10%	Safe Routes to School National Partnership, 2009. 13% of children walk OR bike to school
School Population (9-12)	1,935		2,023		2,133		9-12 students = 6% of Leawood population, ACS 2012
School (9-12) Bike Trips	19	1%	61	3%	107	5%	
College	1,172		1,225		1,292		College Students=3.6% of Leawood population, ACS 2012
College Bike Trips	59	5%	123	10%	194	15%	
Total Bike Commuters	369		791		1,284		
Total Bike Commuter Trips (Commuters x2)	739		1,582		2,568		2 trips for each commuter
Other trips ratio (Commuter to non-commuter trips)	2.73		2.73		2.73		U.S. DOT, Federal Highway Administration, 2001 National Household Travel Survey, via Alta Planning & Design
Other Bike Trips	2,017		4,319		7,011		Commuter Trips x Other Trips Ratio
Total Daily Bike Trips	2,756		5,901		9,579		Commuter Trips + Other Trips

SELF-PROPELLED LEAWOOD SURVEY

The estimates discussed above help quantify the size of a potential active transportation market and also help to assess some of the basic economic and health benefits achieved by reaching this market. With realistic mode projections, Leawood could reach 30,000 daytime active transportation trips. The Self-Propelled Leawood Survey helps define the preferences and opinions of these prospective cyclists and pedestrians, and provides important guidance for designing the network.

Who are Leawood's Active Transportation Users?

While the Self-Propelled Leawood Survey was not a scientific survey, the number and diversity of responses suggested that it represented a fairly representative sample of citizens with interest in active transportation. The first questions explored the characteristics of these responses, and found that:

Figure 2.3: Place of Residence of Participants

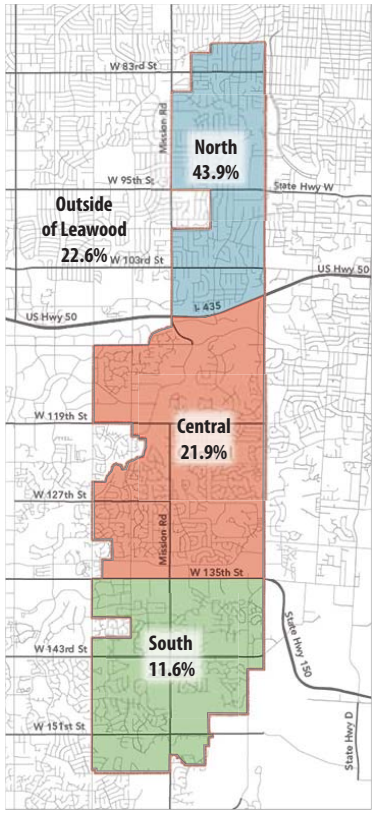
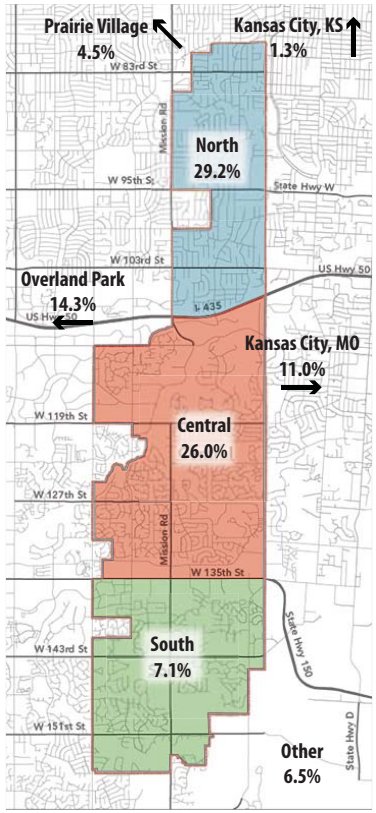


Figure 2.4: Common Destination of Participants



- **Survey respondents represent all parts of the city.** This suggests that residents in all parts of the city are interested in active transportation and that a complete system will find an audience across all of Leawood. About 44 percent of respondents live north of the I-435 axis, 33.5 percent south and 22.5 percent outside the city limits. Figure 2.3 illustrates the distribution of responses.

- **Destinations are distributed within Leawood and the surrounding cities, the highest density destination being north Leawood.** Many residents are, however, traveling outside of Leawood. A more robust active transportation system may entice residents to seek more local destinations within city limits. (Figure 2.4)

PEDESTRIAN PERCEPTIONS

- **Responses for regular pedestrian activity accounts for just over half the total number of responses.** Roughly 53 percent of participants reported walking at least once or twice a week; 47 percent of respondents walk only once or twice a month or less, a very small percent do not walk at all. This is a very hopeful sign that any improvements to the system will see a high level of activity and encourage those who do not regularly, but are interested to walk. (Figure 2.5)

- **Exercise and recreation-related purposes are by far the most frequent reasons mentioned for walking.** The next three largest trip purposes (trips to parks or recreation facilities, family outings, and social visits) also involve recreational purposes. A smaller but significant group walks for transportation to train for events, errands, shopping and community destinations. But recreation remains the most common reason for cycling and walking.

- **The largest group of respondents are pedestrians most interested in improved infrastructure.** The largest single group, over 49 percent, characterized themselves as confident pedestrians and capable of using any route, but believe improvements and new facilities will enhance their environment. The next largest group, about 30 percent, were

interested in walking or running, but were concerned about safety along busy streets. Very small groups were at the edge of the interest spectrum – 3.5 percent responded to being comfortable in every situation and seeing no reason for infrastructure development, and fewer reported that they were unlikely to walk under any circumstances (2.8 percent)

Infrastructure Types

Much of the survey was designed to assess the type of pedestrians, current and prospective, who live in Leawood. To help determine what environments residents find comfortable, the survey asked participants to respond to a few photographs of streets and facilities. The images for evaluating streets were in Leawood, while infrastructure solutions typically came from other cities. Through their responses, participants determined:

- Whether the setting is comfortable for most or all pedestrians.
- Whether the setting is comfortable for the respondent, but not necessarily for less avid walkers/runners.

The images in Figure 2.8 group survey images on the basis of their combined favorability ratings and show the following results:

- The top-rated setting is the right turn bypass median and the other crossings followed. Comfort levels increase the more separation there is between vehicular traffic and pedestrian flow. Modifications to the crossing to provide safe zones along the crossing route ranked higher than the typical crossing.

Importance of Various Actions

Responses to a list of possible actions to improve Leawood's pedestrian environment indicated a strong priority for infrastructure improvements. Initiatives that ranked highest included efforts to infill sidewalks along major streets and around schools. Supporting efforts, including trail development, protected areas within crossings, and safe routes in retail areas were also considered very effective by over 70 percent of respondents. Figure 2.9 presents the percentage of survey responses calling an action effective or very effective for increasing pedestrian activity in the city.

Figure 2.5: Frequency of Walking/Self-Description

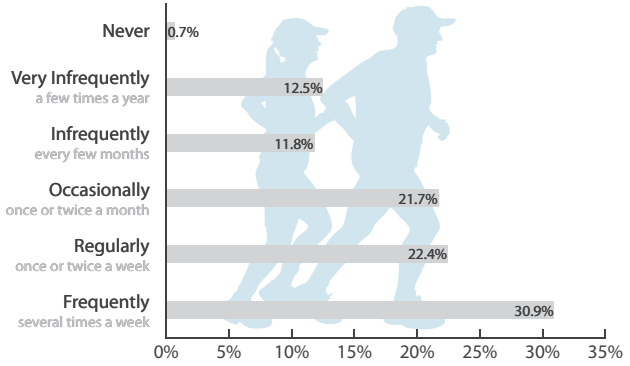


Figure 2.6: Purposes of Walking Trips

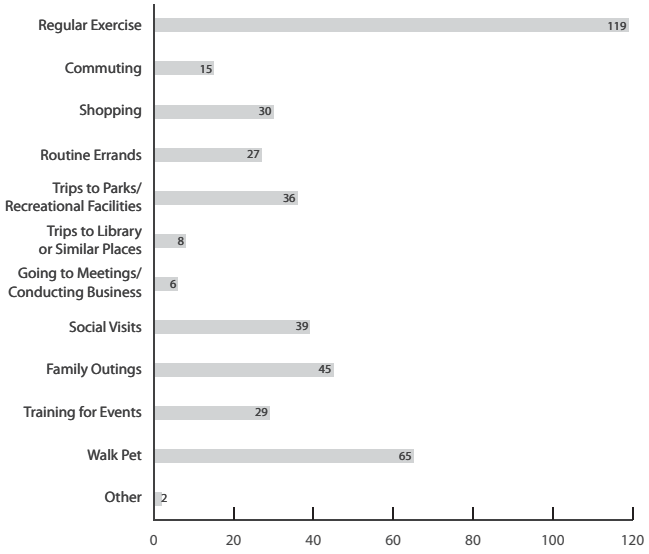


Figure 2.7:
Self-Characterization of Participants

CONFIDENT AND FEARLESS: I am a confident pedestrian who will walk/run any route. I don't believe that any significant further action on pedestrian facilities is necessary. **3.5%**

COMMITTED PEDESTRIAN: I am a confident pedestrian who will walk/run any route, but believes that new facilities like sidewalks and trails are needed to improve Leawood's pedestrian environment for me and encourage other people to walk/run more often. **49.3%**

INTERESTED AND CONCERNED: I am interested in walking/running more often, but am concerned about the safety along busy streets. More sidewalks (or replacing damaged/missing walks) and trails would increase the amount of trips that I make by foot. **30.3%**

RECREATIONAL TRAIL USER: I am a recreational or occasional walker/runner and travel primarily on trails. I would like to see more trails, but am unlikely to walk/run on city streets even with sidewalks. **10.6%**

INTERESTED NON-WALKER: I do not ride a walk/run now, but might be interested if Leawood developed facilities that met my needs better or made me feel safer. **3.5%**

NON-WALKER UNLIKELY TO WALK: I do not walk/run, and am unlikely ever to do so. **2.8%**

PEDESTRIAN CONCLUSIONS

This consideration of market potentials and preferences tells us that:

- **There is a substantial potential market for pedestrian activity in Leawood.** Reasonable and attainable assumptions, based on meeting infrastructure and supporting needs, suggest that the number of weekday pedestrian trips can increase from the current level of 8,700 trips to 22,000 daily trips within 20 years.
- **The nature of people responding to the Bikeways Survey helps substantiate the conclusion of substantial growth potential for active transportation.** Over half the respondents are frequent walkers or runners, but their participation and responses indicate a substantial interest in increasing their own level of safety.
- **Participants placed a high priority on both infrastructure improvements and supporting initiatives like safety programs.** Generally, projects focused on improving access and safety for school children ranked highly and were seen as effective measures.

Figure 2.8: Comfort Rating of Various Infrastructure Settings

Comfortable for most people and comfortable for me: 80-90% favorable

Comfortable for most people and comfortable for me: 60-80% favorable

Figure 2.9: Effectiveness of Various PEDESTRIAN Actions

Very Effective or Effective Over 70% ★★★★★	Very Effective or Effective 50-70% ★★★★	Very Effective or Effective Less than 50% ★★★
Constructing sidewalks on at least one side of all major streets	Establishing groups of kids walking to school under the supervision of parents [walking school buses]	More enforcement of traffic laws
Providing sidewalks on at least one side of the street for a specific area around schools	Better markings at crosswalks	More community walking events
Installing pedestrian crossing signals at school crossings and other important locations	Count down crossing signals	
Constructing sidewalks on other streets with heavy pedestrian use	Better design of sidewalk ramps at intersections	
More safe routes to schools projects and activities	Wayfinding and directional signs	
Having a safe walkway between streets and public sidewalks to the entrance of shopping centers		
Better project design that improves walkability		
Better crossings of major streets		
More trail development		
Providing protected area for pedestrians at crossings of wide streets		
Providing pedestrian paths within retail developments		

CYCLISTS' RESPONSES

- **Responses for regular cyclists nearly double those from infrequent riders.** In fact, roughly 63 percent of participants reported riding once or twice a week or more; 37 percent rode only once or twice a month or less, down to not at all. This is a very hopeful sign that any improvements to the system will see a high level of activity. (Figure 2.10)

- **Exercise and recreation-related purposes are by far the most frequent reasons mentioned for bicycling.** The next three largest trip purposes (trips to parks or recreation facilities, family outings, and touring) also involve recreational purposes. A smaller but significant group use bicycles for transportation to work, social visits, errands, and shopping. But recreation remains the most common reason for cycling and walking.

- **The largest group of respondents are cyclists most interested in improved infrastructure.** The largest single group, 46 percent, characterized themselves as committed to cycling and capable of using a mix of streets, but believes improvements should be made to Leawood's biking environment. The next largest group, about 37 percent, were interested in cycling and comfortable on low-traffic streets, but showed concerns for safety and see a real need for new facilities to expand ridership and improve safety. Very small groups were at the edge of the interest spectrum – only about 1.5 percent responded to being comfortable in every situation and seeing no reason for infrastructure development, and few reported that they were likely to ride under any circumstances (4.3 percent)

Figure 2.10: Frequency of Cycling

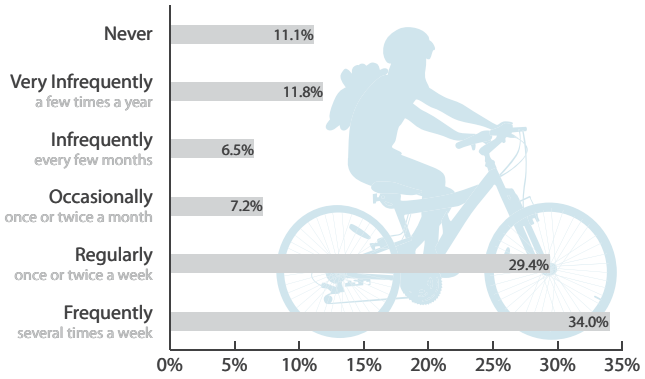


Figure 2.11: Purposes of Cycling Trips

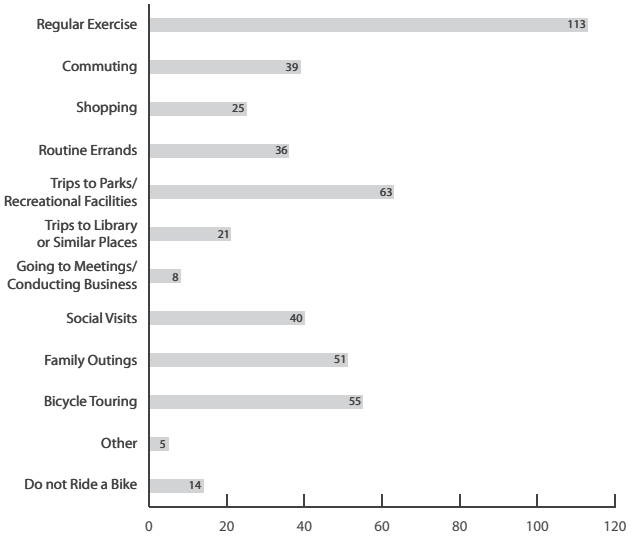


Figure 2.12:
Self-Characterization of Participants

COMMITTED AND FEARLESS: I am a committed bicyclist who rides in mixed traffic on every street. I don't believe that any significant further action on bicycle facilities is necessary. **1.4%**

COMMITTED URBAN CYCLIST: I am a committed bicyclist who rides in mixed traffic on most streets, but believes that new facilities like bike lanes, bike routes, and trails are needed to improve Leawood's biking environment for me and encourage other people to ride more often. **46.1%**

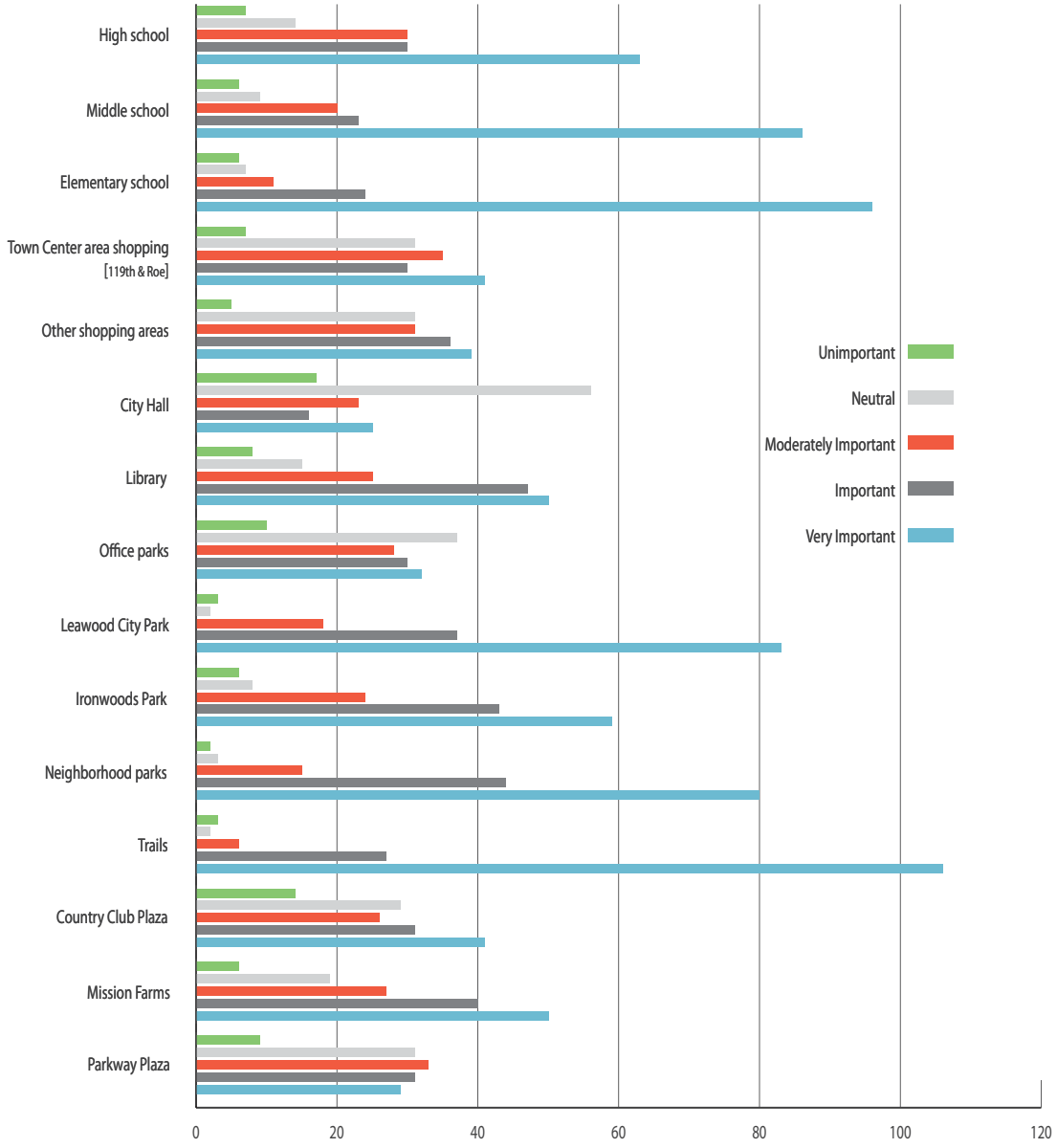
INTERESTED AND CONCERNED: I am interested in bicycling and use low-traffic streets, but am concerned about the safety of riding in mixed automobile traffic. More trails and bike lanes and routes would increase the amount of trips that I make by bicycle. **36.9%**

RECREATIONAL TRAIL USER: I am a recreational or occasional bicyclist and ride primarily on trails. I would like to see more trails, but am unlikely to ride on city streets even with bike lanes **5.7%**

INTERESTED NON-RIDER: I do not ride a bicycle now, but might be interested if Leawood developed facilities that met my needs better or made me feel safer. **5.7%**

NON-RIDER UNLIKELY TO RIDE: I do not ride a bicycle, and am unlikely ever to do so. **4.3%**

Figure 2.13: Importance of Various Destinations



Destinations

A bicycle transportation network should get people where they want to go. The survey listed a number of different community destinations or destination types, and asked respondents to rank them based on the importance of good bicycle access to them. Figure 2.13 describes the results, indicating the number of participants who considered good access important or very important. These in turn suggest the places that the network should serve.

Top priority destinations include the city's trails, principal parks, neighborhood parks, schools, and the library. Nearly every destination listed in the survey was rated as "very important" except for City Hall, office parks, and Parkway Plaza.

Infrastructure Types

Much of the survey was designed to assess the comfort of current and prospective bicyclists with different types of bicycle environments. The survey asked participants to respond to a gallery of photographs of streets and facilities. Most of the images for evaluating streets were in Leawood, while infrastructure solutions typically came from other cities. Through their responses, participants determined:

- Whether the setting is comfortable for most or all cyclists.
- Whether the setting is comfortable for the respondent, but not necessarily for less capable cyclists.

The displays on the facing page group survey images on the basis of their combined favorability ratings and show the following results:

- The top-rated (over 90 percent favorable) settings include either completely separated paths, both along roads and

on exclusive right-of-way, or bike lanes either in calm traffic situations or with some type of physical separation from travel lanes. New York City's buffered cycle track was the second highest-rated image in the survey.

- The next highest-rated group (80-90 percent favorable) included sharrows on local streets, bicycle boulevards, and buffered bike lanes in busier settings.
- The third highest rated group included arterial streets with adjacent sidepaths, sidewalks, and shared lane markings on moderate traffic streets.
- The lowest rated settings were busy streets like multi-lane residential arterials, four-lane divided parkways, and bike lanes on regional highways.

Another point of interest involves looking at settings rated as "comfortable for me" rather than "comfortable for most people" by a substantially larger number of people. These suggest situations that experienced riders find satisfactory for themselves, but not suitable for less capable cyclists. One determining factor was the perceived or indicated amount of traffic for a particular situation. More experienced bicyclists were more comfortable dealing with higher traffic volumes than less experienced riders.

Importance of Various Actions

Responses to a list of possible actions to improve Leawood's bicycle environment indicated a strong priority for infrastructure programs. Initiatives that ranked highest included bike lanes, trails, roadside paths, and improved private project design for better pedestrian and bicycle accessibility. Supporting efforts, including new laws to protect cyclists, enforcement of traffic laws, and safety education were also considered important or very important by over 50 percent of respondents. Figure 2.15 presents the percentage of survey responses calling an action important or very important for increasing bicycling in the city.

Figure 2.14: Comfort Rating of Various Infrastructure Settings

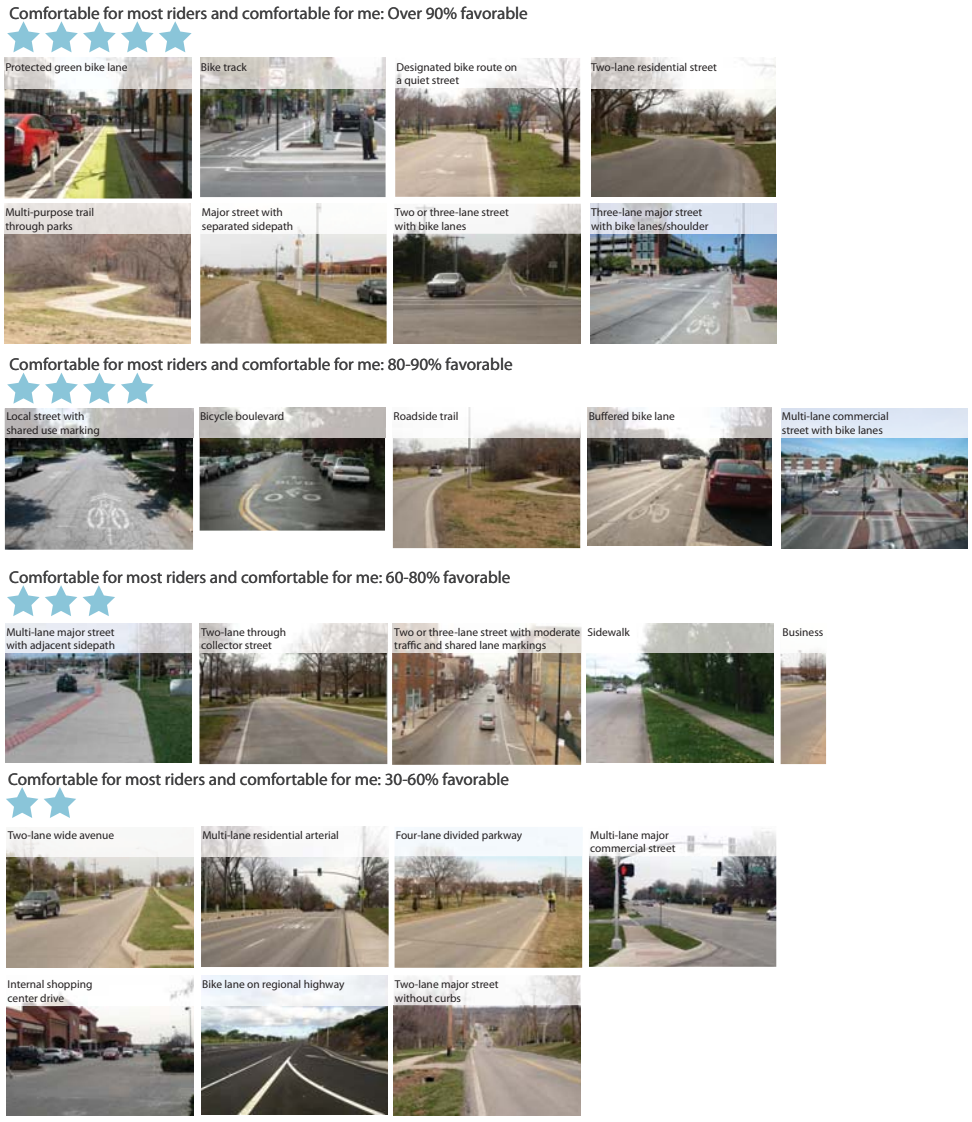


Figure 2.15: Effectiveness of Various BICYCLE Actions

Very Effective or Effective Over 70% ★★★★★	Very Effective or Effective 50-70% ★★★★	Very Effective or Effective Less than 50% ★★★
Bike lanes	Bike safety activities designed for kids	More information about bicycling clubs, events, programs
More safe routes to schools projects and activities	Passage of laws that protect vulnerable road users, such as minimum passing distance laws	More special events, such as benefit rides
More trail development	More bicycle parking in strategic locations	Bike-sharing program
Shared lane markings	Better motorist education programs	A "bike station" with showers, repair, and bike parking facilities
A system of designated on-street bicycle routes that lead to important destinations	More enforcement of traffic laws	
Better project design that encourages bicycle access	Improved bicycle safety and education activities	
Better crossings of major streets	Showers and changing facilities at workplaces	
Widened sidewalks or paths along major streets	Wayfinding and directional signs	
A strong bicycle advocacy organization	Better design of sidewalk ramps at intersections	
Share-the-Road or Bicycle Route signs	Better markings at crosswalks	
	Count down crossing signals	
	More community bicycling events	
	Challenges and promotions for bicycle commuters	

BICYCLE CONCLUSIONS

This consideration of market potentials and preferences tells us that:

- **There is a substantial potential market for urban bicycling in Leawood.** The distribution of destinations and compact, bikeable nature of the city makes bicycling a viable form of transportation for many Leawood residents. Reasonable and attainable assumptions, based on meeting infrastructure and supporting needs, suggest that the number of weekday trips made by bicycle can increase from the current level of about 2,000 trips to about 9,000 daily trips within 20 years.
- **The nature of people responding to the Bikeways Survey helps substantiate the conclusion of substantial growth potential for active transportation.** Over half the respondents are frequent bicyclists, but their participation and responses indicate a substantial interest in increasing their own level of safety.
- **Participants placed a high priority on both infrastructure improvements and supporting initiatives like safety programs.** Generally, projects located on low traffic volume streets were considered more effective than high volume roads despite improvements to the infrastructure.
- **Generally, participants preferred settings that provided at least some degree of separation of bicyclists and motor vehicles, such as trails, sidepaths, bicycle tracks, and buffered bike lanes.** However, quiet streets with good continuity – a significant asset of the city's street system – also were seen as very safe environments.
- **Streets that included some form of infrastructure were seen as substantially safer than comparable streets lacking these features.** On-street riding and some low-cost adaptive solutions, such as the use of shared lane markings, improved survey ratings for more experienced cyclists, but were seen as less suitable to inexperienced riders, children, and families.

CHAPTER 3

ACTIVE TRANSPORTATION NETWORK: PRINCIPLES AND STRUCTURE

THIS CHAPTER PRESENTS THE PERFORMANCE PRINCIPLES AND FRAMEWORK OF LEAWOOD'S PROPOSED BIKEWAY NETWORK. THESE PRINCIPLES, DERIVED FROM THE ANALYSIS OF EXISTING CONDITIONS AND OPPORTUNITIES, THE COMMUNITY ENGAGEMENT PROCESS, AND MARKET PREFERENCES GENERATE THE OVERALL SYSTEM CONCEPT. The chapter describes the framework of the system and its individual components.

An effective network of bicycle and pedestrian facilities should follow specific principles and performance measurements. Some of the world's best work in identifying design principles was done by the Netherlands Centre for Research and Contract Standardization in Civil and Traffic Engineering. This plan adapts the Netherlands concepts to the contexts of medium-sized American cities, identifying six guiding requirements for an effective active transportation network:

- **Integrity.** The ability of a system to link starting points continuously to destinations, and to be easily and clearly understood by users.
- **Directness.** The capacity to provide direct routes with minimum misdirection or unnecessary distance.
- **Safety.** The ability to minimize hazards and improve safety for users of all transportation modes.
- **Comfort.** Consistency with the capacities of users and avoidance of mental or physical stress.
- **Experience.** The quality of offering users a pleasant and positive experience.
- **Feasibility.** The ability to maximize benefits and minimize costs, including financial cost, inconvenience, and potential political opposition.

These six requirements express the general attributes of a good system, but must have specific criteria and even measurements that both guide the system's design and evaluate how well it works.

Figures 3.1 through 3.6 present criteria for each of the six more abstract requirements, and design guides and methods to manage ultimate performance. Each table includes:

- **The performance factors relevant to each requirement.** For example, the INTEGRITY requirement addresses the ability of users to understand the system and use it to get to their destinations. Examples of performance factors that help satisfy this requirement include clear wayfinding and directional information and continuity, ensuring that users do not confront dead-ends as they move along the route.
- **The measurements that can be used to evaluate the success of the system and its ultimate design.** For example, we can measure the effectiveness of a wayfinding system by its ability to guide users intuitively without either creating too many signs.
- **The performance standards that establish the design objectives and guidelines for each of these factors.** For example, a wayfinding system should avoid ambiguities that confuse users and follow graphic standards that are immediately and clearly understood.

Integrity issues.

Far left: When paths diverge, directional information that tells users where each alternative leads is very important to the user's peace of mind.

Left: In Leawood, where streets are designed to discourage through traffic, users need assurance that a street that looks like a continuous route connects to other parts of the network.

Figure 3.1: Development of the INTEGRITY Requirement

Performance Factor	Measures	Performance Standard
Comprehensiveness	Number of connected destinations on system	Major destination types identified by survey and presented in destinations analysis should all be accessible by the network. 100 percent of top destination types, 80 percent of all destinations should be served. New destinations as developed should be developed along the network or served by extensions.
Continuity	Number of discontinuities along individual routes	Users headed on a route to a destination must not be dropped at a terminus without route or directional information. Even at incremental levels, route endings must make functional sense. Transitions between facility types must be clear to users and well-defined. Transitions from one type of infrastructure to another along the same route should avoid leading cyclists of different capabilities into uncomfortable settings or beyond their capacities. Infrastructure should be recognizable and its features (pavement markings, design conventions) consistent throughout the system
Wayfinding/directional information	Completeness and clarity of signage Economy and efficiency of graphics Complaints from users	Signs must keep users informed and oriented at all points. Sign system should avoid ambiguities that cause users to feel lost or require them to carry unnecessary support materials. Signs should be clear, simple, consistent, and readable, and should be consistent with the Manual on Uniform Traffic Control Devices (MUTCD). Use of the Clearview font is recommended.
Route choice	Number of alternative routes of approximately equal distance	Ultimate system provides most users with a minimum of two alternatives of approximately equal distance. Minimum distance between alternative routes should be about 500 feet.
Consistency	Percentage of typical reported trips accommodated by the ultimate network.	Typically, a minimum of 50-70 percent of most trips to identified destinations should be accommodated by the bikeways network.

Directness issues.

Far right: Multi-use trails provide a more comfortable experience for many cyclists, but their recreational design can take travelers in a hurry well out of their way.

Right: Leawood's development and street patterns, which do not follow a direct grid, can challenge people seeking the most direct route between points.

Figure 3.2: Development of the DIRECTNESS Requirement

Performance Factor	Measures	Performance Standard
Access	Coverage Access to all parts of the city	The network should provide convenient access to all parts of the city. As a standard, all urban residential areas should be within one-half mile from one of the system's routes, and should be connected to those routes by a relatively direct local street connection.
Bicycling speed	Design and average speed of system	The network should permit relatively consistent operation at a steady speed without excessive delays. System should be able to deliver an average point to point speed between 12 and 15 mph for users. Although a portion of routes should permit operation in a 15 to 20 mph range.
Diversions and misdirections	Maximum range of detours or diversions from a straight line between destinations. "Detour ratio:" Ratio of actual versus direct distance between two points.	Routes should connect points with a minimum amount of misdirections. Users should perceive that the route is always taking them in the desired direction, without making them reverse themselves or go out of their way to an unreasonable degree. Maximum diversion of a straight line connecting two key points on a route should not exceed 0.25 miles on either side of the line. Detour ratio (distance between two points/shortest possible distance) should not exceed 1:2 over long distances and 1:4 over short distances.
Delays	Amount of time spent not moving per mile	Routes should minimize unnecessary or frustrating delays, including excessive numbers of stop signs, and delays at uncontrolled intersections waiting for gaps in cross traffic. Routes should maximize use of existing signalized crossings. Target design should limit maximum delays to about 30 seconds per mile over long distances and 45 seconds per mile over short distances.
Intersections	Bicycle direction through intersections	Bicyclists should be able to continue through intersections as vehicles. Situations that force cyclists to become pedestrians in order to negotiate intersections should be avoided.

Directness issues.

Left: Crossings at and movement along east-west arterials present significant user safety concerns.

Center: Offset crossings at intersections complicate safe system continuity.

Right: Several major arterials, including Nall Avenue, include sidepaths. Turning movements across sidepaths at intersections introduce traffic conflicts.

Figure 3.3: Development of the SAFETY Requirement

Performance Factor	Measures	Performance Standard
Reduced number and fear of crash incidents	Number of incidents Reactions/perceptions of users	The network should reduce the rate of crashes over ten year periods. Data collection should be sufficient to trace baseline data and measure the impact of improvements. Bikeways system users should feel that the system protects their physical safety, as measured by both use of routes and survey instruments.
Appropriate routing: mixing versus separation of traffic	Average daily traffic (ADT)criteria for mixed traffic Traffic speed criteria for mixed traffic	System design should avoid encounters between bicyclists and incompatible motor traffic streams (high volumes and/or high speeds). Separation and protection of vulnerable users should increase as incompatibilities increase.
Infrastructure, visibility, signage	Pairing of context and infrastructure solutions Mutual visibility and awareness of bicycle and motor vehicles	Infrastructure should be designed for utility by at least 80 percent of the potential market. Leawood bikeways survey indicates that roughly 85 percent of respondents are comfortable in at least some form of mixed traffic. Infrastructure applications should be matched with appropriate contexts. Warning signage directed to motorists should be sufficient to alert them to the presence of cyclists along the travel route. Surfaces and markings should be clearly visible to all users. Obstructions, such as landscaping, road geometry, and vertical elements, should not block routine visibility of cyclists and motorists. Trail and pathway geometries should avoid sharp turns and alignments that hide cyclists operating in opposing directions. Where these conditions are unavoidable, devices such as mirrors and advisory signs should be used to reduce hazards.
Door hazards and parking conflicts	Number of incidents Parking configurations Location of bicycle tracking guides	Component design should track bicycles outside of the door hazard zone. Back-out hazards of head-in parking should be avoided or mitigated when diagonal parking is used along streets.
Intersection conflicts	Location and types of pavement markings Number of intersections or crossings per mile	Intersections should provide a clearly defined and visible track through them for cyclists. Cycle tracks (sidepaths) should generally be used on continuous segments with a minimum number of interruptions.
Complaints	Number of complaints per facility type	Complaints should be recorded by type of infrastructure and location of facility, to set priorities for remedial action.

Comfort issues.

Introducing bike lanes on moderately high volume corridors has substantially increased the comfort level of users of these through routes.

Figure 3.4: Development of the COMFORT Requirement

Performance Factor	Measures	Performance Standard
Road surface	Quality and type of road surface Materials Incidence of longitudinal cracking and expansion joints	The network's components should provide a reasonably smooth surface with a minimum of potholes and areas of paving deterioration. Roads should be free of hazardous conditions such as settlement and longitudinal cracks and pavement separation. All routes in the urban system should be hard-surfaced, unless specifically designated for limited use.
Hills	Number and length of hills and inclines Maximum grades on segments for both long and short distances	As a general rule, routes should avoid more than one incline over 5 percent for each mile of travel. Maximum average design grades should not exceed 7 percent over a hill not to exceed 400 feet in length; or 5 percent over the course of a mile. Off-road climbing facilities should be provided where slow-moving bike traffic can obstruct motor vehicles and increase motorist conflict.
Traffic stress	Average daily traffic (ADT) Average traffic speed Volume of truck traffic	Generally, the network should choose paths of lower resistance/incompatibility wherever possible and when DIRECTNESS standards can be reasonably complied with. The network should avoid mixed traffic situations over 5,000 vehicles per day (vpd) when alternatives exist. Alternatives can include bike lanes, separations, or alternative right-of-way.
Stops that interrupt rhythm and continuity	Number of stop signs/segment	Network routes should avoid or redirect frequent stop sign controls. The number of stops between endpoints should not exceed three (1 per quarter mile average) per mile segment.

Experience issues.

Leawood's beautiful streets and neighborhoods make cycling through the city a pleasure and invite both recreational and utilitarian riders. These corridors provide a major resource for structuring the Leawood network.

Figure 3.5: Development of the EXPERIENCE requirement

Performance Factor	Measures	Performance Standard
Surrounding land use	Neighborhood setting Adjacent residential or open space use, including institutional campuses Adjacent street-oriented commercial	Surrounding land use should provide the network user with an attractive adjacent urban environment. As a design target, a minimum of 75 percent of the length of the route should pass through residential, open space, or street-oriented (main street) commercial environments. Routes should provide access to commercial and personal support services, such as food places, convenience stores, and restrooms.
Landscape	Location and extent of parks or maintained open space	Network should maximize exposure or use right-of-ways along or through public parks and open spaces. Environmental contexts to be maximized include parks, waterways and lakes, and landscaped settings.
Social safety	Residential development patterns Observability: Presence of windows or visible uses along the route Population density or number of users	The network should provide routes with a high degree of observability – street oriented uses, residential frontages, buildings that provide vantage points that provide security to system users. Areas that seem insecure, including industrial precincts, areas with few street-oriented businesses, or areas with little use or visible maintenance should generally be avoided, except where necessary to make connections.
Furnishings and design	On-trail landscaping, supporting furnishings	Network routes should include landscaping, street furnishings, lighting, rest stops, graphics, and other elements that promote the overall experience. These features are particularly important along trails.

Feasibility issues.

Taking advantage of opportunities can provide major connectivity advances at relatively low cost.

Far left: Existing bridge with new pathway connections can link Lee Boulevard with State Line Road and provide a significant community connection.

Left: Periphery of a little used parking lot can connect Leawood neighborhoods to Kansas City's Ward Parkway regional mall.

Figure 3.6: Development of the FEASIBILITY Requirement

Performance Factor	Measures	Performance Standard
Cost effectiveness	Route cost Maximum use of low-cost components Population/destination density	The network should generate maximum benefit at minimum cost. Where possible, selected routes should favor segments that can be adapted to bicycle use with economical features rather than requiring major capital investments. Initial routes should be located in areas with a high probability of use intensity: substantial population density and/or incidence of destinations. Initial investments should integrate existing assets, extending their reach into other neighborhoods and increasing access to them. Major off-street investments should concentrate on closing gaps in an on-street system.
Phasing and incremental integrity	Self-contained value Ability to evolve	The network should provide value and integrity at all stages of completion. A first stage should increase bicycle access and use in ways that make future phases logical. The network should be incremental, capable of building on an initial foundation in gradual phases. Phases should be affordable, fitting within a modest annual allocation by the city, and complemented by major capital investments incorporating other sources.
Neighborhood relationships and friction	Parking patterns Development and circulation patterns	The network should avoid conflict situations, where a route is likely to encounter intense local opposition. Initial design should avoid impact on potentially controversial areas, such as parking, without neighborhood assent. Involuntary acquisition of right-of-way should be avoided wherever possible. Detailed planning processes to implement specific routes should include local area or stakeholder participation.

ATTRIBUTES OF THE NETWORK

Based on this development of the six requirements presented in the tables, the Leawood system design follows the following major attributes:

Tailored to User Groups. Planning a bicycle network for Leawood, with its rectangular shape and unique role in the metropolitan area, requires us to understand the specific market groups for the system. These groups include:

- People traveling within or to Leawood from outside, bound for destinations within the city.
- Cyclists passing through Leawood as they travel east and west through the metropolitan area. Leawood's north-south length means that anyone traveling to places between 79th and 153rd Street are very likely to move through the city.
- Recreational users. The Indian Creek and Tomahawk Creek Trails are major elements of the regional trail system, and are very heavily used. But these facilities again largely serve through users or people bound for specific destinations. A number of Leawood residents travel by bike or on foot within the city for recreational purposes, taking advantage of its environment for fitness and pleasant experiences.

Destination-Based. As we see above, a key market for the Leawood network are people headed for specific destinations. Destinations that the community and both existing and potential users identify as important help generate the structure of the network. The proposed network is more than a system of bicycle-friendly streets. It is in fact part of a transportation system that takes people to specific places. In Leawood, these key destinations include regional trails themselves, schools, the city center area focused around 119th and Roe, City Hall and the Library, major parks and recreational facilities, retail centers, and employment concentrations like the Tomahawk Creek Parkway corridor.

Function Model. Several reasonable models for network planning exist, with choices dependent on the nature of the city. In planning the Leawood system, we identify routes based on describing their facility type and role in the system. To help cyclists "read" the system with a minimum of supporting materials, we have adapted a "transit model," that identifies several major destination-based routes almost as if they were bus lines.

Incremental Integrity. As discussed in Figure 3.6 (Feasibility), incremental integrity – the ability of the network to provide a system of value at each step of completion – is an important attribute. The first step in completion should be valuable and increase bicycle access even if nothing else is done. Each subsequent phase of completion follows the same principle of leaving something of clear value and integrity, even if it were the ultimate stage of completion.

Evolution. As part of the concept of incremental integrity, the system is designed to evolve and improve over time. For example, a relatively low-cost project or design element can establish a pattern of use that supports something better in the future. To use a cliché, the perfect should not be the enemy of the good.

Conflict Avoidance. Few important actions are completely without controversy, but successful development of a bicycle transportation system in Leawood can and should avoid unnecessary controversy. On most streets, shared streets and signage can provide satisfactory facilities that focus on the positive and minimize divisive conflicts. Projects should demonstrate the multiple benefits of street adaptations. For example, bikeway design can slow motorists and keep unwanted through traffic out of neighborhoods, benefiting both cyclists and neighbors.

Use of Existing Facilities. Great existing features like the Indian Creek, Tomahawk Creek, and Ironwoods Park Trails are integral to the bikeway system. Other existing resources such as paths along Nall Avenue, 133rd Street, and Town Center Drive and the 123rd and 127th streets bike lanes are also key elements of the

system. Finally, "found" but underused features such as the so-called "bridge to nowhere" west of State Line Road at about 89th Street also have great potential utility.

Fill Gaps. In some cases, the most important parts of a network involve small projects that make connections rather than long distance components. Often, these short links knit longer street or trail segments together into longer routes or provide access to important destinations. These gaps may include a short trail segment that connects two continuous streets together, or an intersection improvement that bridges a barrier. The development of the overall network is strategic, using manageable initiatives to create a comprehensive system.

Routes of Least Resistance. The Leawood Bikeways Survey showed that much of the city's potential urban cycling market is comfortable in on-street situations, but understandably prefer quiet streets or corridors with some degree of separation from motor traffic. It is not necessary to try to force bicycle access onto every major street when more comfortable, lower cost options exist. For example, bicycle boulevards – lower volume streets that parallel major arterials – satisfy the comfort requirement successfully. However, some important destinations, including major employers and shopping facilities are served by major arterials. Here, complete street standards should include bicycle and pedestrian accommodations in new major street projects. Projects such as the reconstruction of 143rd Street will be developed to complete street standards, incorporating both bike lanes and pedestrian facilities. Several key routes in the proposed network depend on building these multi-modal facilities.

Facilities for Different Capabilities. The Leawood Bicycle and Pedestrian Survey indicated that present and potential cyclists both use bicycles for different purposes and display different capabilities. A significant number of survey respondents are capable road cyclists, comfortable with corridors like Mission Road north of I-435. Others are far more comfortable with trails and quiet streets. The Leawood system should ultimately work successfully with people with a range of capabilities.

Regional Connectivity. Leawood position as an inner suburb makes it both a destination and a "bridge" in the metropolitan area. This Leawood network must also connect to regional facilities, including on-street routes in adjacent Kansas City, Overland Park, and Prairie Village.

ACTIVE TRANSPORTATION NETWORK

Figure 3.7 presents the proposed active transportation plan for Leawood, based on the requirements and principles described previously in this chapter and the City's facility development opportunities. This map shows the ultimate build-out by component type, and includes route designations that are used to describe infrastructure details. The components of the system include:

- **Principal Lines.** These five corridors are the north-south spines of the system. With one exception, a key connection between the Ward Parkway mall and the Ranch Mart node at 93rd Street and Mission, they follow major corridors and cover relatively long distance. They form the bike and pedestrian arterials that link the three segments of Leawood – north, central, and south – together, and are most important functionally for local transportation. These lines typically use facilities like bike lanes, enhanced sidepaths, and short segments of multi-use trail, but also include some segments of low-volume local streets

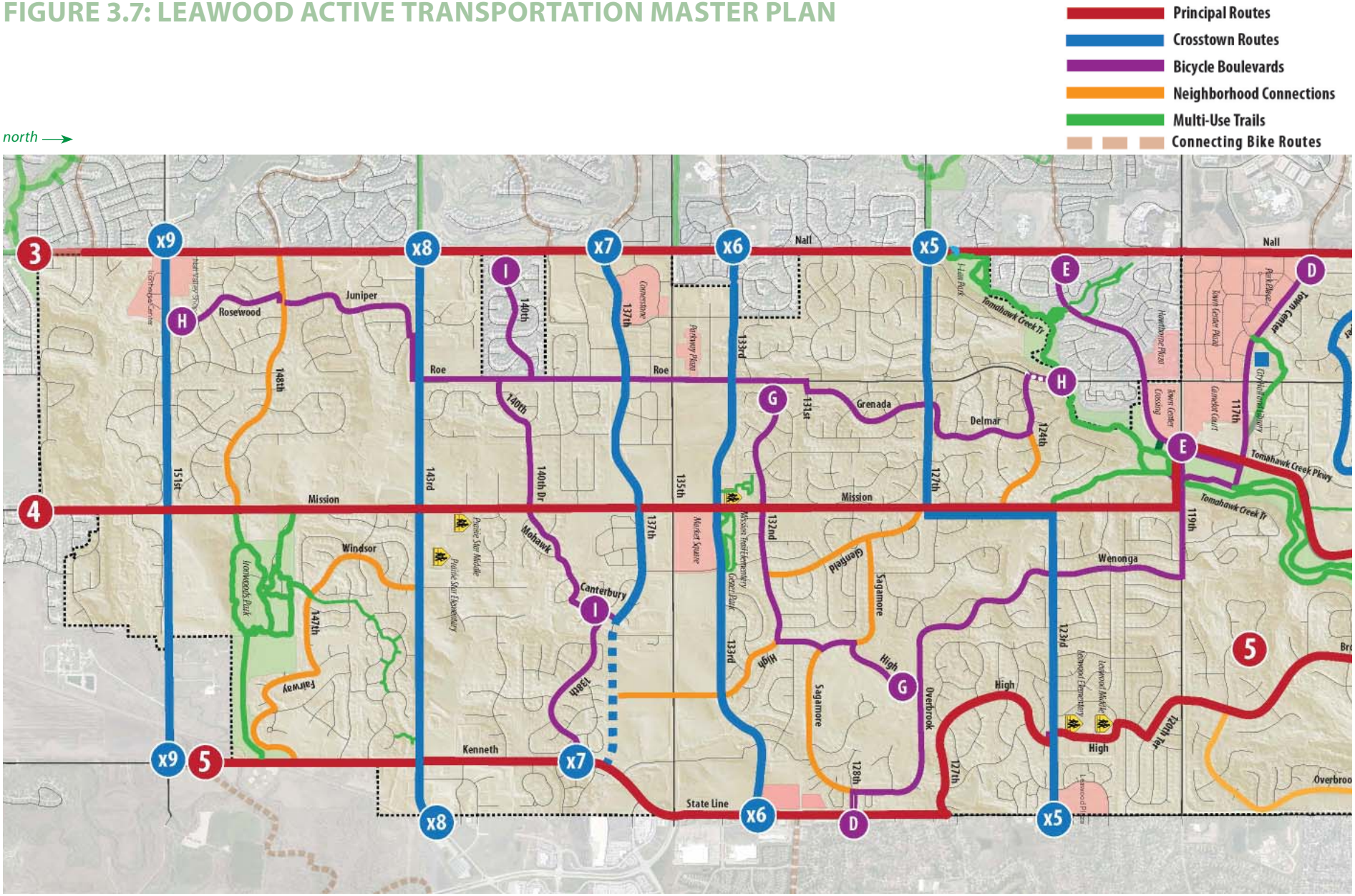
- **Cross-City Corridors.** These nine routes cross Leawood from east and west and, in most cases, connect to other parts of the existing and planned metropolitan bicycle transportation system. They provide the most direct and continuous routes across the city, and also help link the principal lines to local destinations. In most cases, they use on-street infrastructure such as shared lanes and conventional bike lanes. They also incorporate existing completed projects, such as the 123rd and 127th streets bike lanes and the proposed reconstruction of 143rd Street.

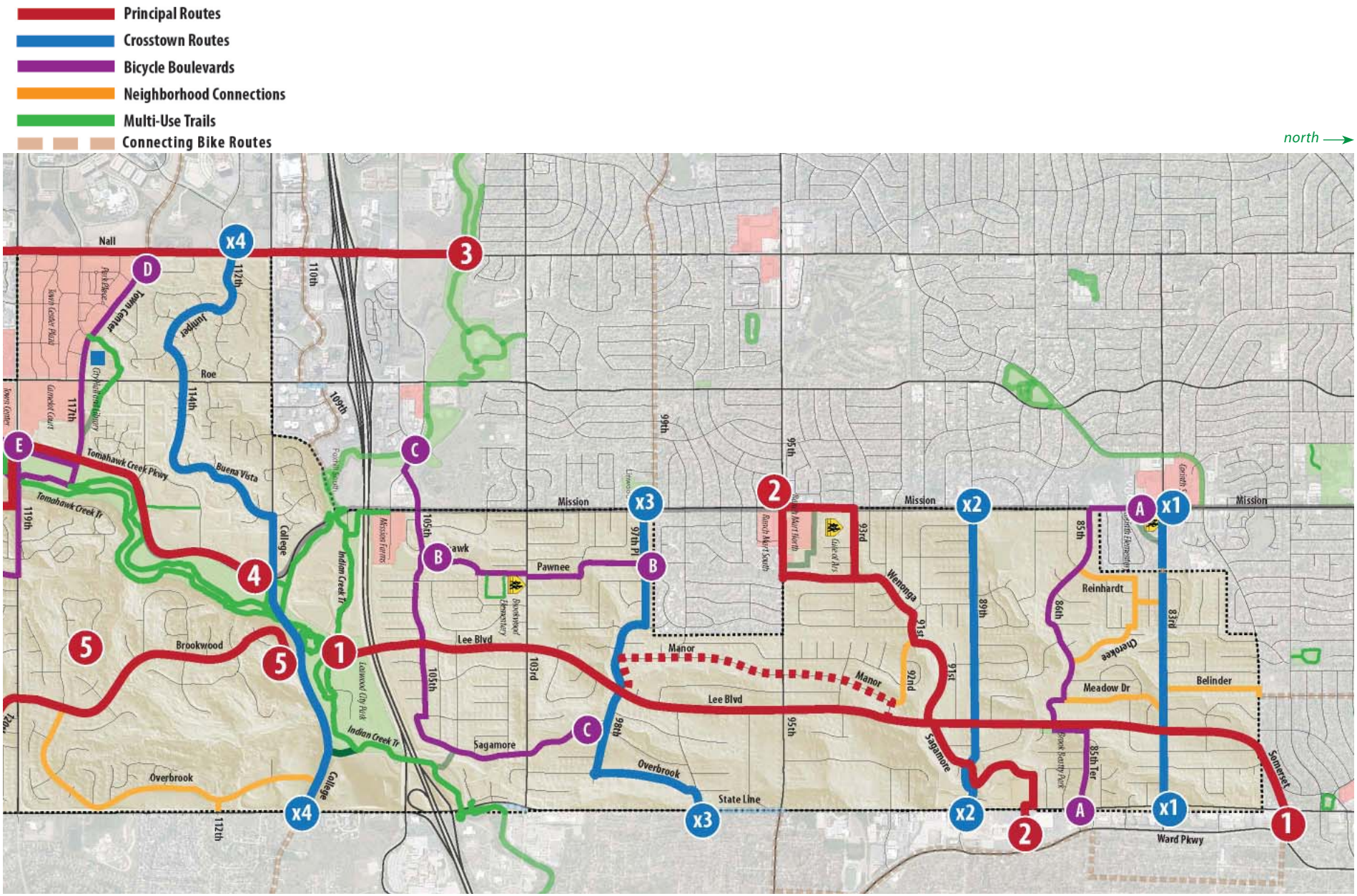
- **Bicycle Boulevards.** These corridors are the primary routes for local bicycle and pedestrian travel around town, and serve most of the city's key destinations and attractions. They are typically local or collector streets with relatively low volumes that have good continuity and in many cases parallel higher order streets. They are far more comfortable for most cyclists and pedestrians than the busy corridors they parallel. Relatively minor adaptations, such as pavement markings, special graphics, and wayfinding can make these streets even more comfortable for a broad range of users. Bicycle boulevards should also form the core of the city's community pedestrian network, and should ultimately have continuous sidewalk access along at least one side of the street.

- **Neighborhood Connectors.** These are short, primarily on-street routes, usually on low-volume local streets, that connect through routes and neighborhoods. Most require minimal infrastructure investment.

- **Multi-Use Trails.** Leawood's major existing multi-use trails, the Indian and Tomahawk Creek, are part of the Johnson County regional trail network and also continue into Kansas City. New local projects would extend Ironwoods Park Trail from Mission Road to State Line Road; and add short but critical segments and facilities to link other parts of the network together by filling major gaps. Clear identification and wayfinding information is also needed to integrate these trails into the overall network. .

FIGURE 3.7: LEAWOOD ACTIVE TRANSPORTATION MASTER PLAN




Principal Routes
Crosstown Routes
Bicycle Boulevards
Neighborhood Connections
Multi-Use Trails
Connecting Bike Routes
north
Nall
Roe
Juniper
Town Center
Tomahawk Creek Pkwy
Tomahawk Creek Tr
College
Buena Vista
Brookwood
Overbrook
Lee Blvd
Manor
Pawnee
Mission
Sagamore
State Line
Indian Creek Tr
Lenexa City Park
Brookwood Elementary
Wenonga
Reinhardt
Meadow Dr
Belinder
Somerset
Ward Pkwy
110th
109th
105th
103rd
98th
97th Pl
95th
93rd
92nd
91st
89th
86th
85th
85th Ter
83rd
112th
114th
117th
119th

A GALLERY OF FACILITY COMPONENTS

MULTI-USE TRAILS

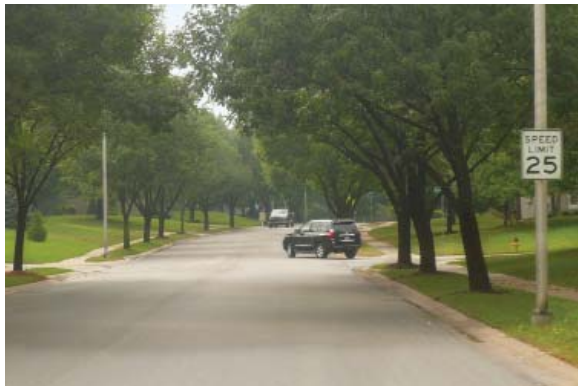
Tomahawk Creek Trail

PRINCIPAL LINES

Lee Boulevard

CROSSTOWN CORRIDORS

89th Street



BICYCLE BOULEVARDS

132nd Street

NEIGHBORHOOD CONNECTORS

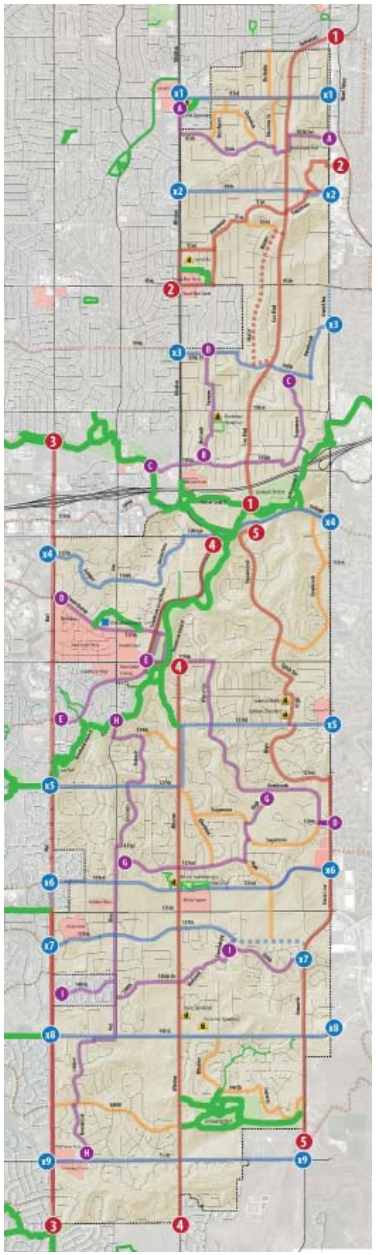
Meadow Lane

MULTI-USE TRAILS

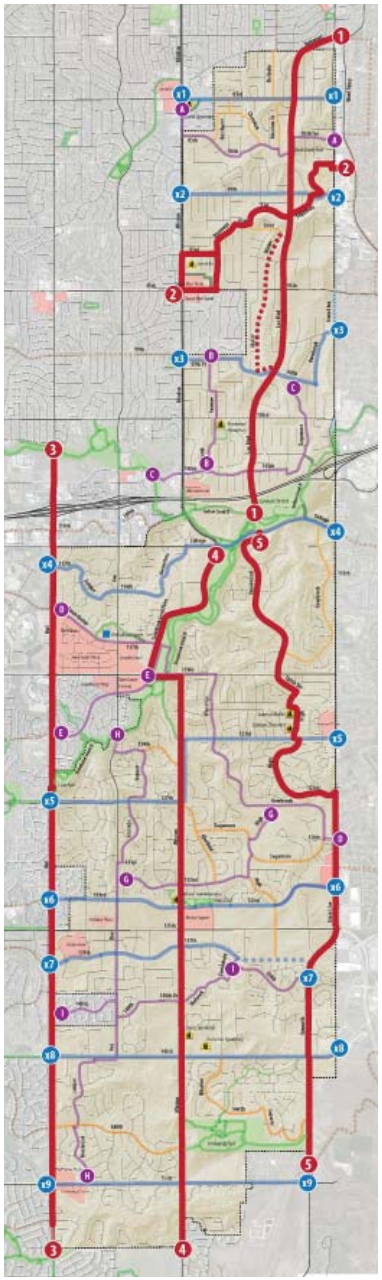
The existing multi-use trail system in Leawood will continue to be central to the overall bicycle and pedestrian transportation network. The city's two dominant trail corridors, along Indian and Tomahawk Creeks, generally proceed in a northeast-southwest direction, connecting Kansas City through Leawood to Overland Park and western Johnson County cities. In the process, they connect the various parts of the on-street network envisioned by this plan. Minor extensions to these central trails will serve major Leawood destinations, including the Town Center/ Park Place district, the Civic Center, and schools and other activity centers. These extensions include a new bridge, improved intersections and street crossings, and short segments that fill continuity gaps.

The system also proposes new connections from trails within Ironwoods Park to Mission Road on the west and Kenneth Avenue on the east. However, most of the anticipated trail network is already in place and requires only minor enhancements such as improved regional wayfindings and connections to destinations and surrounding on-street routes.

In addition to multi-use trails along creeks or through park properties, the plan proposes other paths within roadway corridors. These "enhanced sidepaths" are included as parts of the overall route system described later in this chapter. Sidepaths are already used in a number of locations in and around Leawood, including Nall Avenue and 133rd Street. Enhancements are designed to address the vulnerabilities of these facilities, including intersection conflicts, poor visibility or motorist awareness of the adjacent path, and transitions from on- to off-road facilities. Approaches to these problems are addressed in Chapter Four.



FUNCTIONAL DESCRIPTION	CHARACTERISTICS AND CRITERIA	TYPICAL INFRASTRUCTURE SOLUTION	EXAMPLES	DEVELOPMENT PHASE
Trail system extensions or new trail corridors	Linear, off-road corridors, primarily following watercourses and linear parks (Tomahawk and Indian Creeks), parklands (Ironwoods, City, and Gezer Parks), schoolsites, and underutilized parking lots. Short trail extensions or bridges to connect trails to destinations and other components of the proposed Leawood system.	Trails or off-street paths , typically paved. Typical 10-foot standard width, with wider facilities or pedestrian/bicycle track separation in congested areas. Special trail system mark and wayfinding , identification, and caution information. Cycle tracks on the periphery of underutilized paved areas, most notably parking lots, or integrated into school sites. Enhanced sidepaths are included as parts of other system components	Indian Creek Trail Tomahawk Creek Trail Ironwoods Park Tails City Park Trail	Short to medium-term, because of relative short length and high utility of gap-filling segments.



PRINCIPAL LINES

The Principal Line corridors are conceived as key transportation facilities that provide north-south continuity. Routes provide north-south access on east, west, and central corridors south of I-435, a complete street conversion of Lee Boulevard north of the Interstate, and a key crosstown link between the Ward Parkway and Ranch Mart retail centers. All routes connect to the Indian/Tomahawk Creek Trail and greenway network. A primary market for these facilities is the growing number of people who use bicycles for utilitarian purposes - school, shopping, and work trips. For the most part, these cyclists are comfortable with riding in mixed traffic on bike lanes or low-traffic streets. Enhanced sidepaths are used along arterial corridors. Because these routes serve transportation cyclists, they emphasize directness.

FUNCTIONAL DESCRIPTION	CHARACTERISTICS AND CRITERIA	TYPICAL INFRASTRUCTURE SOLUTION	EXAMPLES	DEVELOPMENT PHASE
Major through or commuter routes, primarily north to south. General focus on cyclists who use bicycles for transportation purposes and are reasonably comfortable with mixed traffic settings.	Streets or combined routes with low to moderate average daily traffic (ADT), typically collectors and minor arterials, or major arterials with right-of-way for enhanced sidepaths Relatively straight, continuous routes covering the length of Leawood, connecting to major destinations. Connections to other components of the system.	Bike lanes preferred where space permits to provide maximum identification and clarity. Sharrows used on local streets. Multi-use path segments to fill gaps. Enhanced sidepaths along major arterials. Special principal line graphics, or use of numbered routes, to communicate connectivity. MUTCD compliant wayfinding, identification, and caution information. Continuous sidewalks to provide pedestrian connectivity. Enhanced sidepaths satisfy this requirement.	Lee Boulevard Mission Road south of 119th Street. Nall Avenue sidepath. Ward to Ranch Mart Connector East side connector via State Line/Kenneth.	Some sidepath segments currently in place. (Nall Avenue) Short-term where bike lanes can be installed easily, or where short segments fill strategic gaps. (Mission Road) Interim short-term on Lee Boulevard. Medium to long-term where major construction is required. (State Line Road)

PRINCIPAL LINE	NAME	ENDPOINTS	MAJOR DESTINATIONS SERVED	HIGHLIGHTS	IMPLEMENTATION TERM
1	**Lee Boulevard Bikeway**	North city limits at Somerset to Leawood City Park and Indian Creek Trail	Leawood Shops, Brook Beatty Park, Police Station, City Park	Preferred north-south route through historic district with moderate traffic and attractive townscape. Short-term program includes climbing shoulders on upgrades, shoulder expansion in other places where possible, and signage. Long-term complete street reconstruction should provide buffered bike lanes. Alternate quiet route uses parallel Manor Road between 92nd and 98th streets.	Short-term for moderate safety shoulder improvements. Medium term (2019-2020) for complete street reconstruction.
2	**Ward to Ranch Mart**	Ward Parkway Center to Ranch Mart	Ward Parkway Center (Kansas City), Cure of Ars School, Ranch Mart shopping centers	Key crosstown route serving major community destinations. Uses shopping center tunnel under State Line Road and edge of parking lot, creek corridor, currently unused pedestrian bridge, and quiet neighborhood streets and short sidepath segments to provide access to major mixed use node at 93rd Street and Mission Road. Connects to Lee Boulevard and crosstown routes.	Short- to medium-term, dependent on cooperation with Ward Parkway mall managers and other property owners.
3	**Nall Avenue**	Indian Creek Trail (Overland Park) to south city limits at 155th Street	Indian Creek Trail, Park Place, Town Center Plaza, I-Lan Park, Cornerstone Shopping Center, Nall Valley Shops, Ironhorse Center	Major sidepath corridor serving major retail destinations and regional trails. Envisions enhancements of existing sidepath from trail to 135th Street, extension of sidepath to city limits.	Short-term for intersection and signage enhancement of existing path; medium to long-term for south extension. Requires joint participation with Overland Park.
4	**Mission Road**	Indian Creek Trail at College to south city limit	Mission Farms and City Park via trail, Tomahawk Creek Parkway and offices, Public Safety center, Camelot Court, Town Center Crossing, Gezer Park, Mission Trail and Prairie Star Elementary Schools, Market Square, Prairie Star Middle School, Ironwoods Park	Major north-south, multi-destination corridor includes new bike lanes of buffered cycle track along Tomahawk Creek Parkway, reconfiguration of Mission Road between 119th and 137th with bike lanes, and complete street reconstruction south of 137th Street.	Short-term for restriping between 119th and 135th streets; medium for Tomahawk Creek Parkway bike lanes, long for Mission Road reconstruction south of 135th Street.
5	**Eastside**	College Avenue to 151st Street	Leawood Elementary and Middle Schools, Leawood Square, Villages of Seville, 135th Street shopping centers, Ironwoods Park	East side route uses local avenues from College to 127th, serving school campus, continues as a new enhanced sidepath along State Line and Kenneth, with access to Ironwoods Park via new trail extension	Short-term to 127th Street - State Line Road; medium for sidepath to 135th Street, long for south extension to 151st Street.

CROSSTOWN ROUTES

The Crosstown Routes provide direct east-west access across Leawood and serve both local and regional cyclists. For local transportation, they combine with the north-south principal lines to create a grid that serves many destinations in the city. From a regional perspective, they complete major bicycle corridors between Kansas City and suburban cities to the west. The routes use a variety of infrastructure types, including shared use lanes on streets with lower traffic volumes, bike lanes along more heavily traveled streets, and enhanced sidepaths on arterials and where space is available. Two of the cross-town corridors, 133rd and 137th streets, provide comfortable pedestrian and bicycle access to the high-density development district emerging along the 135th Street corridor.

FUNCTIONAL DESCRIPTION	CHARACTERISTICS AND CRITERIA	TYPICAL INFRASTRUCTURE SOLUTION	EXAMPLES	DEVELOPMENT PHASE
Direct east-west routes across the city. Routes accommodate a variety of users, and complement trail system for crosstown travel. Provides connections to other parts of the regional trail and bikeway system. Most on-street routes require at least some degree of comfort with shared traffic.	Streets or combined routes with low to moderate average daily traffic (ADT), typically collectors and minor arterials. Relatively straight routes with good connectivity to other regional routes. Connections to other components of the system, including principal north-south lines. Provides parallel service access to major arterials like 119th and 135th.	Bike lanes preferred where space permits to provide maximum identification and clarity. Sharrows used on local streets. Bike lanes and sidewalks/sidepaths provided on new streets or reconstructed streets to complete street standards. Possibility of numbered routes, to communicate connectivity. MUTCD compliant wayfinding, identification, and caution information. Corridors generally have priority over intersecting streets, or signalization at major street intersections. Continuous sidewalks to provide pedestrian connectivity.	83rd Street 89th Street 123rd/127th streets 133rd/137th streets 143rd Street 151st Street	Some bike lane segments currently in place. (123rd/127th) Short-term on pending street widening projects (143rd Street) Short-term on at least one northside corridor Medium to long-term where major construction is required. (151st Street)

CROSSTOWN	NAME	ENDPOINTS	MAJOR DESTINATIONS SERVED	HIGHLIGHTS	IMPLEMENTATION TERM
x1	**83rd Street**	83-Mission Road to 83-State Line Road	Corinth Shops, Corinth Elementary, Ward Parkway Center	Sidepath and multi-use trail around perimeter of Corinth School, with on-street shared lane option, converting to bike lanes with sharrows at three-lane intersections.	Medium-term
x2	**89th Street**	89-Mission Road to 89-State Line Road via pedestrian bridge	Ward Parkway Center (Kansas City),	Shared route to cul-de-sac east of Lee Boulevard, with new path to pedestrian bridge and drive connection to State Line Road.	Short-term
x3	**98th Street**	99-Mission Road to 97-State Line Road	99th Street Bikeway, Linwood Park (Overland Park)	Shared route. Intersection at 97th Street and State Line Road should be redesigned to provide bicycle continuity to KC via 97th Street.	Short-term for roadway, medium-term for intersection improvement.
x4	**College Boulevard**	112-Nall Avenue to College Boulevard-State Line Road	KC Orthopedic Institute, College Avenue offices, Indian City Park	Shared, low-traffic route to Buena Vista and College, with south side sidepath to Mission/ Tomahawk Creek. Redesigned intersection crosses College and uses existing landscaped sidewalk on north side.	Short-term for existing shared street segments and new sidepath segment to Mission Road. Medium for intersection redesign. Long for eventual sidepath widening from Mission to State Line Roads.
x5	**123rd/127th streets**	123-Nall Avenue to 123rd-State Line Road	I-Lan Park, Leawood Elementary and Middle Schools	Existing bike lanes on 123rd and 127th streets, with new bike lanes required for continuity along Mission Road between 127th and 123rd streets.	Existing on east-west streets; short-term for new bike lanes on Mission.
x6	**133rd Street**	133-Nall Avenue to 133-State Line Road	135th Street mixed use corridor, Mission Trail elementary, Gezer Park, Market Square	Complete street to serve 135th Street corridor. Existing sidepath to High Drive should be augmented by bike lanes and completion of sidepath to State Line Road, requiring a pedestrian crossing to south side at High Drive.	Short-term for bike lanes, medium-term for new High Drive crossing and south side sidepath to State Line Road.
x7	**137th Street**	137-Nall Avenue to 137-Kenneth Road	135th Street mixed use corridor	Complete street to serve 135th Street corridor. Street currently ends at Chadwick. Existing sidepath to Chadwick extended east to Kenneth Road should be augmented with bike lanes.	Short to medium for east extension of 137th Street; short for bike lane installation.
x8	**143rd Street**	143-Nall Avenue to 143rd-Kenneth Road	Prairie Star Elementary and Middle Schools	Pending complete street reconstruction with bike lanes and sidepath	Short-term
x9	**151st Street**	151-Nall Avenue to 151-Kenneth Road	Nall Valley and Ironhorse Shopping Centers, Ironhorse Country Club	Future complete street reconstruction with bike lanes and sidepath	Medium to long-term

BICYCLE BOULEVARDS

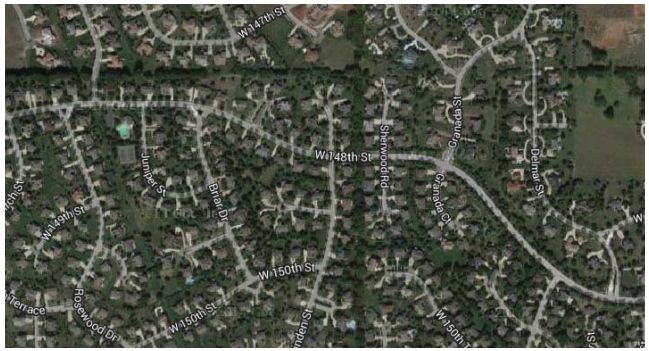
Bicycle boulevards are something of a misnomer, because they are adapted to encourage both bicycle and pedestrian use. They are enhanced shared streets that are especially adaptable to Leawood neighborhoods. These streets provide relatively direct, low-traffic routes that fill the gaps between the grid of principal bike routes. The ideal bicycle boulevard provides both direct routing and good continuity. Bicycle boulevard infrastructure usually involves minimum street modifications, typically pavement markings and special signage. In some cases, intersection priority may be reversed to reduce start and stop routines. When existing traffic speeds or volumes are a problem, traffic calming devices may also be introduced. The Leawood bicycle boulevards also incorporate sidepath segments when arterial streets are used to provide connectivity. This requires special design features at transition points from on-to off-street facilities. An example is the use of Roe Avenue to provide a continuous north-south route between Mission and Nall. Other bicycle boulevard routes serve the city center district along 119th Street.

FUNCTIONAL DESCRIPTION	CHARACTERISTICS AND CRITERIA	TYPICAL INFRASTRUCTURE SOLUTION	EXAMPLES	DEVELOPMENT PHASE
Primary medium distance routes for pedestrians and bicyclists. Focus on local users. Route development with relatively moderate public investment.	Streets or combined routes with low to moderate average daily traffic (ADT). Relatively direct, continuous streets or combinations of streets that typically exceed one mile in length. Minimize misdirection as possible, given Leawood's curvilinear street pattern. Endpoints at trails, destinations, or other system components. Fill gaps between grid established by principal lines and crosstown corridors.	Sharrows are typical maximum infrastructure needed in lower-volume settings. Conventional bike lanes in more moderate volume streets. Sidepaths on arterials to fill gaps and provide route continuity. Special bicycle boulevard (or neighborhood greenway) graphics, may be incorporated into street signs. System mark and MUTCD compliant wayfinding , identification, and caution information. Stop signs positioned to provide bicycle boulevard priority. Bike-sensitive loops at signalized intersections. Special arterial intersection design at non-signalized crossings. Continuous sidewalks. Traffic circles, neck-downs, and other traffic calmers where requested by neighborhoods	105th Street Rosewood/Juniper Overbrook Drive Wenonga 132nd Street	Short term because of low cost and high impact implementation possible. May be part of an initial implementation phase.

BICYCLE BOULEVARD	NAME	ENDPOINTS	MAJOR DESTINATIONS SERVED	HIGHLIGHTS	IMPLEMENTATION TERM
A	**85th Street**	83rd Street-Mission Road to 85th Terrace and State Line Road	Corinth Elementary School, Brook Beatty Park, Ward Parkway Center	East-west route utilizing quiet street project on 85th Street and local streets. Bike shoulder or path developed along Lee Boulevard between 86th and 85th Terrace.	Short-term
B	**Brookwood**	105th Street-Mohawk Road to 97th Place-Pawnee Lane	Mission Farms, Brookwood Elementary	Strategic short route features a short pathway segment that connects Mohawk Road with school site, adds a new path through the school campus and utilizes the existing 103rd Street signal.	Medium-term
C	**105th/ Sagamore**	Indian Creek Trail west of Mission Road to 98th Street-Sagamore Road	Indian Creek Trail, Mission Farms, 103-State Line district with trail bridge	SW to NE linkage using 105th Street and existing Mission Farms trail segment. Requires improved pedestrian crossing at 105th Street and Mission Road. A pathway segment between houses and new trail bridge over Indian Creek could provide linkage from neighborhood to major commercial district.	Short-term for roadway, long-term for possible bridge connection to 103rd Street and State Line Road.
D	**Town Center Plaza**	Town Center and Nall Avenue to 128th Street and State Line Road	Leawood City Center district, City Hall, Library, Tomahawk Creek Parkway offices and trails	Major northwest to southeast route. Incorporates sidepaths and complete street treatment along Town Center/117th, improved pedestrian and bicycle connectivity along a segment of 119th Street, and use of low-volume local streets through the southeast part of town to State Line. Possible alternate route via Mission Road and 123rd.	Short-term for path improvements from Nall to Tomahawk Creek Trail. Medium-term for 119th Street enhancements. Short-term for southeast segment. Use of Mission Road and 123rd Street for short-term continuity.
E	**Tomahawk Creek Parkway**	Tomahawk Creek Parkway-Nall Avenue (Overland Park) to 117-TC Pkwy	Tomahawk Creek corridor, Hawthorne Plaza and Town Center Crossing retail centers	Short route requiring cooperation with Overland Park. Includes widening of sidewalk on north side of TC Pkwy with on-street shared lane alternative. Project includes a trail bridge over creek to Tomahawk Creek Park, linking retail centers directly to regional trails.	Medium-term
G	**132nd Street**	132-Roe to High-Overbrook	Mission Trail Elementary School	Use of existing avenues and streets for internal connectivity with primarily local traffic. Includes improved access to school and crossing improvements at Mission.	Short-term, using existing streets
H	**Westside**	Tomahawk Creek Trail at Roe to 151-Rosewood	Tomahawk Creek Trail, Parkway Plaza and 135th Street mixed use corridor, Nall Valley Shops, Ironhorse Center	Major north-south route between busier streets, designed for neighborhood use. Connectivity depends on extension of sidepath along Roe Avenue from 131st to 133rd and from 137th to 143rd. Also includes bike lane adaptation south of 137th.	Short-term for south segment, using bike lanes on Roe Avenue to 137th Street. Medium for sidepath extensions. Shoert for north segment to 133rd Street. Long for eventual widening of two-lane section of Roe Avenue.
I	**140th Street**	140-Nall to 138-Kenneth		Crosstown route using quiet neighborhood streets. Includes a short path/sidewalk connection for connectivity of 140th Street.	Short-term

NEIGHBORHOOD CONNECTIONS

Neighborhood connectors are important parts of the system, but lack the continuity of bicycle boulevards. Different connectors have different functions, depending on context. They include short connections between other system components or between neighborhoods and the longer distance, destination-based routes. In some cases, they provide natural routes within neighborhoods or to such local destinations as elementary schools. Most of these routes are low volume local streets that require little modification other than advisory signage and, on occasion, sharrows.

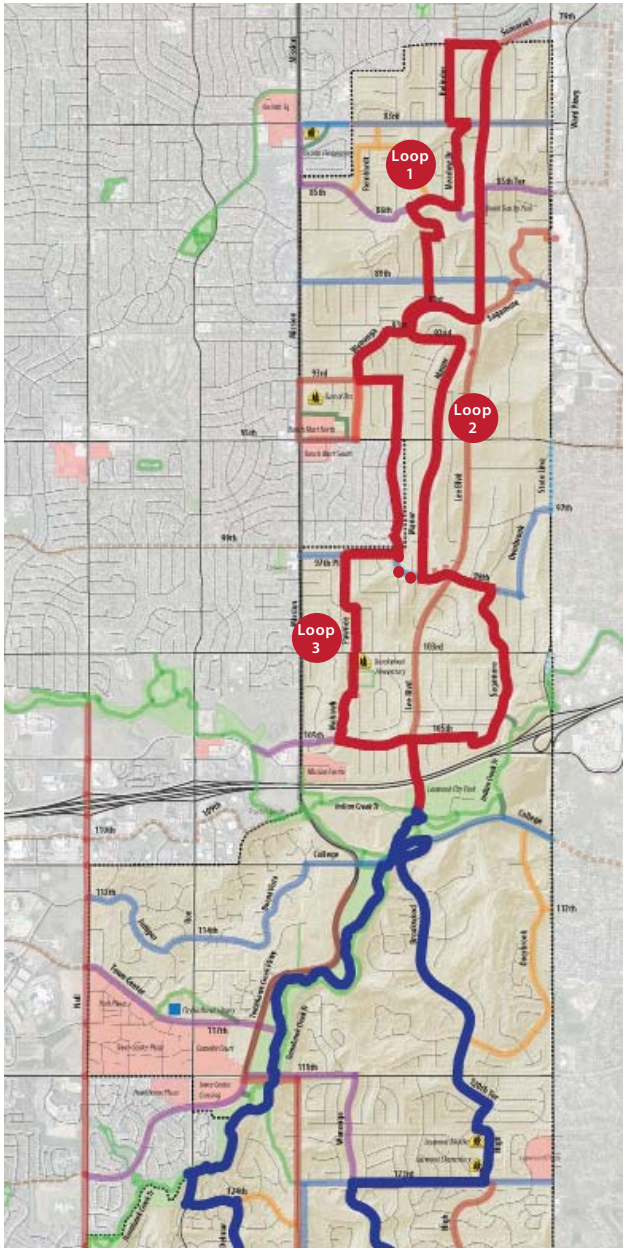


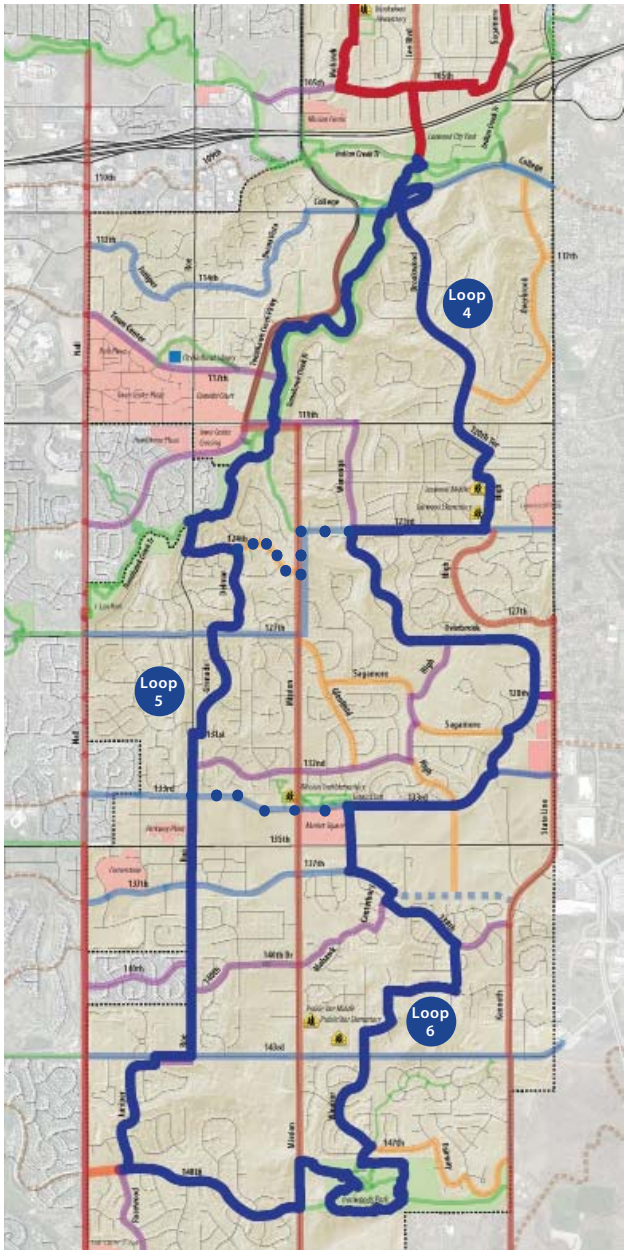
FUNCTIONAL DESCRIPTION	CHARACTERISTICS AND CRITERIA	TYPICAL INFRASTRUCTURE SOLUTION	EXAMPLES	DEVELOPMENT PHASE
Relatively short, local or low-volume street routes within neighborhoods. Connects to higher-order components of the city system, providing direct routes across neighborhoods and to trails, bicycle boulevards, and other components.	Streets with low average daily traffic (ADT) Direct access to other system features Endpoints at trails, destinations, or other system components Short connecting segments, generally offering less continuity than bicycle boulevard routes.	Typically, signage is adequate. Sharrows used where necessary to aid wayfinding or on streets with higher ADT. System mark and MUTCD compliant wayfinding , identification, and caution information. Continuous sidewalks with special treatment at key street crossings.	Meadow Drive Sagamore High Drive segments 148th Street	Short- to medium term implementation because of relatively low cost

STREET	ENDPOINTS	MAJOR DESTINATIONS SERVED
Belinder Road	Somerset to 83rd	Links Belinder bike route in Prairie Village to 83rd Street crosstown route
Reinhardt/Cherokee lanes	83rd to 86th	Links two crosstown routes and provides neighborhood connections to Corinth Elementary School
Meadow Drive	83rd to 86th	Quiet street connection between two crosstown routes, parallel to and complementing Lee Boulevard
92nd Street	91st to Manor	Quiet street and neighborhood connection to Ward Parkway-Ranch Mart principal route
Overbrook Road	College to Brookwood	Quiet street route paralleing State Line Road
124th Street	Delmar to Mission	Links north-south bicycle boulevard to Mission Road corridor
Glenfield Road	Mission to 132nd	Incorporates community boulevard into system as a quiet street alternative to Mission Road
Sagamore Road	Glenfield to 128th	Links two bicycle boulevards in southeast quadrant, provides neighborhood access to State Line corridor.
High Drive	132nd to 137th (future extension)	New north-south connector across 135th Street corridor
148th Street	Nall Avenue to Mission Road	Links two principal routes and school access using a quiet neighborhood street, also provides a direct route to Ironwoods Park
Windsor/147th/Fairway streets	143rd to Kenneth Road	Continuous local route through southeast neighborhood, with links to Ironwoods Park and trails

WALKING AND BIKING CIRCLE ROUTE

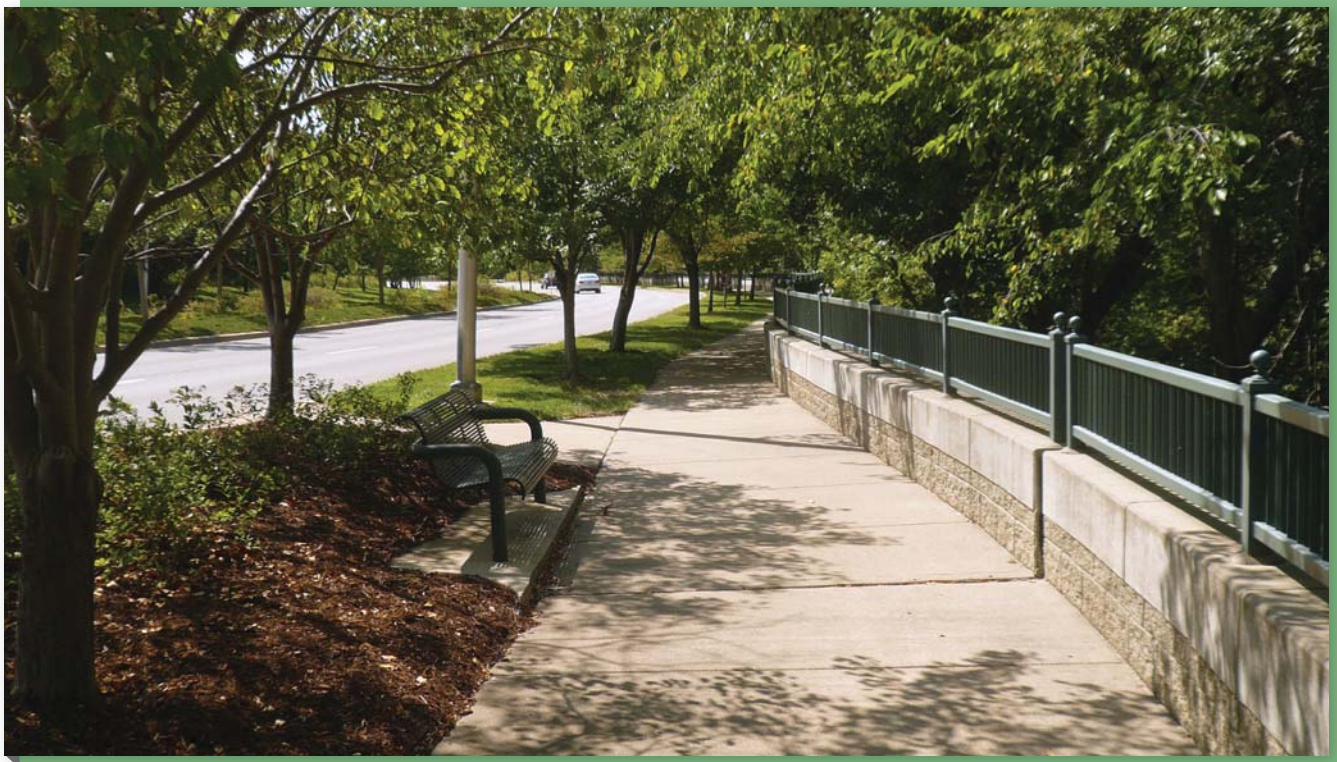
The Circle Routes are designed for leisurely, recreational travel around Leawood's neighborhoods. They assemble segments of other system components, usually along quiet neighborhood streets and trails, to create two interconnecting loops. The loops, north and south, meet at Leawood City Park and connect to the regional trail system there. While these loops do serve destinations, they are not intended as point to point, destination-based routes. Rather, they display many of the city's beautiful residential streets, scenic resources, public art, and other special features.





CHAPTER 4

ON FOOT IN LEAWOOD



LEAWOOD SHOULD DEVELOP AND MAINTAIN A CONTINUOUS NETWORK OF SIDEWALKS AND TRAILS TO COMPLEMENT THE STREET SYSTEM.

Providing a safe and complete environment for non-motorized transportation can complement or even replace automobile trips. The incorporation of sidewalks into new development and the provision of sidewalks in areas of existing development are essential to maintaining a safe, convenient pedestrian environment.

At present, Leawood's neighborhoods maintain a relatively incomplete sidewalk network. Ensuring that new development requires sidewalks to provide eventual links to the overall system and gradual adaptation of major pedestrian facilities to full accessibility will be an important priority for Leawood's pedestrian system. In addition, the city's multi-use trail network should be linked to activity centers, enhancing the city's walkability and allowing residents to safely walk to work and school, as well as being used for recreation.

Only within the last 50 to 60 years has community design moved away from a premise of pedestrian access, of which Leawood demonstrates in many of its neighborhoods. Today's development is more auto-dependent, with street patterns that can make pedestrian movement unsafe, which is true for the State Line Road area. In a truly walkable community, neighborhood commercial services, schools, and other activity centers are located within walking distance of housing. Walkable communities also encourage social interaction and expand transportation options. The pattern and design of development should serve a range of users including pedestrians and bicyclists, as well as motorists, moving them around the community in a convenient and efficient manner.

Decisions regarding vehicular travel also affect a community's walkability. A good transportation network uses special design techniques to ensure that street traffic is consistent with pedestrian safety, which is important when linking neighborhoods to commercial and civic destinations around the community.

The goal of creating a walkable community is to:

- Ensure that all areas of the community are accessible by a network of sidewalks and trails.
- Key activity centers are accessible by residential areas.
- Design streets so that traffic moves at speeds that allow for pedestrian activity.

MODE SHARE

Leawood's mode share for commuting to work by walking is less than the state and nation. About 0.5 percent of commuters walk to work in Leawood, compared to 2 percent for the State of Kansas and 2.8 percent for the nation. Table 6.1 identifies commuter patterns based on Census data.

Maps 4.1 to 4.4 show maps that describe mode share split for walking, public transportation, bicycling, and car by block group.

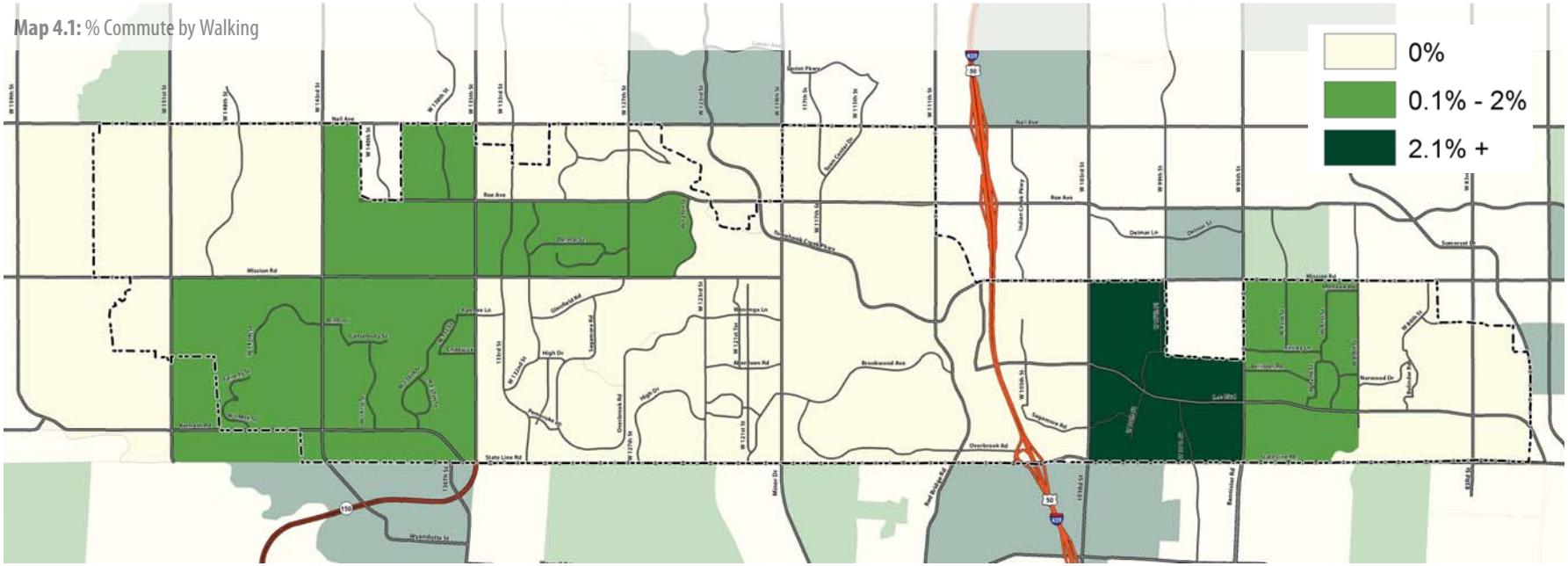
Areas with greater mode share split are noticeable immediately north of I-435, showing a slightly higher proportion of commuters walking. The neighborhood immediately south of I-435 shows a slightly higher proportion of commuters carpooling. Otherwise, the commuting habits by other neighborhoods is primarily by car.

Table 4.1: Commuting to Work

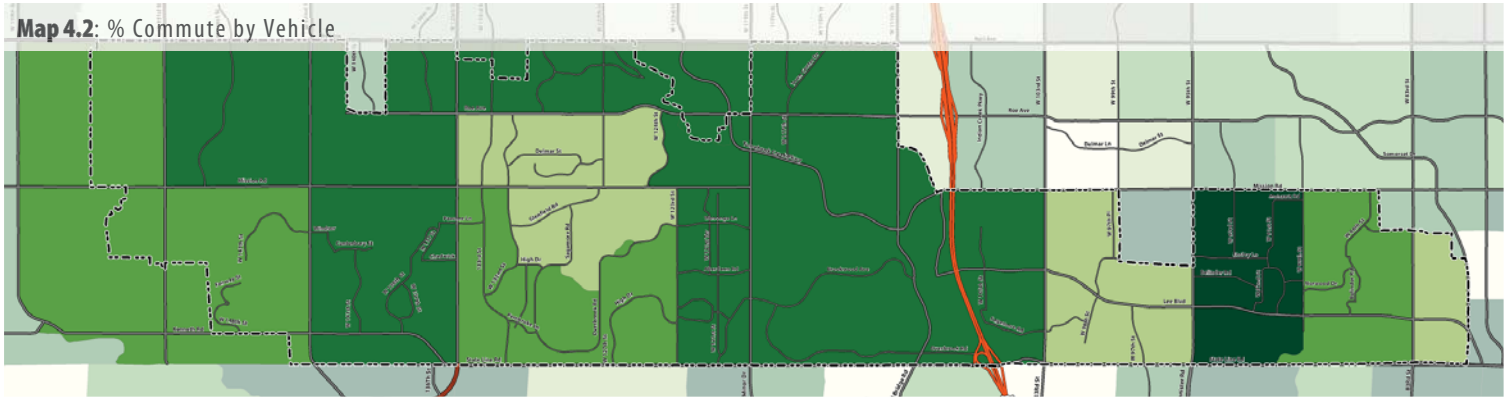
Mode of Commute	Workers	% of Workers
Workers 16 years and over	15,204	100
Car	13,562	89.2
Carpool	502	3.3
Public transportation	30	0.2
Walked	76	0.5
Bicycle	15	0.1
Other means	137	0.9
Worked at home	1,399	9.2

Source: US Census Bureau, 2012 American Community Survey 5-Year Estimates

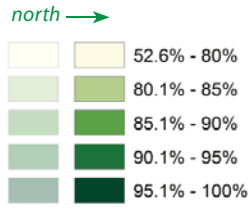
Map 4.1: % Commute by Walking



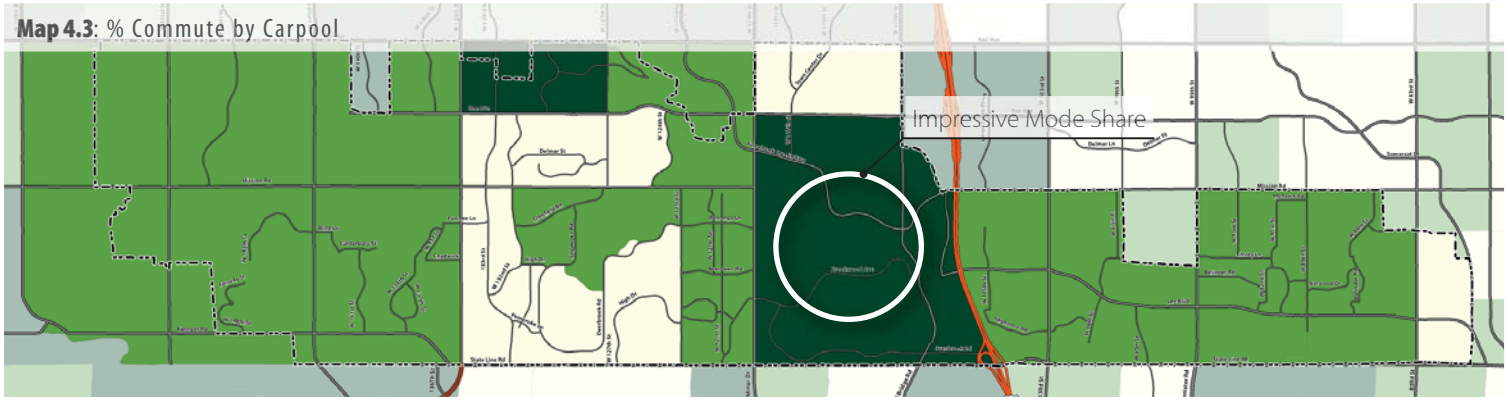
Map 4.2: % Commute by Vehicle



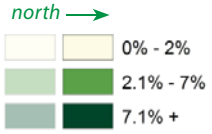
A significant proportion of Leawood residents commute by car.



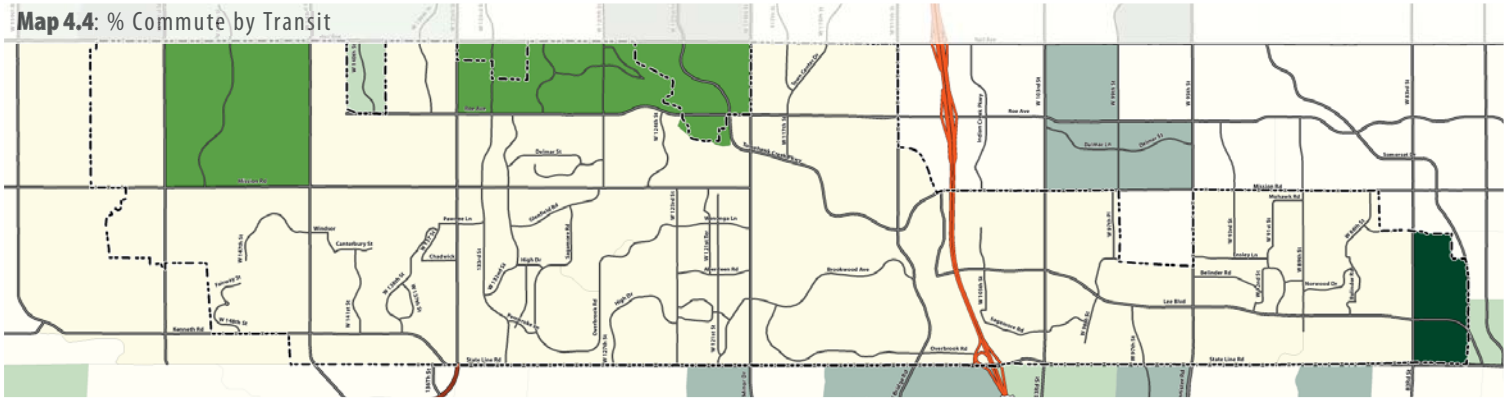
Map 4.3: % Commute by Carpool



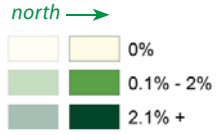
Percentage of people carpooling is slightly elevated near the interstate.



Map 4.4: % Commute by Transit



Ridership for public transit is low in Leawood.

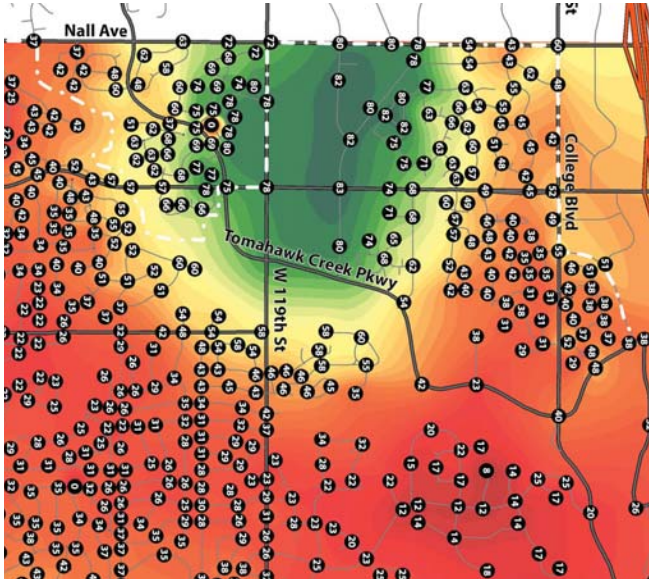


WALK SCORE

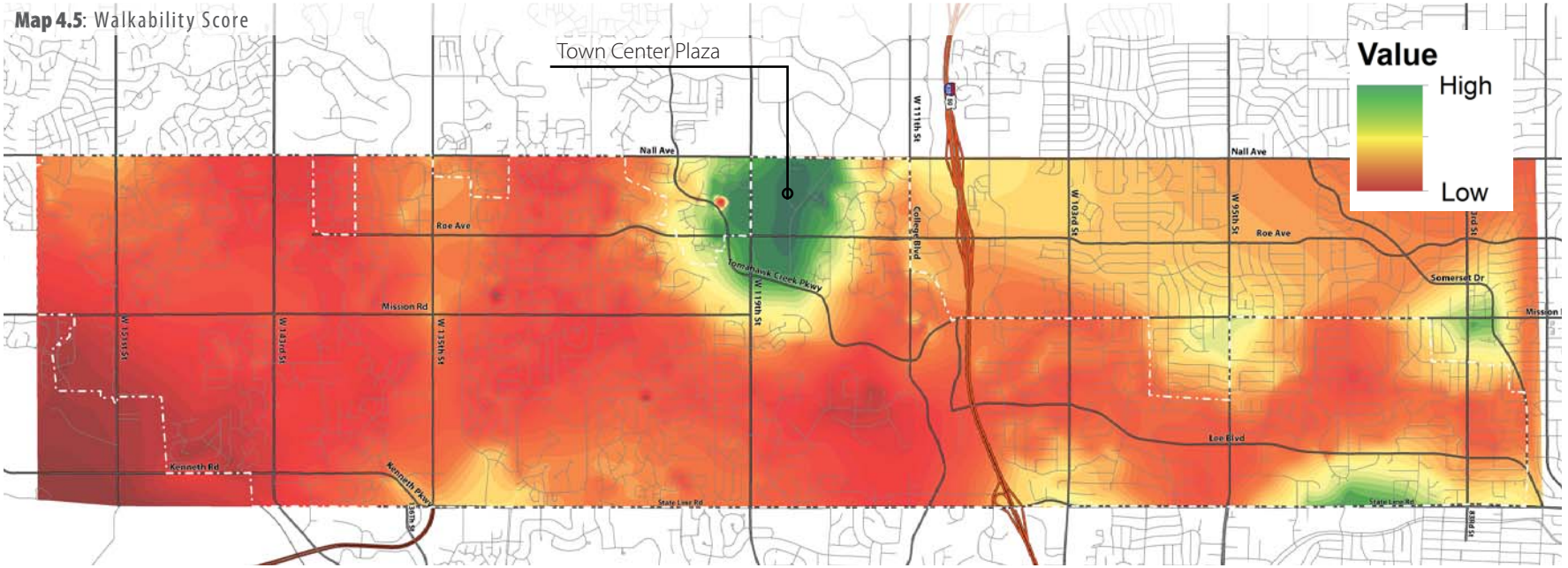
WalkScore.com is a website that maps the walkability of communities throughout the United States and other countries. The website indicates that the scores "measure walkability on a scale from 0 - 100 based on walking routes to destinations such as grocery stores, schools, parks, restaurants, and retail." The scoring system excludes connectivity of streets and sidewalks that lead to destinations, but indicates areas that may experience a higher demand for walking to destinations.

Overall, Leawood's walkability score is 21, and described as car-dependent with almost all errands requiring a car. Map 4.5 illustrates the city's walkability score for the entire community. The heat map indicates the walkability of the area being higher near the Town Center Plaza area, then declining away in neighborhoods (~30s).

Despite the Town Center Plaza's higher score in the 80s, the internal and external are generally unfriendly to pedestrians. The clustering of restaurants, cafes, hospitality services, daily needs, and shopping create a set of amenities that influences people's sense of destination. People will walk blocks to their destination if they sense that they have already arrived. Park Place, an emerging development project to the north of Town Center Plaza, is very walkable, yet the connections to Town Center Plaza are somewhat fractured by 117th Street.



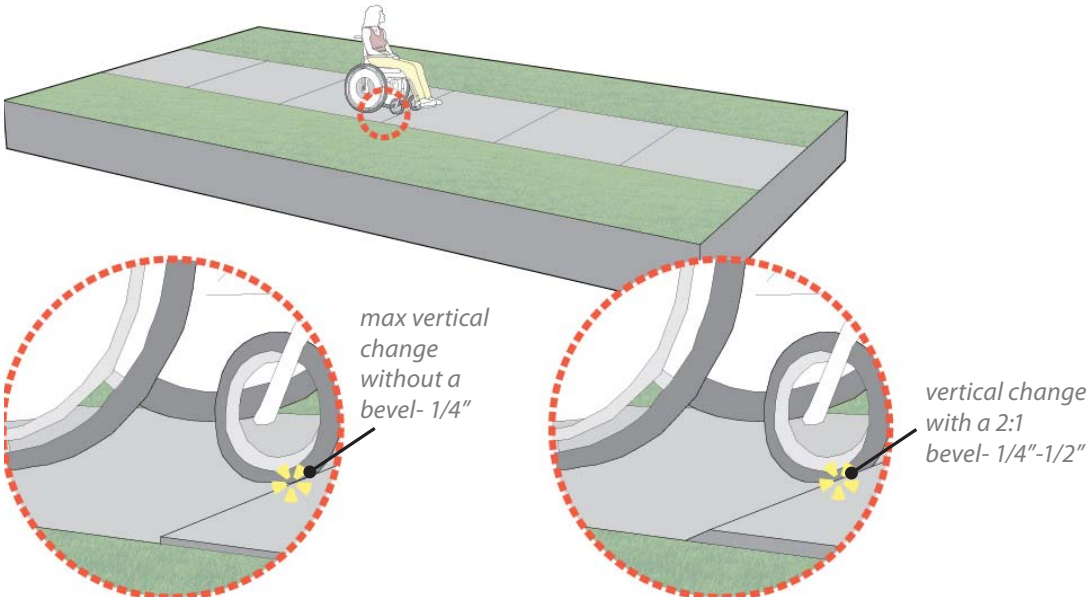
Map 4.5: Walkability Score



SIDEWALK ASSESSMENT

The process of evaluating Leawood's sidewalk system was conducted by a windshield survey for a majority of the community, with more detailed investigation near schools. Hundreds of photos were taken and field notes recorded. This data was transposed to GIS for future use by city staff.

Reports of damaged walks are not precise, but intended to reflect the frequency of damaged walks for a block. The survey identifies existing sidewalks in good condition, sidewalks that need improvement, gaps, and intersections where sidewalks do not comply with ADA standards. The level of detail shown in this survey is not part of the project's original scope, but included nonetheless. The assessment indicates patterns in the pedestrian environment that show the level of connectivity in neighborhoods.



The survey classifies sidewalks into the following categories:

- **Existing sidewalk, Good Condition.** Sidewalk is present and in good condition.
- **Existing sidewalk, Needs Improvement.** Sidewalk is present and obstruction is present. In general, improvements were based on whether a sidewalk was passable by wheelchair or stroller. Impairments may include: (1) concrete plates do not align, creating a tripping hazard; (2) significant cracking; (3) concrete damaged by use of salt and other chemicals; (4) heaving as a result of uprooting of trees; (5) too narrow of a walkway; and/or (6) overgrowth of plants in walkway or over walkway.
- **Gaps.** No sidewalk is present.
- **ADA Intersection.** Sidewalks at an intersection do not meet ADA requirements. Typical issues include: (1) no ramps at all, (2) ramp going in a single direction, or (3) obstruction in the path. The presence of truncated domes was not considered as part of the evaluation.

PATTERNS IN THE ENVIRONMENT

Identifying patterns in the pedestrian environment can be generally discussed by separating the city into three segments - north, central, and south.

North

North Leawood covers the area north of I-435. Many of the local neighborhood streets were developed without sidewalks. Major corridors, such as Lee Boulevard and 95th Street, have some sidewalks. Patterns include:

- **Gaps.** Many neighborhoods throughout the country built post-World War II do not have sidewalks. This was generally caused by a desire to cut costs and a basic and unjustified assumption that most people would drive everywhere.

- **Sidewalk Adjacent to Curb.** 103rd Street is a four-lane corridor with 4 foot sidewalks set behind the curb. This environment is rather difficult for pedestrians as the proximity of the intense traffic can be uneasy for pedestrians, and rendered impassible when snow is plowed over the sidewalk.

- **Bridges.** Bridges are not designed to accommodate pedestrians. For example, the bridge for Wenonga Road over the creek is designed for vehicles only.

- **Crossing I-435.** Mission Road, Lee Boulevard, and Indian Creek Trail are the means of crossing I-435. State Line Road is a major arterial with sidewalks along the Missouri side.

- **Possible Retrofitting.** Retrofitting existing streets for sidewalks will require care and detailed design. Drainage intakes, mature trees, fencing, light poles, slopes, ditches, and landscaping are common obstacles for placing the sidewalk along the curb.

  Lee Boulevard was retrofitted with a continuous sidewalk. The sidewalk is separated from street by a ditch with intermittent drainage intakes.

  Neighborhood sidewalks could be setback from the curb behind trees, yet the sidewalk would likely be placed out of the right-of-way. Connections from the sidewalk the driveway requires design. Several demonstrations are provided in this plan.

  Retrofitting streets with a rural section, such as 96th Street, will require significant engineering to accommodate a sidewalk.

Central

Central Leawood covers the area from I-435 to about 119th Street. This area has many sidewalks along one side of the street and a network of trails. Patterns include:

- **Damaged walks.** Several sidewalk sections require repair as a result of settling, heaving from roots, or obstructions from drainage intakes.

- **Sidewalks on one-side**. Several neighborhoods provide sidewalks on one side of the street only.

- **Circulators.** Major corridors should have sidewalks to offer choices in mobility. For example, Sagamore Road provides strong connectivity to a number of areas in the central part of Leawood, yet does not have a sidewalk.

- **State Line Road.** The sidewalk along State Line Road terminates south of the I-435 interchange and pedestrians are not directed where to travel. Looping the path to Indian Creek Trail or providing wayfinding for pedestrians would improve the user's experience.

- **Town Center Walking Trail.** The Town Center Walking Trail provides a critical connection to Leawood's major commercial destination, City Hall, and neighborhoods. Yet, the trail terminates abruptly near Tomahawk Creek. Again, the trail needs to loop back into an existing sidewalk or be programmed for extension.

South

South Leawood covers the area from 119th to 159th Streets. Many of the neighborhoods were planned with a sidewalk on one-side of the street, such as Hampton Place and Estate of Ironhorse. The walkways are separated from the street with typically a row of shade trees. Major corridors like 138th Street provide sidewalks on both sides of the street.

- **Crossing 135th Street.** Pedestrians must cross seven lanes of traffic or 150' of street on 135th Street at Nall Ave. Walking this distance can be challenging for some pedestrians. Providing countdown timers and median refuges with pedestrian-actuated signals would increase the connectivity near commercial areas.

- **Connectivity.** Subdivisions have limited connections between each other often caused by the frequency of cul-de-sacs. Camden Woods and Steeplechase neighborhoods have a strong connection to Ironwoods Park

by way of a backyard trail. Future subdivisions, particular the Leabrooke neighborhood, should consider a similar trail to improve connectivity.

- **Greenways.** Pavilions of Leawood and Whitehorse have a backyard greenway that obstructs connections and forces pedestrians to walk along collector streets. Future subdivisions in South Leawood should provide more connectivity, especially for subdivisions with cul-de-sacs that back into each other.

- **Parkway Plaza Area.** Commercial projects like the Parkway Plaza at 135th Street generally provide good internal and external circulation for pedestrians.

EXISTING SIDEWALK CONDITIONS


No sidewalk

Incomplete sidewalk


Obstructions


Deteriorating sidewalk


Incomplete sidewalk


Obstructions


Steps


Overgrowth obstructions


Impaired sidewalk

Missing curb cuts

Incomplete crossings

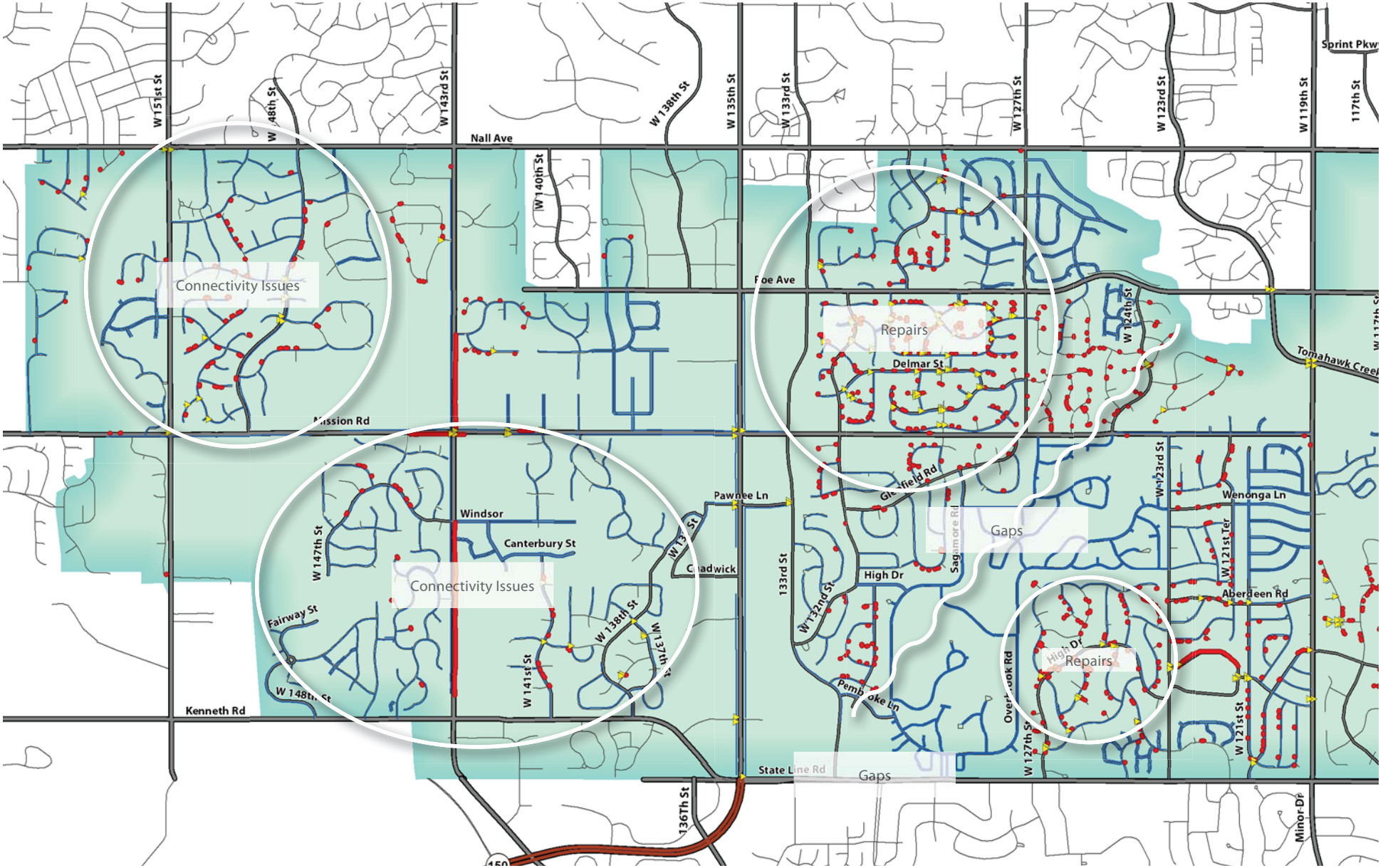
Missing crossing striping

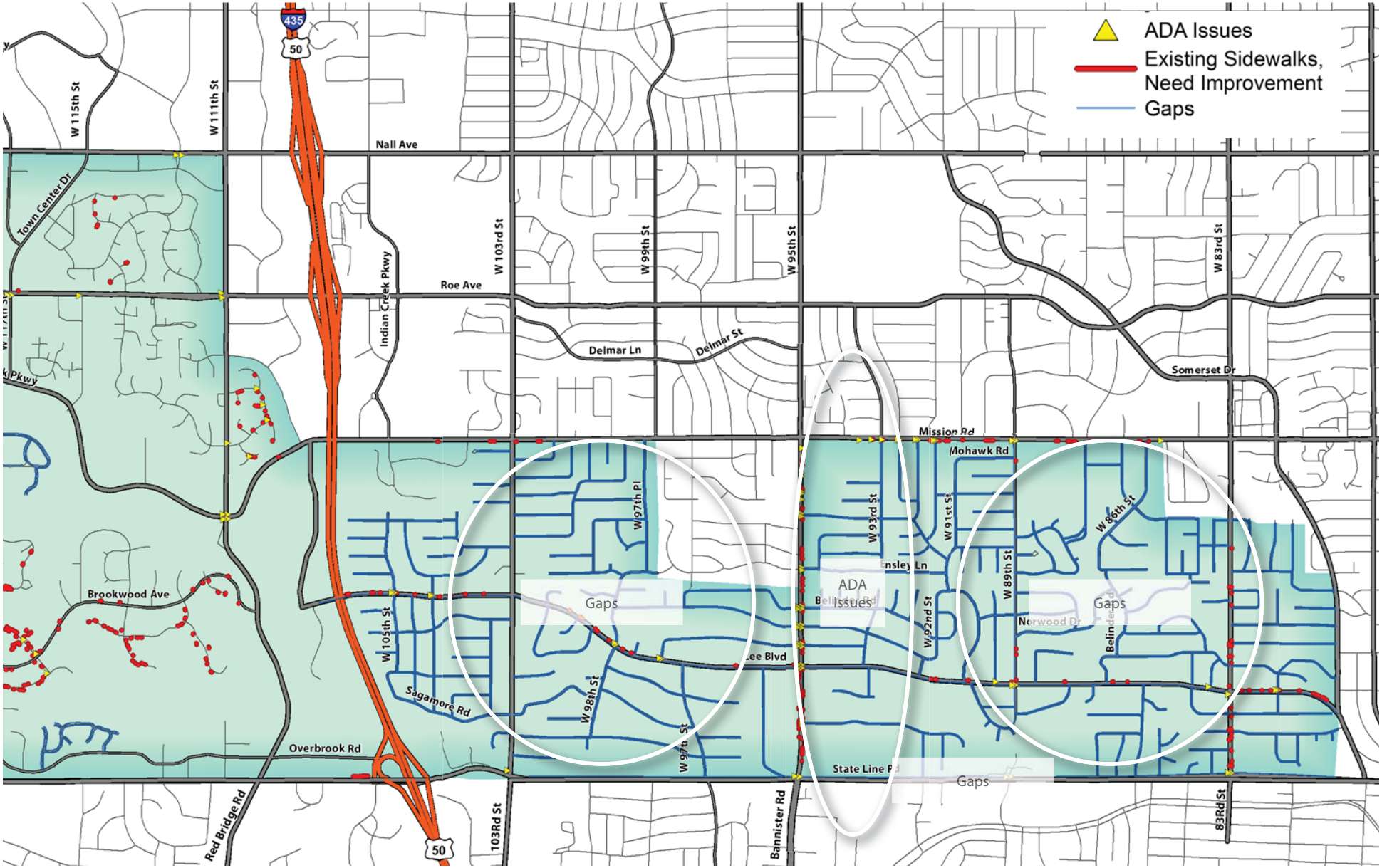
Material transition

Poor drainage

Cracking sidewalk

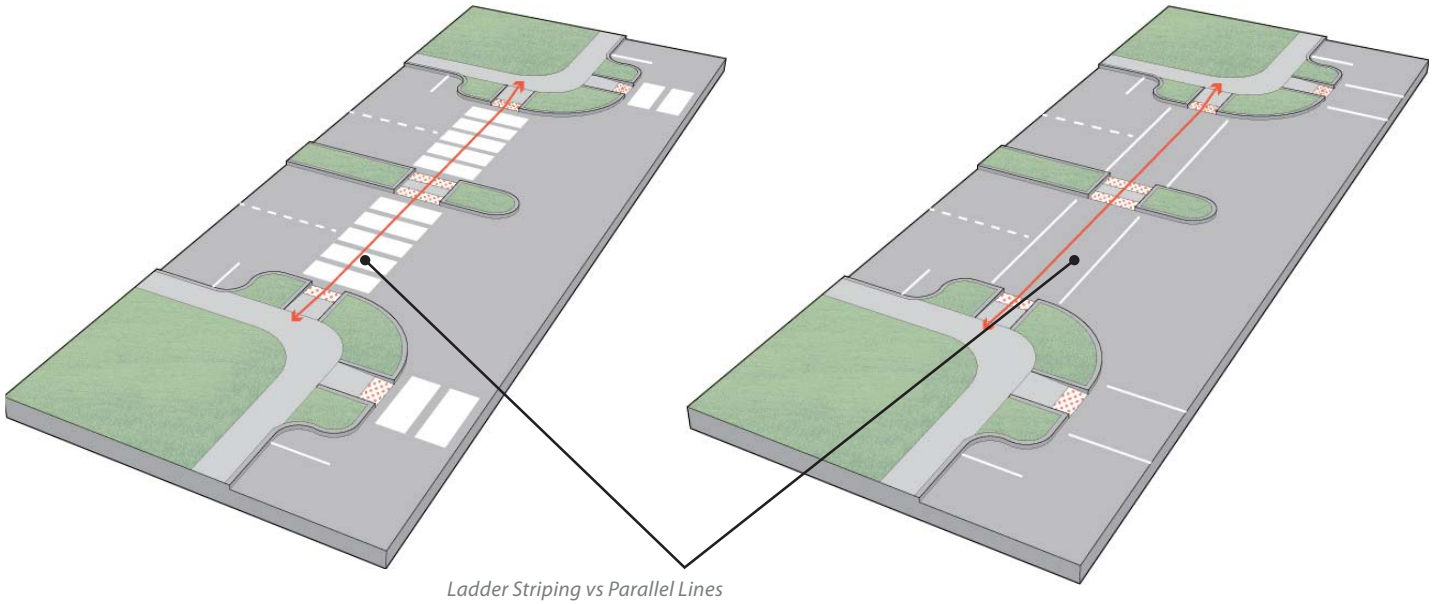
Map 4.6: Sidewalk Conditions




ADA Issues
Existing Sidewalks, Need Improvement
Gaps
435
50
W 115th St
W 111th St
Nall Ave
Town Center Dr
Indian Creek Pkwy
W 103rd St
Roe Ave
W 99th St
W 95th St
W 83rd St
Delmar Ln
Delmar St
Somerset Dr
Mission Rd
Mohawk Rd
W 97th Pl
W 93rd St
W 91st St
W 86th St
Ensley Ln
W 89th St
W 92nd St
Brookwood Ave
W 105th St
Sagamore Rd
Lee Blvd
W 98th St
Overbrook Rd
State Line Rd
Red Bridge Rd
103Rd St
Bannister Rd
83Rd St
Gaps
ADA Issues
Gaps
Gaps

APPLICATIONS: MEDIANS AND MIDBLOCK PEDESTRIAN REFUGE ISLANDS

Medians and pedestrian refuge islands at street crossings shall be cut through level with the street or comply with the curb ramp requirements. The clear width of pedestrian access routes within medians and pedestrian refuge islands shall be a minimum five feet. If a raised median is not wider than 6 feet, it is recommended the nose not be placed in the pedestrian street crossing.



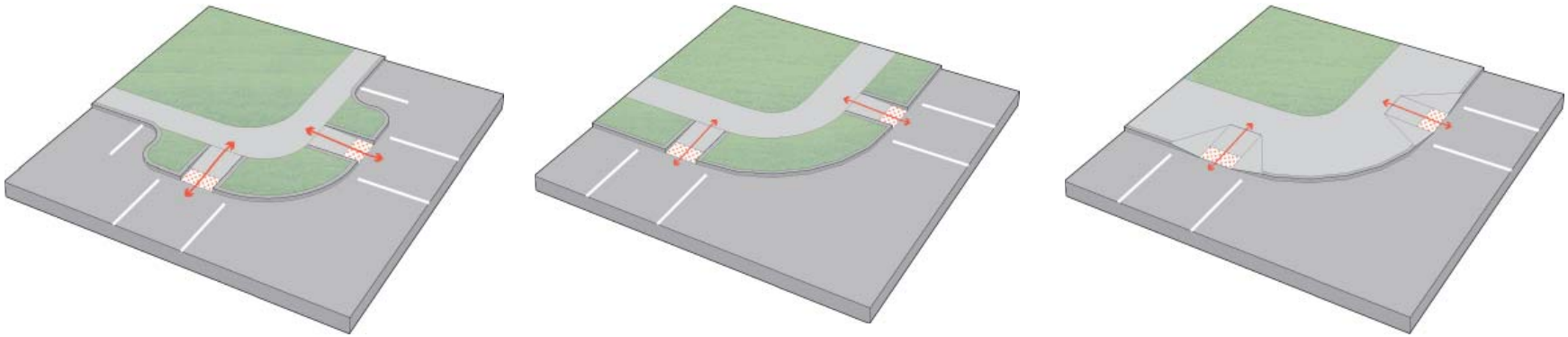
Ladder Striping vs Parallel Lines
Ladder striping can be seen better by motorists and pedestrians, while parallel lines is a more affordable application.

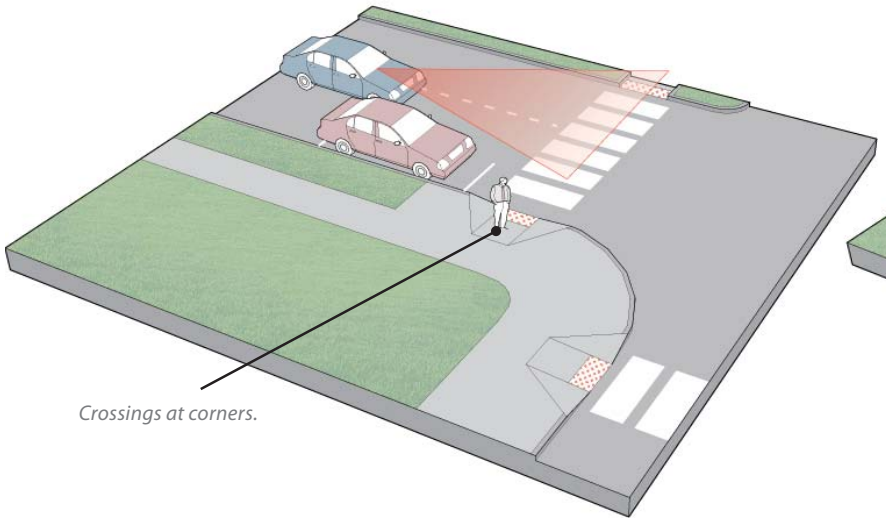
4-Lane Road with Refuge
River Drive in Davenport, IA

APPLICATIONS: CROSSING LOCATIONS

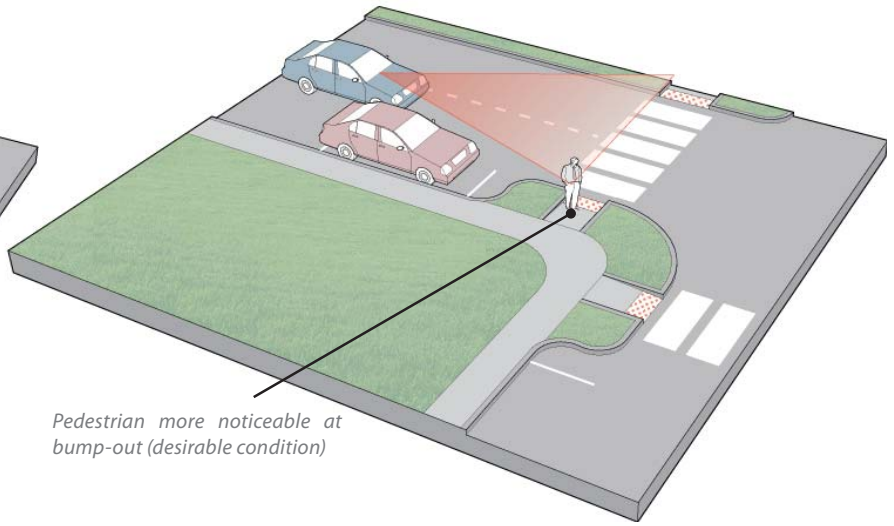
Awareness between drivers and pedestrians increase with improved visibility. Crossing should be located near the intersection. The illustrations above show desirable alignments for pedestrian crossings.

Therefore, curb ramps and pedestrian street crossings should be located as close to the edge of the adjacent traveled lane as practical. Where a stop sign or yield sign is provided, MUTCD requires the pedestrian street crossing, whether marked or unmarked, be located a minimum of four feet from the sign, between the sign and the intersection. It is recommended stop and yield signs be located no greater than 30 feet from the edge of the intersecting roadway; however, MUTCD allows up to 50 feet. Consult MUTCD for placement of curb ramps and pedestrian street crossings at signalized intersections.





Crossings at corners.

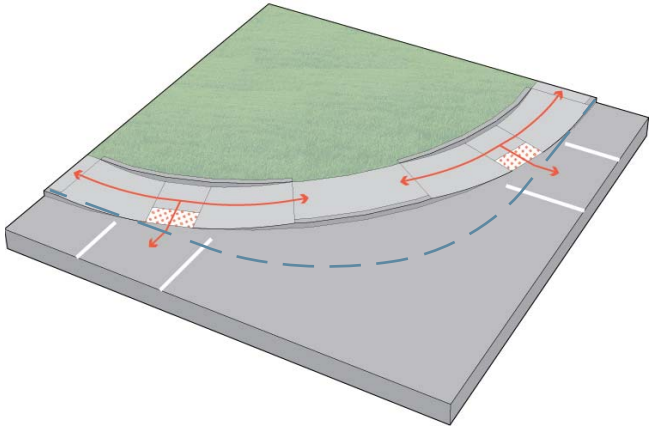


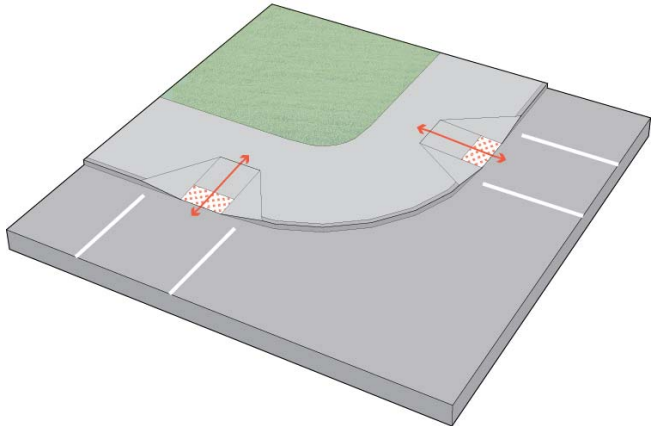
Pedestrian more noticeable at bump-out (desirable condition)

APPLICATIONS: CORNER RADIUS

A tighter corner radius slows down the motorist when turning, while a broader radius encourages motorists to move faster through the intersection. The design of the corner improves the mobility of motorists at the cost of reducing safety for the pedestrian. Both practices to the right are acceptable. However, a tighter radius is preferred for pedestrian safety.

Bump-outs in Omaha

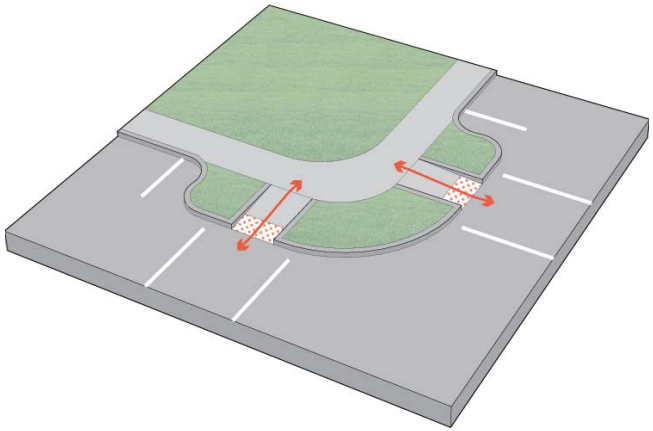


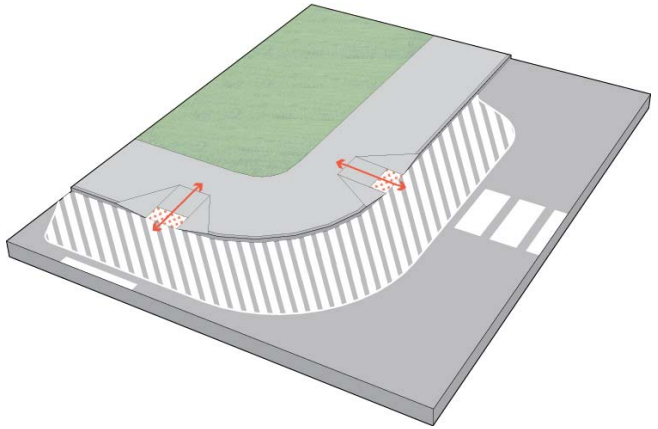


BUMP-OUTS

Bump-outs calm traffic, protect the edge of diagonal parking, and make streets more crossable for pedestrians. Bump-outs may include planting beds, including tree planting, paving, and street furniture. The nodes may also include interpretive graphics and public art.

Virtual bump-out in Esparto, CA



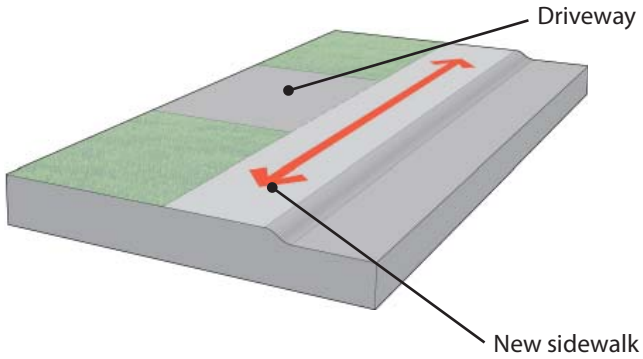


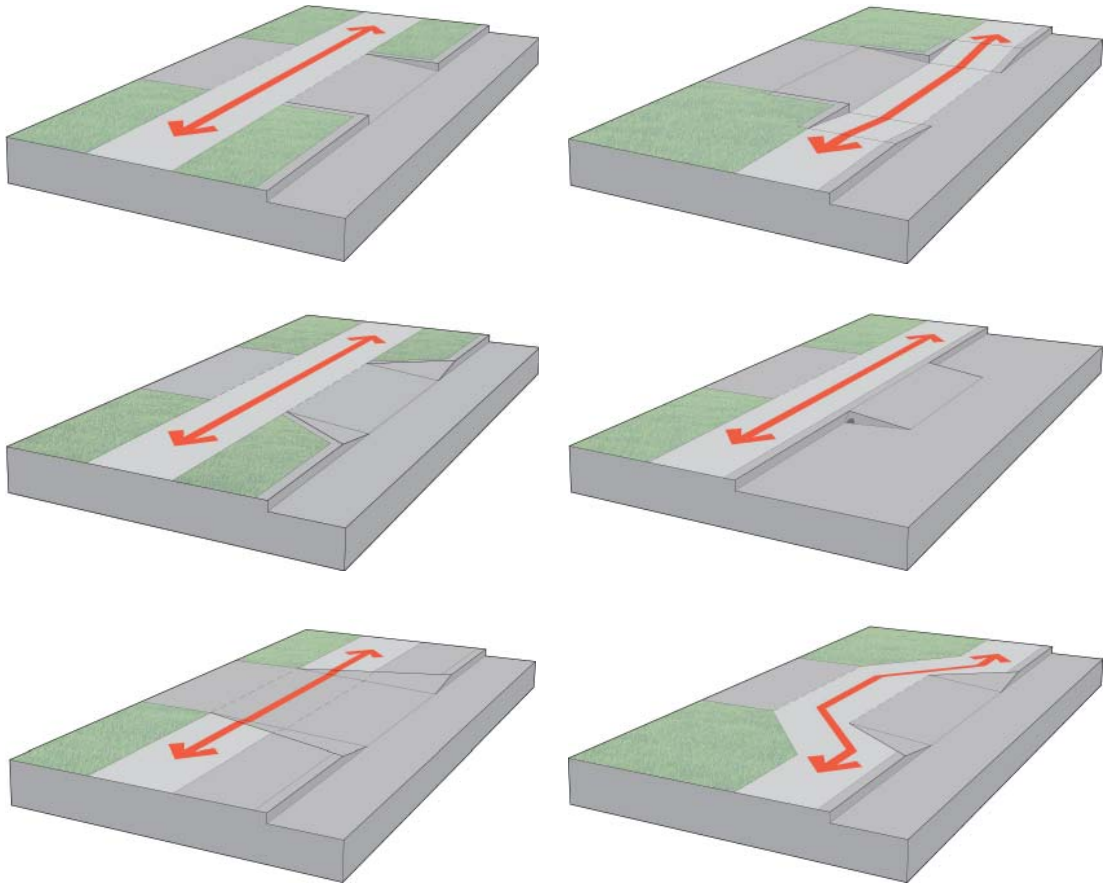
APPLICATIONS: DRIVEWAY TOOL GUIDE

Sidewalks in existing neighborhoods should provide continuous access. The alignment of the sidewalk to the driveway is an important junction. Sidewalks should be flush with the driveway and allow the pedestrian to walk on an unobstructed path. Retrofitting a sidewalk along Leawood's neighborhood streets require care, as numerous obstacles appear within the path of a possible walkway.

The figures on this page identify typical points of junction between sidewalks and driveways. Typical features include:

- **Consistent Setback.** Preferably, sidewalks are setback from the curb to (1) allow for space to plant trees and (2) prevent snow from being plowed from the street to the sidewalks. Sidewalks may meander, however subtly.
- **Width.** Sidewalk widths should be consistent throughout neighborhood and be a minimum of four feet.
- **Material.** Sidewalks should be constructed of concrete. Pavers and stones are irregular and do not provide a consistent surface.
- **Maintenance.** Property owners are responsible for keeping sidewalks clean and free of snow

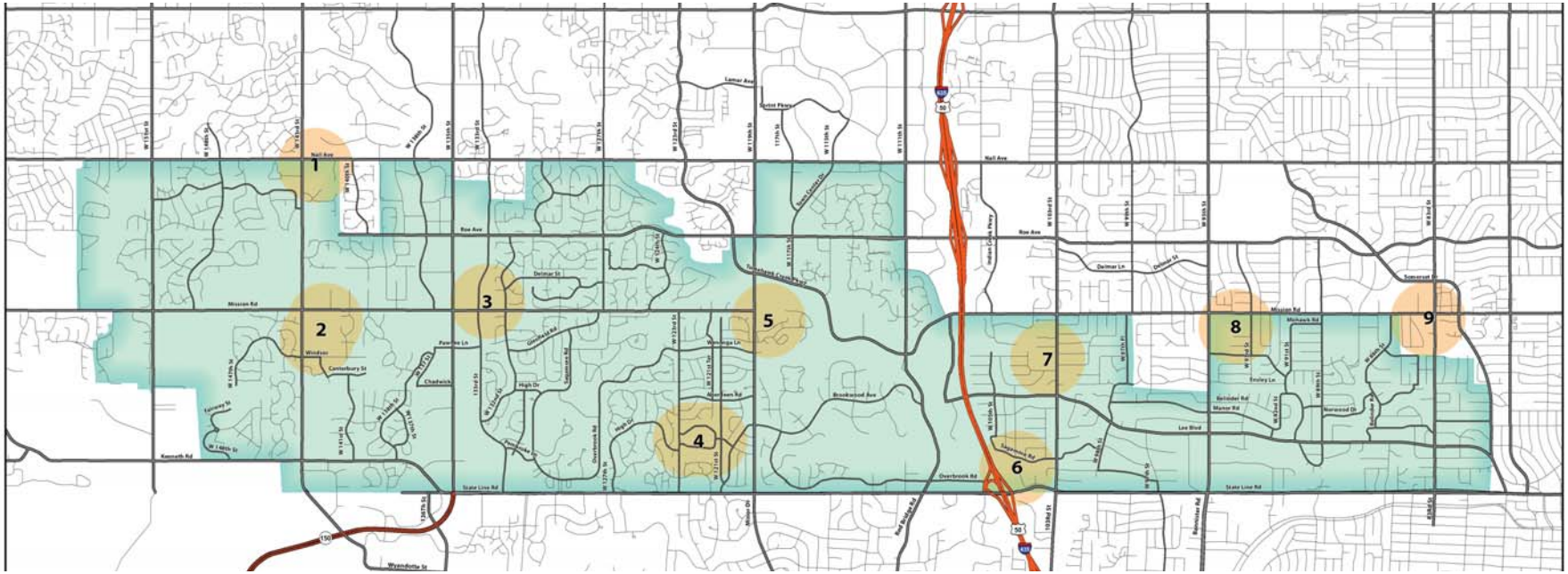




SAFE ROUTES TO SCHOOL ANALYSIS AND TREATMENTS

Map 4.7 identifies schools in the City of Leawood and shows a quarter-mile buffer. This plan provides a detailed assessment of each school and suggests possible solutions for improving the safety and connectivity for students traveling to work, while alerting motorists that children are present. The following diagrams illustrate scenarios of high priority for improving zones around elementary and middle schools.

Map 4.7: School Locations



Key

1. St. Michael the Archangel Catholic School
2. Prairie Star Elementary School/Prairie Star Middle School
3. Mission Trail Elementary School
4. Leawood Elementary and Middle School Campus
5. Nativity Parish School
6. Phoenix Montessori School
7. Brookwood Elementary School
8. Cure of Ars Catholic School
9. Corinth School

School Overview

All crosswalk markings observed in the vicinity of the elementary schools and at major intersections use traditional paralleling white bar crosswalk. This marking has limited visibility to motorists, particular when the pavement is wet conditions and at night.

A much more effective marking pattern is the high-viz ladder pattern with both white and high visibility neon green marking materials incorporated to create a contrasting pattern on the pavement.

Dual colored, high-viz ladder style crosswalks should be incorporated on all public street crosswalks and at school entry/exit drive. This crosswalk style is also highly recommended on all internal school site crosswalks where student pedestrian traffic is the most concentrated.

Crosswalks at major intersections require pedestrians to travel significant distances (150' at times). At a minimum, these intersections should be adapted to include countdown timers. Other features could include signage, ladder striping, flashing crosswalks, and possibly redirecting the path to stop at a median refuge.

For example, a midblock refuge shown in the example from Des Moines has a pedestrian-actuated signal that allows walkers more time to cross the street. This application could be applied to a number of major crossings, including 135th and Nall Avenue.

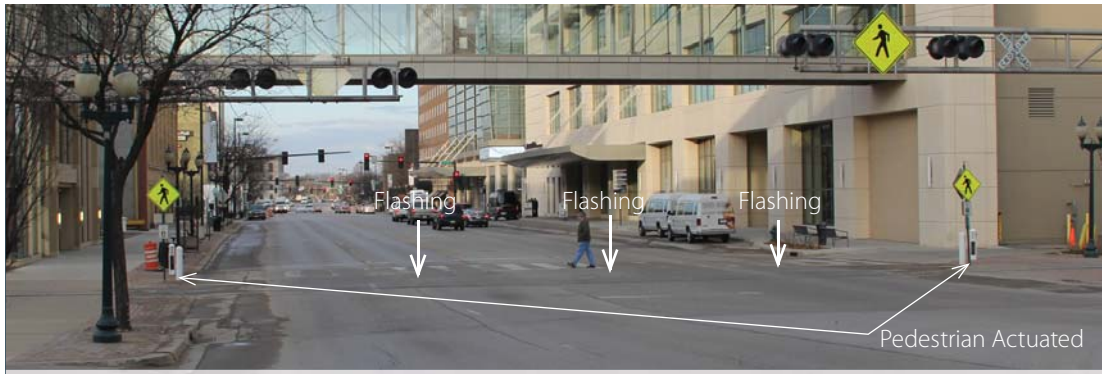
The following studies for school areas includes an analysis and possible recommendations for improving pedestrian circulation.

Ladder crossing


Ladder crossing with parallel stripes


Caution Painting - Sacramento, CA


Median Pedestrian-Actuated Signal - Des Moines



Flashing Crosswalk - Cedar Rapids, IA

LEAWOOD ELEMENTARY AND MIDDLE SCHOOL CAMPUS

Primary Challenges

- Access to the Pembroke Court residential area east of schools
- Crosswalk configuration north of middle school
- Perimeter drive path
- Bicycle parking in grass area south of elementary school parking
- Sidewalk alignment along 123rd Street
- Crosswalk delineation on 123rd Street at High Drive.

Analysis

- **Access to the Pembroke Court.** There is no direct access to Pembroke Court even though the subdivision shares a =/- 1/4-mile boundary with the school campus. The medium density housing style limits options for providing direct access between most residences due to the predominantly narrow side-yard building setbacks. This results in students who walk to school, but live in adjacent proximity to the schools having to walk east to Pembroke Lane then nearly ¼-mile along 123rd Street or be driven to school, which adds to the vehicular congestion at the schools.

- **Crosswalk configuration.** The crosswalks north of the middle schools at High Drive and the perimeter drive treats High Drive and the perimeter drive both as if it is one crosswalk, instead of two with a corner ramp/refugee on the northeast corner of the intersection. This creates an exceptionally long crosswalk where motorists and pedestrians, alike, may be confused as to who has the right-of-way when pedestrians reach the corner and encourages students to stand in the street and crosswalk after cross one of the drives.

- **Perimeter drive path.** A perimeter walkway exists on the west side of the campus between High Drive and 123rd Street with two connecting walks to the Bradford Place subdivision west of the campus. The following issues influence the effectiveness of this walkway:
  - The perimeter walkway does not continue on the east side of the campus to connect to Pembroke Court or the athletic fields. Extending the walkway around the

east side of the campus would facilitate pedestrian circulation, link adjacent neighborhoods and provide a community walking loop within the neighborhood.

- The path is not wide enough to accommodate multiple students at a time or bicyclists and pedestrians, which can be expected on a daily basis at the schools.

- **Bicycle parking area.** A randomly placed bike rack is located between 123rd Street and the elementary school paring area in grass. There is photographic evidence of usage justifying a more appropriate location closer to an entrance to the elementary school.

- **Sidewalk alignment.** The sidewalk along the north side of 123rd Street is logically located to accommodate pedestrians walking east-west on 123rd Street. The sidewalk's layout does not reflect the potentially high volume of student traffic walking to the southeast corner of the elementary school from the signalized crosswalk or from the east.

- **Crosswalk delineation.** High Drive at 123rd Street has sidewalks on both side and a sidewalk with ramp on the north side of 123rd Street aligning with the west sidewalk on High Drive. There is no crosswalk delineation to protect pedestrians crossing at this location. This creates a conflicting message for pedestrians and motorists, alike, as to whether pedestrians should cross at this location.

Possible Solutions

- **Access to the Pembroke Court.** Direct access to the school campus from Pembroke Court will require an easement between Sagamore Road and the campus's east boundary for a walkway. Only one property has adequate space within the lot to accommodate a walkway. 12212 Sagamore Lane is turned at an angle to Sagamore Lane resulting in a larger side/rear yard than all other properties along Sagamore. If an easement can be acquired a walkway could be extend between 12212 and 12210 Sagamore and the athletic fields aligning with the elementary school. A new crosswalk on the perimeter drive should be located south of the east parking lot with a walk connecting to the sidewalk on the west side of the parking area to complete the connection.

- **Crosswalk configuration.** A crosswalk refuge with ramps in both directions should be added on the northeast corner of High Drive and the perimeter drive. The two crosswalks should be realigned to shorten the overall crosswalk as much as possible. Stop bars should be provided for all crosswalks.

- **Perimeter drive path.** The usefulness of the perimeter path can be improved by:
  - Widening the perimeter path to a minimum eight foot width to accommodate multiple users when the path needs replacement or major maintenance improvement.
  - Shifting the path further from the perimeter drive between High Drive and the middle school's west drive
  - Extending a path around the east side of the perimeter drive to 123rd Street to complete a loop that can be incorporated into structured physical education programming, become part of the recommended Pembroke Court connection and provide a community walking loop in for the neighborhood.

- **Bicycle parking area.** Relocate the bicycle rack to a more appropriate location near an entrance to the elementary school. A bicycle parking area existing on the southwest corner of the elementary school, so moving this rack to the southeast corner would provide bicycle parking at both entrances.

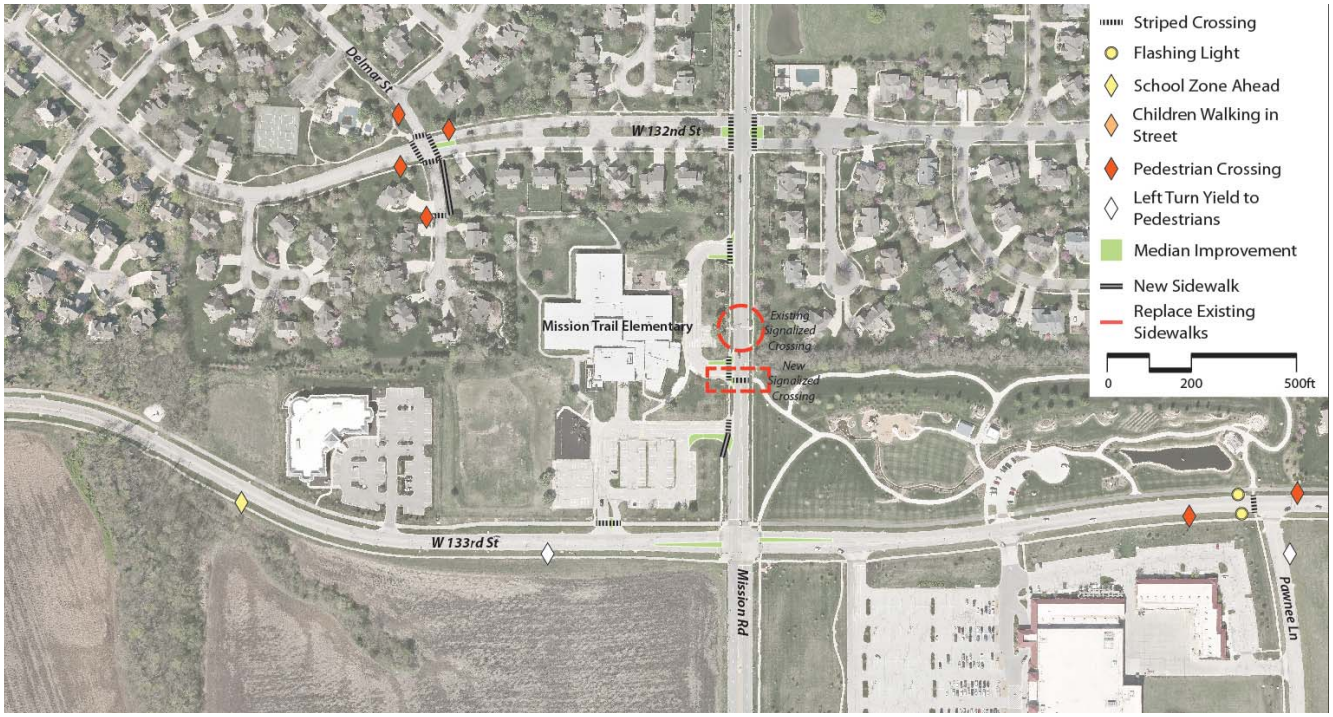
- **Sidewalk alignment.** Redesign the sidewalk between the signalized crosswalk and the east campus drive to encourage using the sidewalk when walking to the elementary school's sidewalk system. Adding a curve to the walkway leading towards the gap between elementary school's south parking area and the perimeter drive will achieve this goal and provide the opportunity to create an attractive pedestrian entrance to the overall campus. The 123rd Street sidewalk should remain the dominant walk, with the school walk connecting to it at the apex of the curve. This will also shift a portion of the sidewalk further from 123rd Street, improving the experience for all pedestrians.

Source: Bing map search.

MISSION TRAIL ELEMENTARY SCHOOL

Primary Challenges

- Neighborhood connection to Delmar Street
- Connecting walks at ends of cul-de-sacs and long blocks
- Mid-block location of pedestrian signal/crosswalk
- Lack of crosswalks on drive approaches
- Wide drive entrance and exit aprons on Mission Road
- Irregular crosswalks and signing at 123rd Street and Delmar Street
- Neighborhood connection from Delmar Street



Analysis

- **Neighborhood connection.** The connection at the northwest corner of the school site linking to Delmar Street south of 131st Street greatly improves the accessibility of the school to students and others walking or bicycling to and from the school. Students and others using this walkway from the Wilshire subdivision are not forced to Mission Road to access the school. The need for neighborhood connections increases when schools are located along arterial roads, which restrict pedestrian access due to the high traffic frontage of the chosen site. A crosswalk or sidewalk is needed to link the walkway connection to the public sidewalk system.
- **Connecting walks.** Cul-de-sacs at the ends Alhambra Street, El Monte Drive, 131st Terrace and Pawnee Lane have walkways connecting each street's sidewalks with neighborhood collector streets or public trails. This results in improved pedestrian circulation throughout the neighborhood and encourages walking.
- **Mid-block signalized crosswalk.** The location of the mid-block pedestrian signal creates conflict immediately in front of the school and at the exit drive. Students walking west to the signalized crosswalk have to cross two vehicular travels at ways, the school drive and Mission Road to proceed east.

The location adds to congestion on the school property when vehicles stopped by the signal block left exiting traffic from the school. This delay slows on-site traffic and can result in longer pick-up lines and delays entering the north drive entrance, causing more congestion on Mission Road.

- **Sidewalk Gaps.** Lack of crosswalks at drive entrance and exit aprons – Crosswalks are not defined for the sidewalks across the school's four drive aprons on Mission Road and 133rd Street.

- **Wide drive aprons.** Bus pick-up occurs along the drive south the school entering the south Mission Road entrance and exiting on to 133rd Street. As bus circulation does not occur in front of the school, the two northern approaches on Mission Road are exceptionally wide increasing the level of conflict between pedestrians and motorists. Tightening the radius on the exit apron will force turning motorist to pull up to Mission Road more perpendicular, giving them a better view of on-coming motorists and pedestrians. Parking within the drive entry is a hazard for all users, creates confusion at both locations from motorists entering and exiting and further adds to the width of the apron.

  A full lane has been stripped-out on the south Mission Road drive approach as part of the one-way circulation pattern for the site's traffic control, resulting in a long crosswalk.

- **Irregular crosswalk and signing.** The crosswalks at 131st Street and Delmar create a confusing pattern for motorists and pedestrians to pass through the intersection in a predictable manner. The signs used to identify the existing crosswalk to not meet regular signing standards for crosswalk and are not consistent with other signs used in the city. This is compounded by the location of the neighborhood access to the school being on the east side of Delmar to the south and without a sidewalk connecting directly to it. All pedestrians going to or from the school via this connection are required to cross the street at the end of the connection, which aligns with a private residential driveway. Drivers leaving this residence must back into the street from their curved driveway at the point of crossing for the school's neighborhood connection, greatly increasing the conflict between pedestrians and drivers.

- **Neighborhood connection.** A walkway is ideally located in the northwest corner of the school site and connects to the school's paved walkway system. This results in reduced walking distance and improved walking conditions by minimizing walking along streets and arterial roads. The connection does not tie directly to a sidewalk or a mid block crosswalk at Delmar Street and is located dangerously close to a curved driveway across the street. Backing maneuvers for drivers leaving this residence must back into the "extended" crosswalk area creating a potential hazard for students and pedestrians using the neighborhood connection.

Possible Solutions:

- **Neighborhood connection – Extend the walkway connection north with a sidewalk to the 131st Street and Delmar.** Connections, such this, should be encouraged through development regulations to provide direct pedestrian connections with all educational site and commercial development. Such connections increase walkability between residential subdivisions and adjacent development and reduce short vehicular trips and congestion associated with school and commercial development traffic. Encourage schools district to locate future elementary schools, in the center of residential blocks rather than on the perimeter to decrease walking distances for many of the schools students.
- **Connecting walks at cul-de-sacs and between long blocks – Walkways can be encouraged by using walking-friendly development regulations.** These regulations encourage walkways through the ends of cul-de-sacs and at key mid-block locations between key residential lots. Establishing a maximum distance of 1/8 to 1/4-mile between connections promotes walking within and between

developments. Walking connections should be located between residential areas and:

1. Neighboring residential developments
2. Adjoining institutional and commercial land uses, which residents may otherwise drive to
3. Internal private open spaces
4. Adjacent public open spaces, parks, trail systems and greenways, and
5. Collector and arterial sidewalk networks.

- **Mid-block signalized crosswalk.** The signalized crosswalk will function better if relocated and aligned with the walk on the south side of the east entry exit apron and the park trail on the east side Mission Road. This location will eliminate the need for the crosswalk immediately in front of the school and encourage students to use the park trail to walk east. The south bound stop bar for Mission Road should be located north of the drive's curb return so left turning traffic is allowed to turn left while the signal is red for Mission Road traffic. Right turning traffic will be allowed to turn left whenever traffic is clear on southbound Mission Road. This should alleviate some of congestion in front of the school.

- **Crosswalk Gaps.** Lack of crosswalks at drive entrance and exit aprons – Crosswalks should be added across all the schools drive aprons on Mission Road and 133rd Street to improve pedestrian safety when crossing the aprons. Stop bars with the "Stop Here" placard should be place behind the crosswalks at exiting drives to reinforce where motorists are required by law to stop.

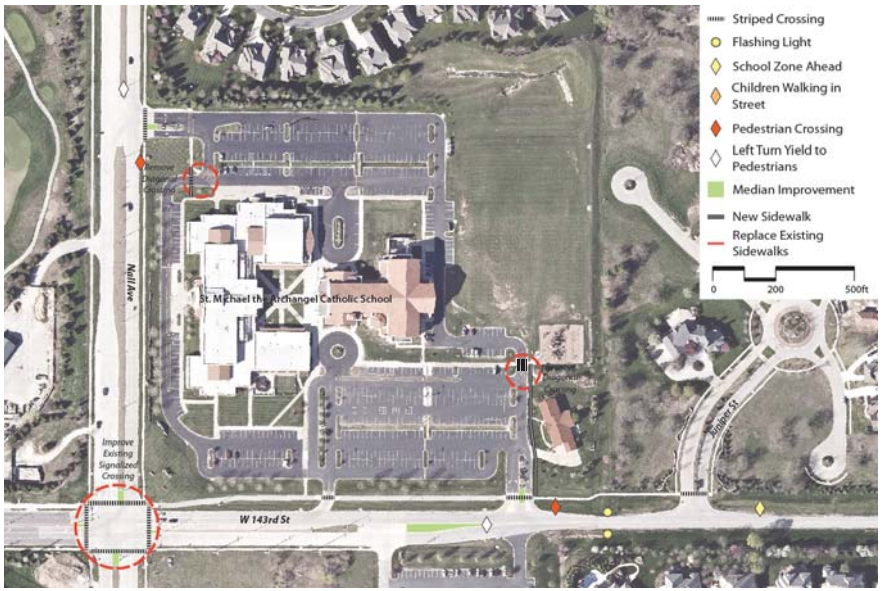
- **Wide drive aprons.** The wide aprons on Mission Road drive can be narrowed by:

    1. Extending the south curb of the southernmost drive north to take in the stripped out lane.
    2. Reducing the curb radii on the two northern aprons in front of the school, as buses do not routinely use these drives.
    3. Reducing the curb radius on the south apron of the south drive as northbound buses do not need a large radius on this corner to turn left across Mission Road into the site.
    4. Narrowing the effective driving aisle width on the exit apron to Mission Road to two lanes, one each for right and left turning traffic.
    5. Removing parking stalls in the drive entry and exit in front of the school. At a minimum, five stalls, two at the south and three at the north, should be removed. Once removed the drive apron can be reduced the width of the parking stalls to further shorten the crosswalk.
    6. Since busses do not appear to routinely use the east drive area, the radii on these aprons can be reduced to slow turning traffic to a safer speed when near pedestrians and to reduce the overall length of the crosswalk.

- **Irregular crosswalk and signing.** The crosswalks at 131st and Delmar should connect all four corners of the intersection to allow for the free flow of students and pedestrians in all direction with the fewest number of street crossings. Consistent crosswalk ahead and crosswalk signs should be placed prior to the intersection in all directions. The 131st Street median east of Delmar should be extended to through the crosswalk to provide a pedestrian refugee and to prevent u-turning motorists from driving through the recommended north-south crosswalk

- **Neighborhood connection.** A sidewalk should be installed on the east side of Delmar north to 131st Street to align with recommended crosswalks at 131st and Delmar.

ST. MICHAEL THE ARCHANGEL CATHOLIC SCHOOL



Primary Challenges

- **Replace campus diagonal crossings.** A perpendicular crosswalk should be installed on the north and east drives.
- **Install school zone signage.** East of school on W 143rd Street there is no school zone signage, both signs and lights should be installed.
- **Intersection improvements.** The intersection of Nall Avenue and W 143rd Street should be updated with ladder striping and pedestrian refuges on islands.
- **Implement left turn lane.** Near the southeast entrance where W 143rd Street narrows, a left turn lane to help facilitate traffic flow should be installed, replacing the current striped median.

Source: Google image search.

NATIVITY PARISH SCHOOL

Primary Challenges

- **Create access point on the north side of campus.** Install a new sidewalk along the north property line to connect the adjoining neighborhood to the school.
- **Connecting sidewalks.** Connect sidewalks along Mohawk Lane north of new suggested crossing.
- **Intersection improvements.** The intersection of Mission Road and W 119th should be updated with ladder striping and a pedestrian refuge.
- **Improve crossings within the school zone.** Improve nearby crossings by installing ladder striped crosswalks and signage to alert motorists of pedestrian activities.

Source: Google image search.

BROOKWOOD ELEMENTARY SCHOOL

Primary Challenges

- Crossing 103rd Street and the school drive.
- Improving crosswalk configuration at Cherokee Lane and Wenonga Lane
- Improving visibility of mid-block crosswalk on W 103rd Terrace
- On-site pedestrian-vehicular conflicts on east side of school

Analysis

- **Crossing 103rd Street and the school drive.** This issue involves a number of issues affecting students and pedestrians ability to safely cross 103rd Street including the lack of sidewalks on approach local streets, the location and design of the signalized crosswalk and the profile of 103rd Street and the relation of the school's drives and local streets.

    1. Adding new sidewalks in established neighborhoods is always a sensitive issue. However, if more students can be encouraged to walk by improving conditions for them to walk, there will be less vehicular traffic on the approaching local streets and less congestion at schools. Two streets, Pawnee and Wenonga Lanes, have a similar number of driveways and mature street trees, making directness a key determinate for choosing a street for sidewalk treatment. Most driveways are circular driveways, which minimize the backing risk of driveway/sidewalk conflicts.
    2. The mid-block location of the existing signalized crosswalk can increase traffic flow issues on 103rd Street. However, since the signal is located at the crest of a hill, the location has better visibility than if located at either of the school drive intersections which generally align with Pawnee and Wenonga Lanes. While the stone veneered barrier provides an attractive

Source: Google image search.

protection for pedestrians walking along the north side of 103rd, it does reduce motorist's visibility of students and pedestrians waiting to cross from the north. Motorist's visual awareness of a crosswalk is minimized by the crosswalk's pavement markings being on the crest and not on the same visual plain. The existing signal contains one overhead beacon and one side pole beacon. The lack of an overhead beacon for each travel lane creates a contradictory signalization pattern with the typical multi-lane intersection signals with overhead beacons for each travel lane.

3. The crosswalk delineation across the school's front drive is minimal, using only paint to define the crosswalk and extends the full width of the parking bay and aisle.

- **Improve crosswalk configuration at Cherokee Lane and Wenonga Lane.** The existing diagonal crosswalk is atypical, which can create confusion for motorists and pedestrians alike. The crosswalk configuration treats both streets as if it is one crosswalk, instead of two with a corner ramp/refugee on the northeast corner of the intersection. This creates and exceptionally long crosswalk where motorists and pedestrians alike may be confused as to who has the right-of-way when pedestrians reach the corner. This encourages students and other pedestrians to stand in the street or crosswalk after crossing one street.

- **Improve crosswalk configuration at Cherokee Lane and Wenonga Lane.** The existing diagonal crosswalk is atypical, which can create confusion for motorists and pedestrians alike. The crosswalk configuration treats both streets as if it is one crosswalk, instead of two with a corner ramp/refugee on the northeast corner of the intersection. This creates an exceptionally long crosswalk where motorists and pedestrians, alike, may be confused as to who has the right-of-way when pedestrians reach the corner.

- **Improve visibility of mid-block crosswalk on W 103rd Terrace.** There are no "School Crosswalk Ahead" warning signs approaching the crosswalk from either direction. A mature elm tree close to the walkway and curb restricts the walkway visibility for westbound motorists. Advance warning of the crosswalk is hampered by the intersection of Mohawk Lane and 103rd Terrace.

- **On-site vehicular conflicts on east side of building.** The lack of a clearly defined walkway and vehicular areas at the south end of the east parking/service area creates vehicular conflict between pedestrians and bicyclists using the connecting walkway to Wenonga Lane.

Possible Solutions

- **Crossing 103rd Street and the school drive.**

    1. Lack of sidewalks on approaching streets north of 103rd Street - Install a sidewalk on the east side of Pawnee Lane taking precautions to minimize damage to existing trees to provide the most direct access to Brookwood and its pedestrian signal on 103rd between Pawnee Lane and Wenonga Lane.

    2. Location and design of mid-block crossing - Provide crosswalk platform and upgrade crosswalk signal on 103rd Street to emphasize crosswalk area and calm traffic in front of school. A raised crosswalk with chevrons on the approaching gradient will improve motorist's visual cueing of the crosswalks presence and slow traffic slightly through this high-pedestrian use area. Permanently colored paving materials can be used to further highlight the crosswalk.

    3. Installing a full pedestrian actuated signal with one overhead beacon per travel lane in each direction in addition to the side beacon. A HAWK-type signal or other approved signal crossing will greatly improve communication to motorists of the presence of pedestrians and highlight the crosswalk's presence.

    4. Modifying the on-site crosswalk in front of the school's entrance to reduce on-site pedestrian-vehicular conflict. Provide a curb bulb out at the drive crosswalk where currently stripped out and install an elevated crosswalk with approaching chevrons, similar to the 103rd street treatment, but on a smaller scale. Extend bulb-out east enough to allow a motorist in the fist stall east of the bulb out to back out of stall without their vehicle entering the crosswalk.

- **Improve crosswalk configuration at Cherokee Lane and Wenonga Lane.** The following three suggestions, taken in whole will improve the functionality and safety of this intersection for pedestrians and motorists:

    1. Install a short sidewalk with ramps along the east side of Wenonga Lane from Cherokee Lane north to align directly across Wenonga from the existing walkway access to Brookwood. The sidewalk should be set back five to six feet from the curb to allow a buffer between pedestrians and vehicles on Wenonga and adequate distance for an ADA ramp.

    2. Relocate crosswalk to extend connecting walkway due east across Wenonga to the north terminus of the new sidewalk in Recommendation 1.

    3. Extend a crosswalk from the south terminus of the walk in Recommendation 1 across Cherokee Lane. Install a ramp/landing area for waiting pedestrians.

- **Improve visibility of mid-block crosswalk on W 103rd Terrace.**

    1. Install advance "School Crossing Ahead" signs in both directions. The east sign will need to be located on the curve of Wenonga Lane. The distance between the sign and crosswalk to the west needs to be compressed between the crosswalk and the Mohawk Lane intersection or may need to be placed south of the intersection with Mohawk with a right directional arrow placard beneath the "Ahead" placard.

    2. Consider removing the mature Elm tree on the northeast corner of the crosswalk to improve visibility of pedestrians at or approaching the crosswalk.

- **On-site vehicular conflicts on east side of building.**

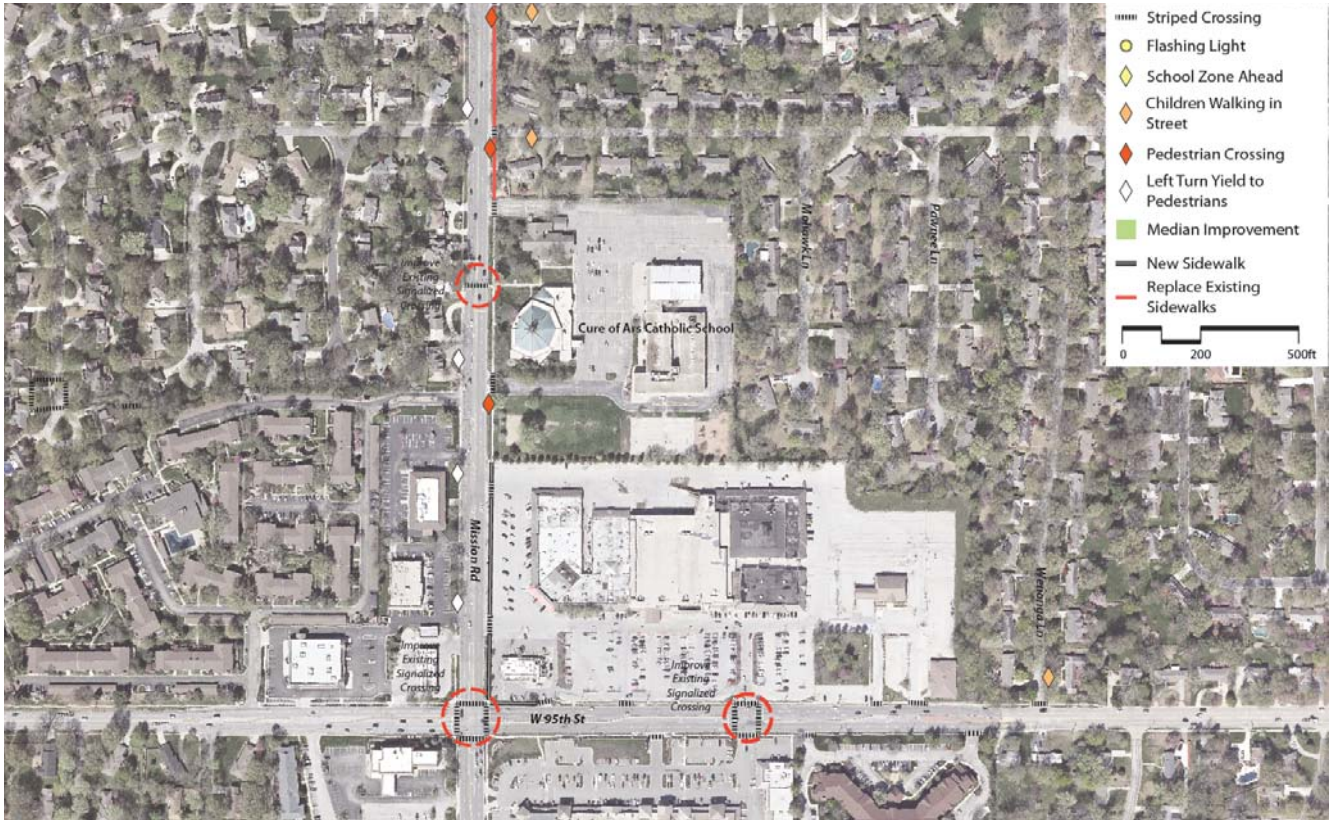
    1. Install curbs to define a vehicular turn-around with adequate space for a walk extending west along the playground perimeter fence connecting to the school's fence gate in the southwest corner of the parking area, existing internal walks and building entrances.

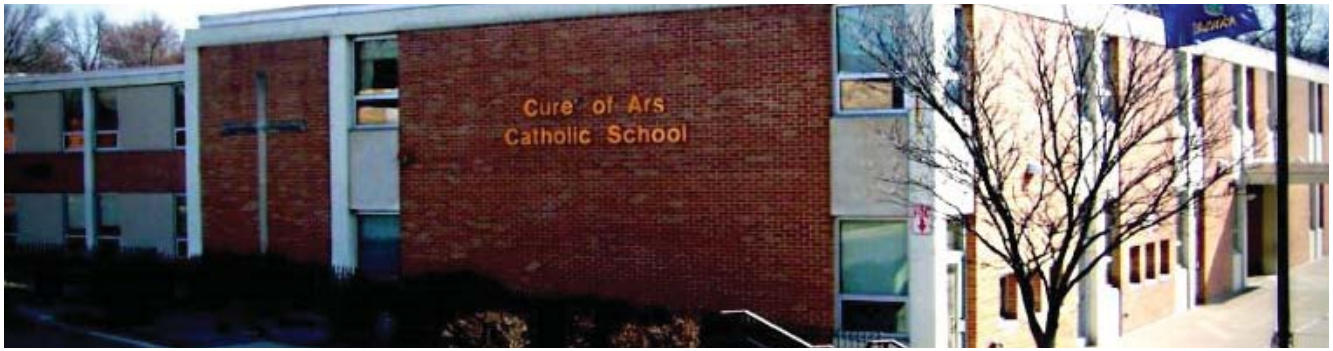
    2. Provide a service drive apron and access gate to the playground area. Use gate that only opens towards playground to avoid obstructing walkway when open.

CURE OF ARS CATHOLIC SCHOOL

Primary Challenges

- Replace sidewalks north of campus along Mission Road. Current sidewalks should be widened with improved curbs and any obstructions relocated outside the pathway.
- Improve existing signalized crossings. Replace parallel striping with ladder striping to increase pedestrian visibility and motorist awareness.
- Install sidewalks. The west edge of Ranch Mart North has no sidewalks, the parking should be modified to allow sufficient space for a new sidewalk. The new sidewalk should also connect to the existing sidewalk along the north side of 95th Street.
- Neighborhood entrances. Neighborhoods should be retrofitted with sidewalks on at least one side of the street. If the solution proves too costly then signage indicating children and pedestrians in general may be walking in the street should be installed to alert motorists.





Source: Cure of Ars Catholic School website.

PRAIRIE STAR ELEMENTARY/MIDDLE SCHOOL

Primary Challenges

- Access from north and east limited to arterial street walks, if present.
- Sidewalk gap at south entrance to middle school
- No crosswalks at any school entrance/exit drives.
- Constricted walkway in west parking lot at elementary school
- No sidewalk on south side of 143rd Street or west side of Mission Road

Analysis

- **North & East access.** Accessibility issues for the Prairie Star campus are exacerbated by the campus's location on an arterial street intersection and the lack of any connections to adjoining residential area. All pedestrian access to the Prairie Star School campus is forced to either 143rd Street or Mission, both arterial streets. All property along the north and east boundaries of the campus is developed with in medium to large lot residences. The service boundary for the schools extends to the northeast approximately a half mile with no street or walkway connections to the campus. No sidewalk exists north of the middle school on the east side of Mission Road to 141st Street. There are no sidewalks in the large lot subdivision east of the elementary school.
- **Sidewalk gap.** A short gap exists in the sidewalk to the middle school at the south entrance from Mission Road. The school's sidewalk appears to stop at the right-of-way line. The existing temporary sidewalk along Mission Road is approximately 10 feet from the end of the school's sidewalk.
- **Crosswalks.** No crosswalks are provided at the four entrance/exit drives to either 143rd Street or Mission Road.
- **Constricted walkway.** The walkway in front of the elementary school is constricted by parking curb and car bumper overhang in the southeast corner of the parking lot creating a potentially hazardous walking condition for students walking west from the main entrance.

- **No sidewalks.** The lack of sidewalks on the south side of 143rd Street and the west side of Mission Road is likely a timing issue resulting the area development preceding the area's arterial streets being built to their final configuration. During the interim period, sidewalk deficiencies discourage walking to school or for short trips.

Possible Solutions

- **North & East Access.** Several solutions, either in whole or combination can be enacted to provide more direct pedestrian access to the campus from the residential areas adjoining the school campus. These solutions will improve the safety for pedestrians and students walking to school and increase the likelihood more students will walk to school. These solutions are:

    1. Provide a connecting walk between 14101 and 14111 Pawnee Lane and extend the street sidewalk on the west side of Pawnee Lane south from 141st Street. Construct a path/walkway along the school's boundary connecting to existing walks north of the elementary school and between the middle school and football field. The option provides the most direct access for pedestrian approach the campus from the northeast.

    2. Alternatively, provide a single walkway connection on either side of 14119 Mohawk. Construct a path/walkway along the school's boundary, as needed, connecting to existing walks and entrances between the middle school and football field and to existing walks north of the elementary school.

    3. To further improve access and to shorten the walk for students in the northeastern portion of these school's service areas, consider adding sidewalk along 141st Street between Aberdeen Street and Pawnee Lane. A connecting walkway on the common north property lines of 14100 Canterbury and 14101 Windsor will reduce the walking distance for students, improving the likelihood they will walk to school and reduce vehicle congestion at the schools.

    4. Provide a temporary sidewalk from the north entrance drive to the middle school along the east side of Mission Road connecting to the existing sidewalks on 141st Street similar to the temporary sidewalk south of the campus. This solution should be resolved by future improvements to Mission Road. However, it those improvements are not planned in the city's capital improvement program in the next 1-2 years, the temporary connection should be provided in the interim.

- **Sidewalk Gap.** Infill sidewalk gap between existing walks at the Middle School's south entrance drive.

- **Crosswalks.** Proved crosswalks, adjusting stop bars if necessary, at all entrances and exits onto 143rd Street and Mission Road.

- **Constricted Walkway.** Remove the southernmost parking stall in the east bay of parking, realign curb and widen walkway to remove constricted walkway in the middle of the vehicular drives at the southwest corner of the elementary school.

- **No sidewalks.** Construct sidewalks on the south side of 143rd Street and the west side Mission Road when these streets are upgraded, along with provide concrete walks where interim asphalt sidewalks exist. Connect to cul-de-sacs along these streets wherever, possible, such as Howe Drive on the south side of 143rd Street to improve the efficiency of the existing sidewalks and reduce walk times to school and other locations.

Source: Google image search.

INTERSECTION CONCEPTS

Demonstrations for Improved Pedestrian Mobility

The following diagrams illustrate a variety of typical major intersections within Leawood and highlight options of enhancing pedestrian safety and accessibility and increasing motorist awareness.

- 83rd Street and State Line Road
- 85th Street and State Line Road
- 95th Street and State Line Road
- 103rd Street and State Line Road

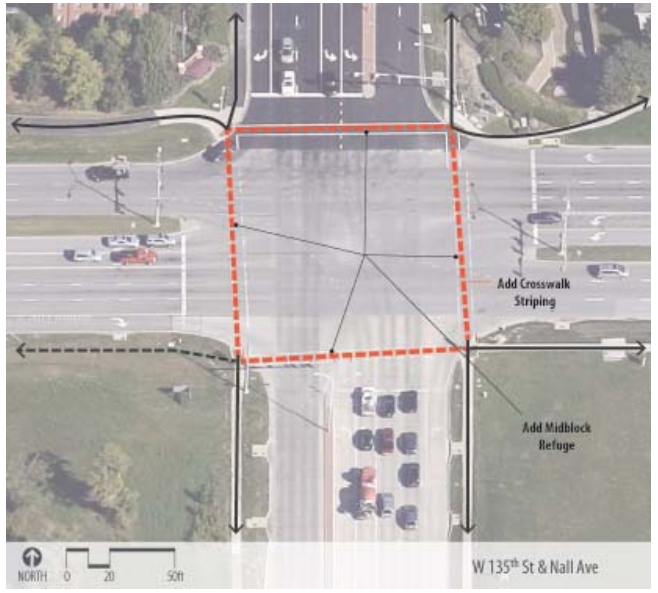
INTERSECTION CONCEPTS

Concepts for Improved Pedestrian Mobility

- 103rd Street and Pawnee Lane
- 103rd Street and Wycklow
- 84th Terrace and Mission Road
- 119th Street and Pawnee Drive

Demonstrations for Improved Pedestrian Mobility

- College Boulevard and State Line Road
- 135th and Nall Avenue
- 123rd Street and High Road



PRIORITY CRITERIA

Completing the entire sidewalk system will need to be accomplished through an incremental process that requires setting priorities and evaluating new conditions along the way.

Evaluative criteria apply questions such as the following to specific sidewalk projects when they are considered.

- Does the sidewalk connect important resources, such as schools to neighborhoods?
- Does the sidewalk provide continuity and integrity to the surrounding vicinity and overall system?
- Does the sidewalk create a safer path for pedestrians?
- Does the sidewalk generate community support or consensus?
- What is the sidewalk's potential to transform the image of the area?
- Does the sidewalk respond to a specific need for improved trail facilities?
- Does the sidewalk incorporate and leverage outside funding sources, such as state grants or charitable contributions?
- Is the engineering and cost feasible to construct?
- Does the sidewalk yield economic development opportunities?

The key to successful implementation will be to establish priorities based on the specific benefits of the project.

The criteria for Leawood's sidewalk system begins with identifying individual destinations and the quarter-mile area surrounding the destination. These target areas help establish a system of priorities that connect residents to amenities in the community.

- **Schools.** Access, circulation, and safety to schools is a critical to ensuring mobility choices. Increased access reduces traffic congestion.
- **Shopping Centers.** Providing convenience to major shopping centers like Town Center Plaza, Park Place, Camelot Court, One Nineteen, and Ranch Mart area.
- **Employment Centers.** Providing convenience between homes and places of employment will encourage people to travel to work by alternative means.
- **Neighborhoods.** Connecting residents to businesses and work places, providing convenient trips by sidewalk.
- **Parks and Trails.** Completing this plan will connect users to the city's parks and open spaces. Prioritizing the construction of the trails to create loops will increase their usability.
- **Community Attractions and Service Centers.** Ironwoods Park, area clinics, and Johnson County Library are all area attractions.

SIDEWALK IMPROVEMENT PROGRAM

In an effort to create a balanced transportation system that meets the needs of both the automobile and the pedestrian, Leawood should establish a Sidewalk Improvement Program. The program should provide safe pedestrian access for all residents and assist the city in meeting requirements of the Americans with Disabilities Act (ADA). A Sidewalk Improvement Program (SIP) should provide a closed loop network of sidewalks throughout Leawood that can be easily accessed from any residence in the city.

Priorities for the program should include:

- Accessible routes to schools.
- Accessible along transit routes.
- Linkages along arterial streets that provide a safe area for pedestrians.
- Linkages to the city's trail system. These links may include widened sidewalks that are improved as a part of the city's Trail Master Plan.
- Missing ramps.

The development of the Sidewalk Improvement Program (SIP) began with a review of the city's current sidewalk system in Fall of 2013.

PRIORITIES

Each year the city should budget for the SIP. In the past the city has done this at approximately $60,000 annually. The city should consider appropriating more funds to cover constructing new neighborhoods sidewalks and grants for repairing existing sidewalks. Funding of the SIP is discussed further under Implementation.

The program is broken down into priorities and within each of the phases yearly projects are identified based on quarter-mile radii around key destinations in the community. Many of these areas are overlapping and meet the priorities laid out above. Yearly projects may overlap as needs within service radii might not be as great or have been covered in previous years. Project phases and descriptions are as follows.

High Priorities

High Priority Routes are defined by their proximity and direct connectivity to major destinations in the City. Participants in the planning process indicated that connections to schools, senior facilities and housing, employers and services, and downtown are the priority projects for enhancement.

- **Accessible Ramps.** Much of the city's sidewalk system meet grade requirements, however, they do not meet other design requirements. Missing ramps or ramps that are in poor condition should be a first priority, and all ramps at an intersection should be replaced to make them uniform. Those intersections that have not previously been addressed because they are currently in good condition should be addressed in this final stage. The city should re-evaluate the priorities and phases for the Street Improvement Program on an annual basis and re-assess sidewalk conditions every five years. The city should also consider a signage system that directs sidewalk users to key destinations within the city and to the city's trail system.

- **Schools.** Sidewalks and crossings that define "spine routes" within a quarter-mile of elementary schools should receive highest priority. The system can be extended to a half-mile as a later phase. Specifying actions for improvement are beyond the scope of this plan, yet this chapter goes into some detail near public schools. The existing condition survey indicates that adapting curbs to be compliant with ADA standards is the most critical item.

- **Senior Facilities and Housing.** Access and circulation around senior facilities should be complete and free from obstruction. These routes should provide wider sidewalks, possibly five to six feet, to allow for easier movement.

- **Employers and Services.** Connecting residents to employers and visitors by sidewalk is critical to creating a complete transportation system for Leawood. Just as arterial and collector streets are important for moving vehicles, they are also important for moving pedestrians.

- **Town Center Plaza and Camelot Court.** Pedestrian paths from the Town Center Plaza to development along the fringe of the parking area are fragmented or nonexistent. Connections to Camelot Court and other major commercial areas are fragmented by the street, resulting in shoppers wanting to get in their cars and moving on to possibly other shopping centers. Improving circulation between the cluster of commercial buildings and to other commercial centers is critical to retaining and attracting customers.

- **Transit.** Leawood does not have an extensive transit system, yet the presence of transit creates a strong base of circulation between residents, employers, and major service providers in the community. 95th Street is the primary route experiencing bus ridership. As other routes arrive, the sidewalks along those corridors should be improved.

Improving crosswalks is the most significant priority. Painting crosswalks and retrofitting signals with countdown timers and audible signals are a priority. Proving safe crosswalks near schools is particularly critical for encouraging students to walk, rather than be dropped-off.

The walkways should be defined more to direct pedestrians to the entrance of the building. This can be done with both visual and texture cues, including painting cross-hatched paths or using colored/stamped concrete.

Priority Routes

High Priority Routes define the spine routes for improvement, while the Priority Routes provide the support system and behave as collector routes.

- **Schools.** Priority Routes near schools are local streets that support the arterial, or High Priority routes.

- **Neighborhoods.** Some routes connect neighborhoods, helping improve accessibility and encouraging extended trips.

- **Parks and Trails.** Connections to neighborhood parks are well-established. Improved access to the city's parks is an important project for all ages. The system should continue to restore missing connections and replace damaged walks.

- **Civic and Cultural Destinations.** The library, museums, Music Man Square, and architectural resources are popular destinations to visit and tour.

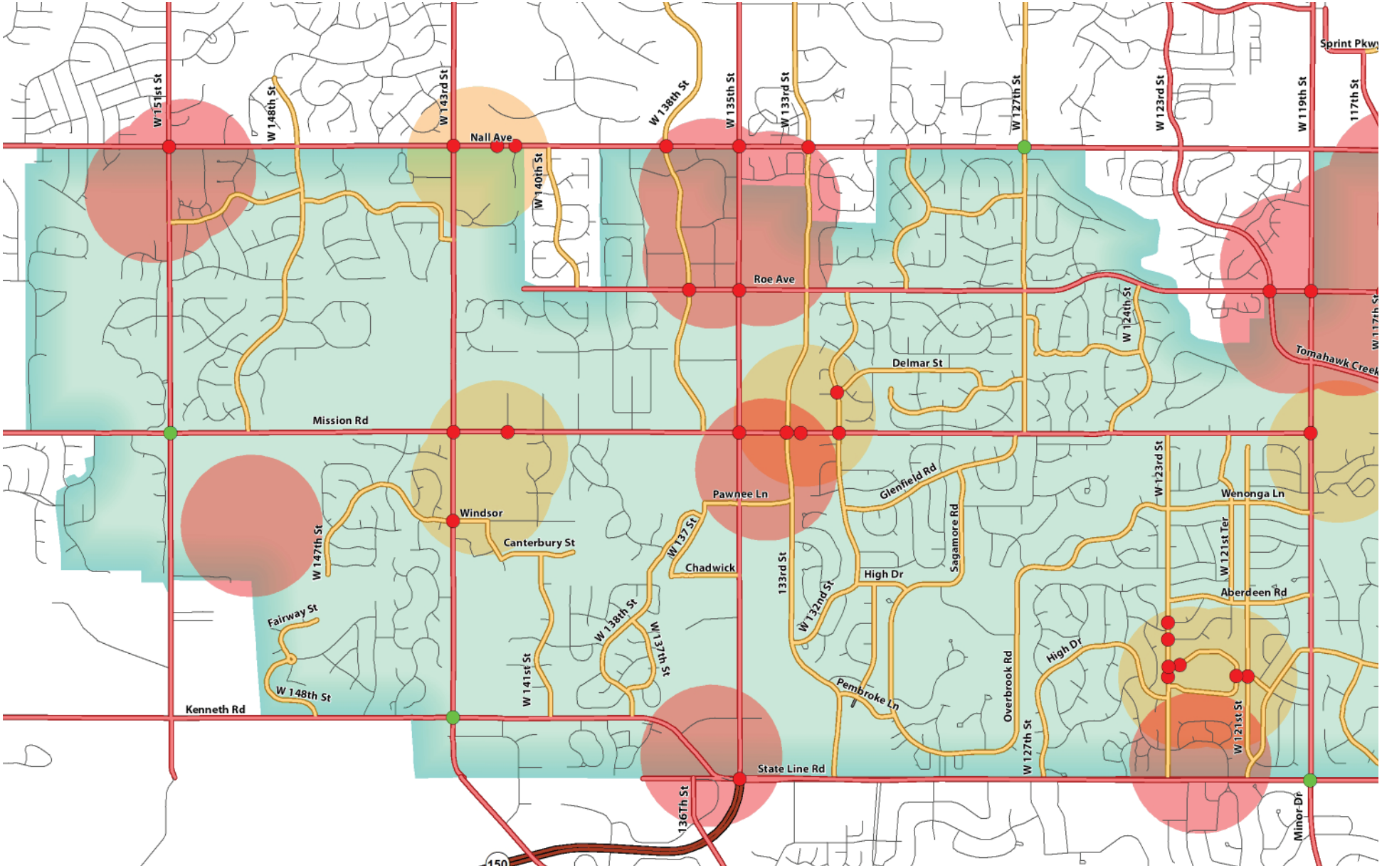
Intersection Priorities

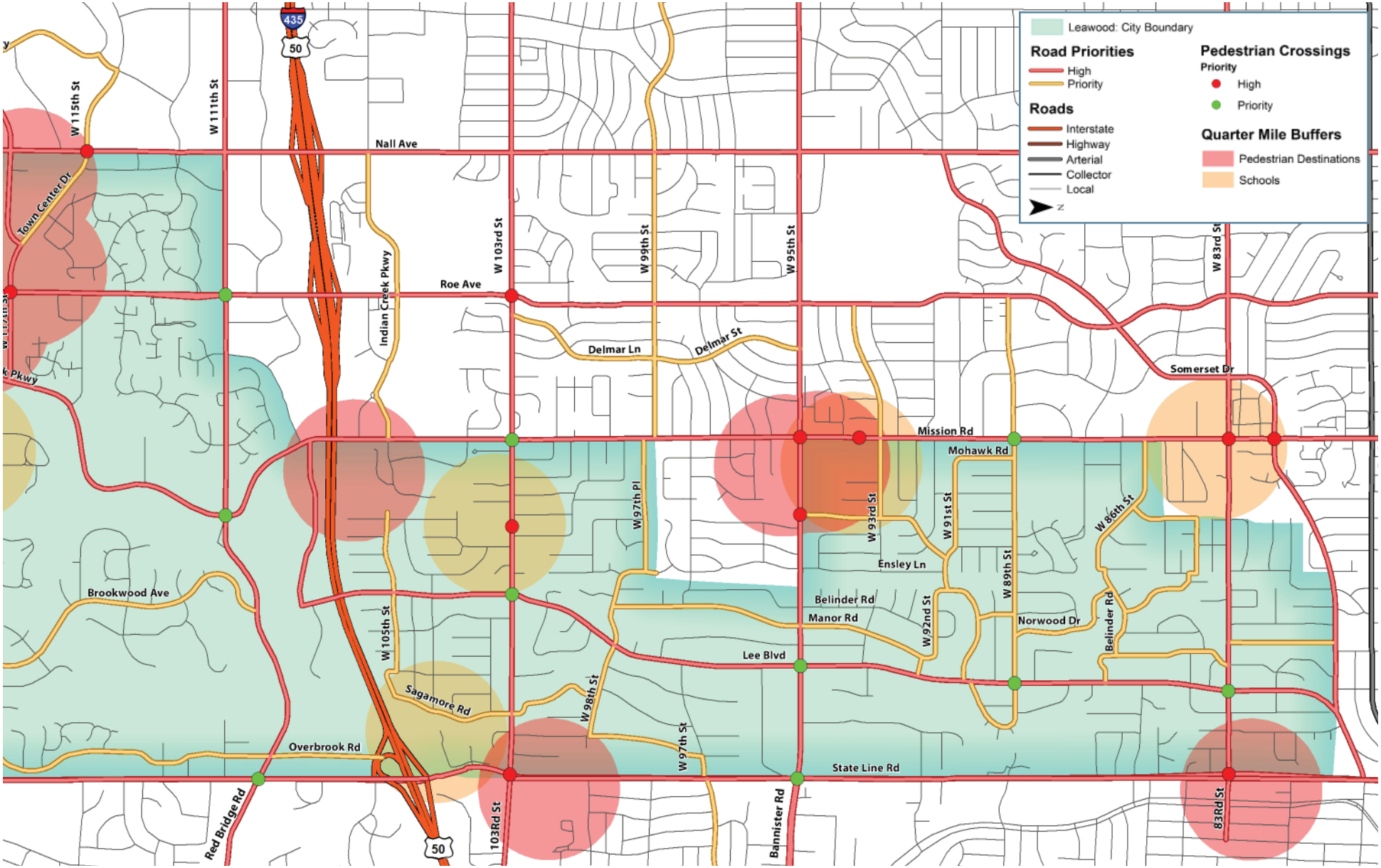
In addition to addressing intersections that do not meet ADA requirements, this plan identifies crossings that should be maintained to the highest level of quality to ensure safety for pedestrians.

Map 4.8 identifies priority intersections, and classifies them based on their proximity to schools and ability to connect neighborhoods to destinations.

Priority intersections are eligible for enhanced crossing features, such as countdown timers and signage. High Priority intersections take precedence.

Map 4.8: Sidewalk and intersection Improvement Program and Proposed Priority Sequence




Leawood: City Boundary
Road Priorities
High
Priority
Roads
Interstate
Highway
Arterial
Collector
Local
N
Pedestrian Crossings
Priority
High
Priority
Quarter Mile Buffers
Pedestrian Destinations
Schools
435
50
W 115th St
W 111th St
Nall Ave
Town Center Dr
W 103rd St
Roe Ave
Indian Creek Pkwy
W 99th St
W 95th St
Delmar Ln
Delmar St
W 83rd St
Somerset Dr
Mission Rd
Mohawk Rd
W 97th Pl
W 93rd St
W 91st St
W 86th St
Ensley Ln
W 89th St
Brookwood Ave
Belinder Rd
Manor Rd
W 92nd St
Norwood Dr
Belinder Rd
W 105th St
Lee Blvd
Sagamore Rd
W 98th St
W 97th St
Overbrook Rd
State Line Rd
Red Bridge Rd
103Rd St
Bannister Rd
83Rd St
50

PUBLIC TRANSIT

Bicycling, walking, and driving are major modes of moving about the city. Public transit is another mode of transportation that is critical to completing a community that is well-served by transportation choices.

In Leawood, users have limited options for accessing public transit from their home, workplace, or shopping destination. Map 4.9 shows the routes operated by the Kansas City Area Transportation Authority, or KCATA, in 2014. Route 175 passes through Leawood on 95th Street to connect to Metcalf Avenue and then to Sprint's Corporate Campus. Leawood's Town Center Plaza is underserved by transit, along with the city's other commercial business corridors.

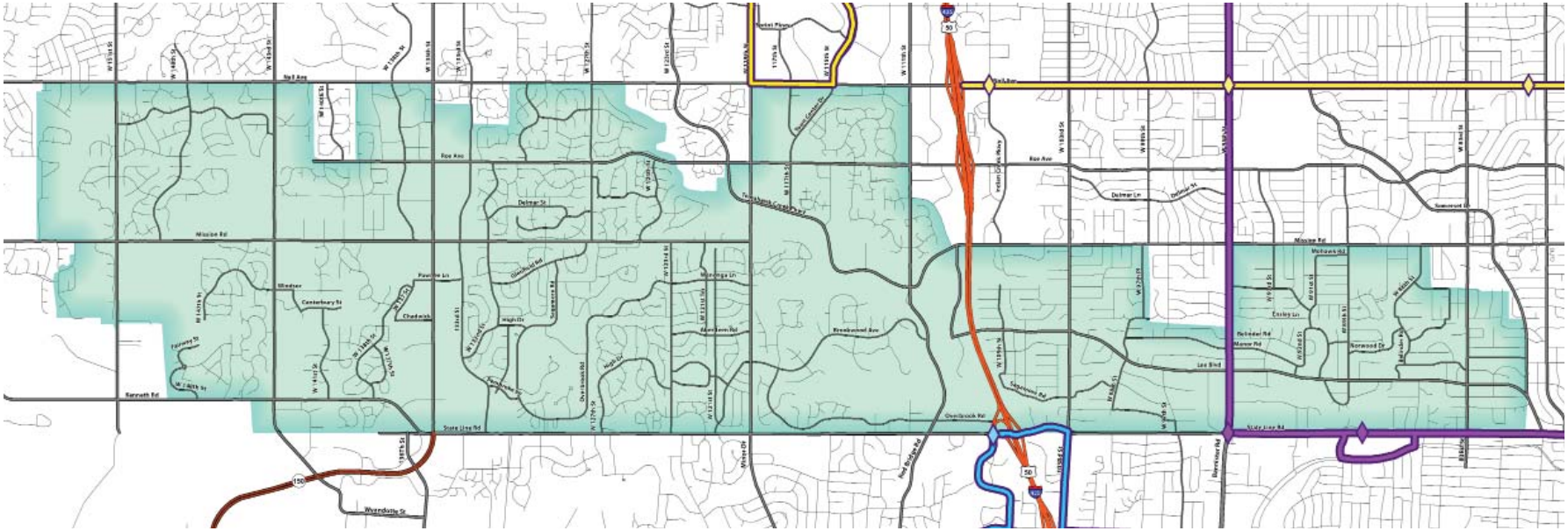
Expanding the serviceability of the system to reach Leawood's major destinations provides options to users. Ultimately, placing sidewalks and quality bus shelters near areas with higher traffic will encourage ridership within, to and from Leawood.

Sidewalks along transit routes receive high priority for completing gaps, repairs, and ADA improvements.

Possible Actions

- **Improve sidewalks along major streets.** The presence of sidewalks, or lack thereof, influences a person's decision to walk to locations where bus service could be made available. State Line Road, for example, does not have a sidewalk south of the interstate, and could be a prime route for bus service.
- **Install quality signs and bus shelters at stops.** Where new bus shelters are provided, install or position them to allow a wheelchair user to enter from the public way. An accessible route should be provided from the shelter to the boarding area.
- **Require pedestrian paths from the street to business entrances.** The Ranch Mart area is a premier example of having multiple connections for pedestrian from the sidewalk to the storefront. Stops and sidewalk connections should be logically placed for future bus service.

Map 4.9: Transit Routes



RETAIL SERVICES

Walking to buy groceries or household supplies, or finding a convenient destination to enjoy are genuine motives for walking to business centers. Yet, Leawood's business centers are not well-connected to the surrounding neighborhoods or within its own property.

Persons with limited transportation choices, including some seniors, are still committed to finding vehicle transportation for routine supplies.

Leawood has several commercial centers that should be more accessible by walking or bicycling within the center and to other businesses centers and neighborhoods.

Leawood's initial priority is facilitating discussions among retailers in a center, helping them identify possible paths that connect storefronts, thereby increasing customer convenience and traffic. The Town Center Plaza is a demonstration project shown on the following spread. The new paths show mutually beneficial connections that link businesses and gathering space that ultimately:

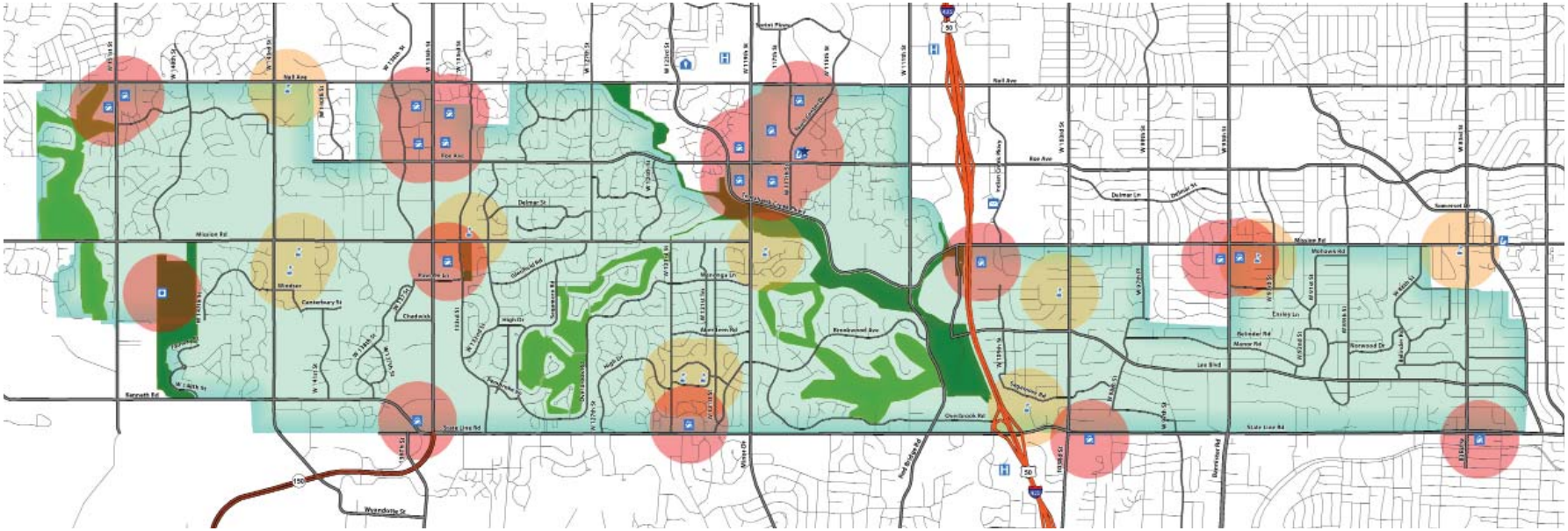
- Increase the sense of place
- Increase customer convenience
- Increase the stay of customers to the space
- Encourage private investment

Internal circulation is critical, as well as connections to surrounding neighborhoods. The lack of connection discourages a people to exercise to their destination.

Possible Actions

- **Design facilitation.** City to facilitate discussions among property owners to improve the design the internal and external circulation.
- **Improve sidewalks along major streets.** The presence of sidewalks, or lack thereof, influences a person's decision to walk to locations.
- **Require walks from the street to business entrances.** The Ranch Mart area is a premier example of having multiple sidewalk connections from the street to the storefront.
- **Wayfinding.** Direct customers to gathering places and stores.

Map 4.10: Retail Destinations



TOWN CENTER PLAZA

Leawood's major commercial destination is Town Center Plaza. The center offers retail shopping, restaurants, and services. Nearby, Park Place has a premier hotel, retail, restaurants, outdoor event space, and offices. Camelot Court, located east of Roe Street, has numerous restaurants, pharmaceuticals, and retail. Hawthorne Court to the south offers more shopping, restaurants, and services. Combined, these commercial centers provide a significant share of Leawood's retail and restaurant choices. Yet, the proximity of these projects share a significant opportunity to benefit from improved access and circulation for pedestrians and bicyclists, and operating as a unified district.

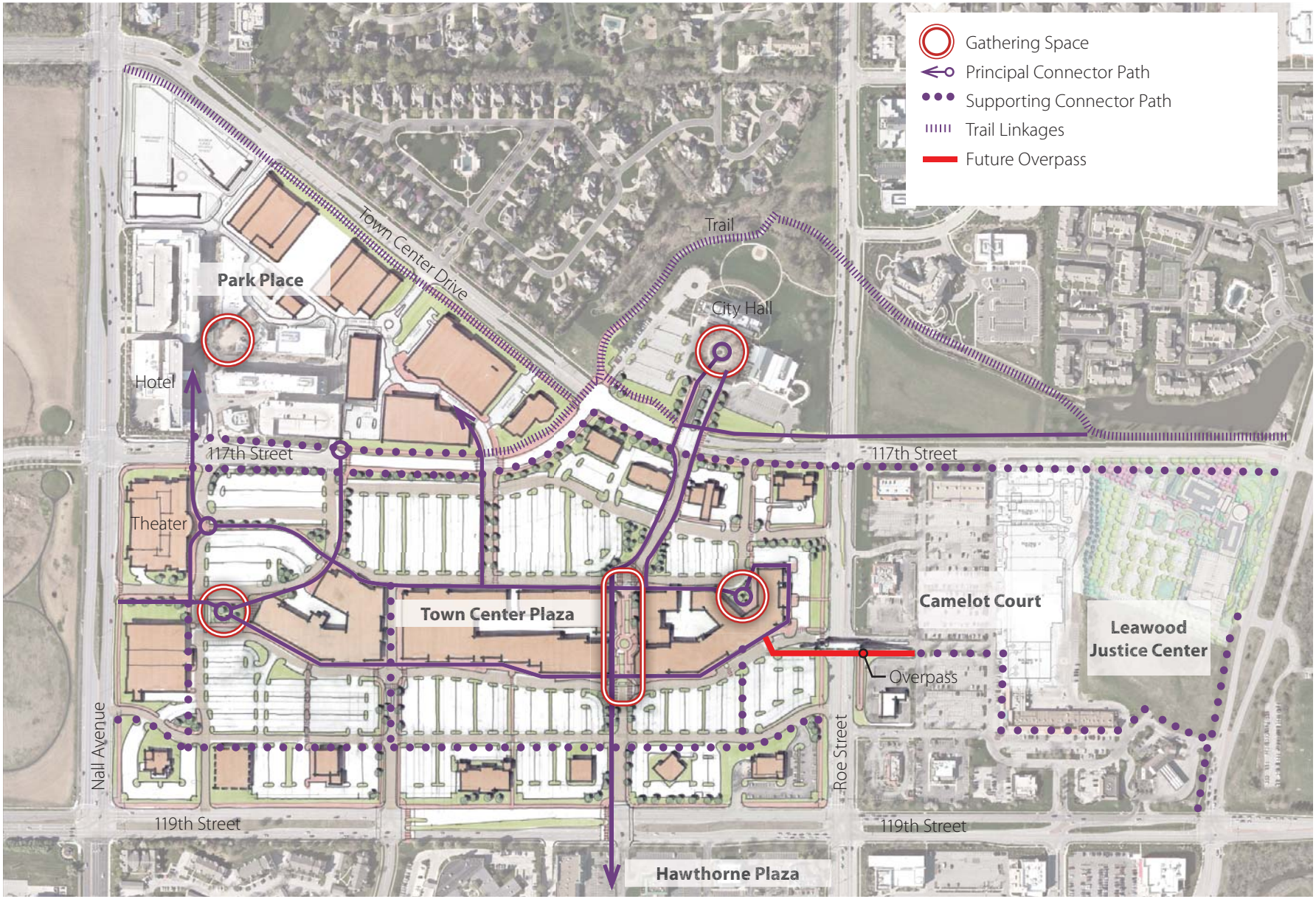
Map 4.11 shows a scenario for retrofitting the Town Center Plaza area to become an even stronger destination for the City of Leawood. It does not prescribe specific recommendations, but rather establishes an initial program for private developers to consider a unified approach to improving the walkability and bikeability of the district. More importantly, the purpose is to create a stronger sense of place, keep shoppers in the area for a greater period of time, attract visitors to frequent the district more often, and appeal to shoppers from greater distances. Operating as a unified district is good for business and the image of the city.

The illustration is for demonstration only and establishes an initial program for enhancements. The graphic shows principal routes for pedestrian circulation, gathering spaces, and supporting routes that connect patrons to/from peripheral developments. Elements of the program should include:

- **Improve Traffic Circulation.** Access to and within the Town Center Plaza present several conflicting traffic movements. Realigning internal streets, particularly on the west side will relieve some of the awkward movements.
- **Connect gathering spaces.** Gathering spaces encourages pedestrians to explore and stay in the district. The illustration identifies current gathering spaces in the district, along with a possible new space west of the Town Center Plaza building. This site would improve the overall circulation in the area, while providing much needed outdoor seating in the area.
- **Define Pedestrian Crossings.** Pedestrians should feel that they are a priority, and motorists alerted that the environment Crossing major streets should include pedestrian-actuated signals that have countdown timers and audible signals. Crosswalks should be well marked and corners of intersections should have a tighter radius to calm the speed of traffic entering the district.
- **Improve Bikeability.** Establishments throughout the center should have bike racks near entrances. Bike lockers or covered parking provide additional protection.
- **Add Parking.** Redesiging the surface parking should consider logical walking paths for patrons, and designed to maximize the number of parking.
- **Unify Commercial Centers.** Town Center Plaza, Park Place, Hawthorne Plaza, and Camelot Court provide residents of Leawood with a variety of shopping options.
    - ***Connection to Camelot Court.*** Providing an uninterrupted path between development projects is paramount to encouraging shoppers to park once and shop the entire district. Also, it encourages people to walk/bike to the district rather than drive.

      Access points for pedestrians must be as direct as possible. A pedestrian overpass over Roe Street would allow pedestrians to avoid traffic along Roe Street.
    - ***Connection to Park Place.*** Crosswalks on 117th Street should be signed and signalized with pedestrian-actuated signals, alerting motorists of pedestrians crossings.
    - ***Connection to Hawthorne Plaza.*** Pedestrians crossing 119th Street at Roe Street walk 120' of pavement before arriving to the other side. Installing countdown timers and aligning walkway to be more direct decreases the amount of time for pedestrians in the street. Adding a pedestrian refuge at the median along with a pedestrian-actuated signal and bollards provides walkers with more security if caught in the middle of the intersection.
- **Connect to City Hall.** Aligning and connecting the entrances of City Hall's plaza and Town Center Plaza establishes public gathering spaces and formalizes the path to the trail.
- **Link to the Trails.** The City Hall connection links trail users to commercial businesses, thereby encouraging the number of trips to businesses and increasing the number of transportation choices for residents of Leawood.

Map 4.11: Town Center Pedestrian Linkage Demonstration



IMPLEMENTATION

Funding for the Sidewalk Improvement Program can have several approaches, which include:

- **New Subdivisions.** Construction of sidewalks in all new subdivisions on both sides of the street as part of the city's Subdivision regulations. The city may consider requiring them on only one side in projects where at least 50 percent of the units are affordable units.
- **Grants and Outside Funding.** Outside funding sources, including grants designated routes and beautification projects. The Pedestrian and Bicycle Information Center offers a number of funding sources to assist in the construction and financing of sidewalks, including:
  - National Transportation Enhancements Clearinghouse
  - Pedestrian and Bicycle Information Center (PBIC)
  - Robert Wood Johnson Foundation's Active Living Research Program
  - Federal Highway Administration (FHWA)
- **City Funding.** Three common funding approaches to generating revenue for financing sidewalk improvements include (1) special bond issues, (2) dedications of a portion of local sales taxes or a voter-approved sales tax increase, and (3) use of the annual capital improvement budgets of Public Works and/or Parks agencies.
- **Cost Sharing.** In the past the city has funded sidewalk improvement programs through the general fund. The city should consider a cost sharing arrangement to ease the impact of the cost on the property owner. For instance, the city could require the owner to pay half the cost and be assessed for this cost over ten years. At current construction costs, approximately $25 a linear foot, the owner of a 50 foot wide lot would then be assessed $625 or $62.50 a year.
- **Major Streets.** Construction of sidewalks along arterial and collector streets with special emphasis to improving pedestrian crossings.
- **Street Improvement.** As major infrastructure projects are completed in city right-of-way or curb-replacement projects are completed, intersections should be brought to current ADA standards.

A number of communities can be cited for their implementation strategy and noted below. For additional approaches, visit www.pedbikeinfo.org/planning/funding_resources.cfm

Ann Arbor, MI Approach. In November of 2011, voters approved a 1/8-mile increase to the Street Reconstruction Millage for the purpose of repairing sidewalks in the public right-of-way. Prior to the passage of this millage, property owners were required to repair or replace deficient sidewalks that adjoined their property. Beginning in 2012, the City assumed responsibility for the repair of the sidewalk system, which will be performed through this project over the course of the next five years.

Missoula, MT Approach. The city spreads a large percentage of the cost of installing sidewalks to the whole community by using an insurance model. The financing model is based on the concept used in the health insurance industry. There will be a premium, deductible, co-pay, out of pocket maximum, and city payment cap. The program establishes a deductible of $300. The city co-pays 70 percent while the property owner pays 30 percent. The maximum out-of-pocket for the homeowner is $2,000 and the city caps out at $15,000. The owner would pay any amount over the city's cap. The premium is the increment in general taxes necessary to finance the program.

More detailed description available: missoulagov.org/Sidewalks.

Manchester, NH Approach. The city provides a 50-50 match to property owners for sidewalk and/or curb construction. If the construction of a sidewalk necessitates the construction of a retaining wall, the homeowner is responsible for the cost and construction of said wall before construction on the sidewalk will commence. The retaining wall is to be constructed such that no part of said wall is within the city's right of way.

Table 4.2: Summary of Opinion of Costs

	Basic Cost				Cost with Contingency			
	High Priority Routes	Priority Routes	Remaining Routes	Total	High Priority Routes	Priority Routes	Remaining Routes	Total $
SOUTH								
1	$6,946	$0	$565,373	$572,319	$10,946	$0	$569,373	$580,319
2	$165,211	$159,496	$928,434	$1,253,141	$167,211	$175,496	$938,434	$1,281,141
3	$168,354	$0	$790,614	$958,968	$178,354	$0	$792,614	$970,968
4	$233,436	$152,747	$774,227	$1,160,411	$235,436	$152,747	$774,227	$1,162,411
5	$343,709	$363,979	$579,677	$1,287,366	$359,709	$377,979	$581,677	$1,319,366
Subtotal	**$917,657**	**$676,223**	**$3,638,325**	**$5,232,205**	**$951,657**	**$706,223**	**$3,656,325**	**$5,314,205**
CENTRAL								
6	$85,497	$324,561	1,397,321	$1,807,379	$87,497	$374,561	$1,471,321	$1,933,379
7	$98,324	$171,644	615,167	$885,136	$106,324	$175,644	$619,167	$901,136
8	$126,025	$730,315	1,409,062	$2,265,402	$128,025	$734,315	$1,409,062	$2,271,402
9	$7,109	$786,713	2,296,291	$3,090,113	$11,109	$828,713	$2,304,291	$3,144,113
10	**$60,929**	**$7,467**	**529,329**	**$597,725**	**$90,929**	**$9,467**	**$557,329**	**$657,725**
Subtotal	$377,885	$2,020,699	6,247,172	$8,645,755	$423,885	$2,122,699	$6,361,172	$8,907,755
NORTH								
11	$403,806	$767,327	3,495,532	$4,666,665	$439,806	$767,327	$3,495,532	$4,702,665
12	$648,789	$1,312,334	4,878,174	$6,839,297	$736,789	$1,312,334	$4,878,174	$6,927,297
Subtotal	**$1,052,595**	**$2,079,661**	**8,373,707**	**$11,505,962**	**$1,176,595**	**$2,079,661**	**$8,373,707**	**$11,629,962**
TOTAL	**$2,348,136**	**$4,776,583**	**$18,259,204**	**$25,383,922**	**$2,552,136**	**$4,908,583**	**18,391,204**	**$25,851,922**

← ~$26 million

Cost Assumptions

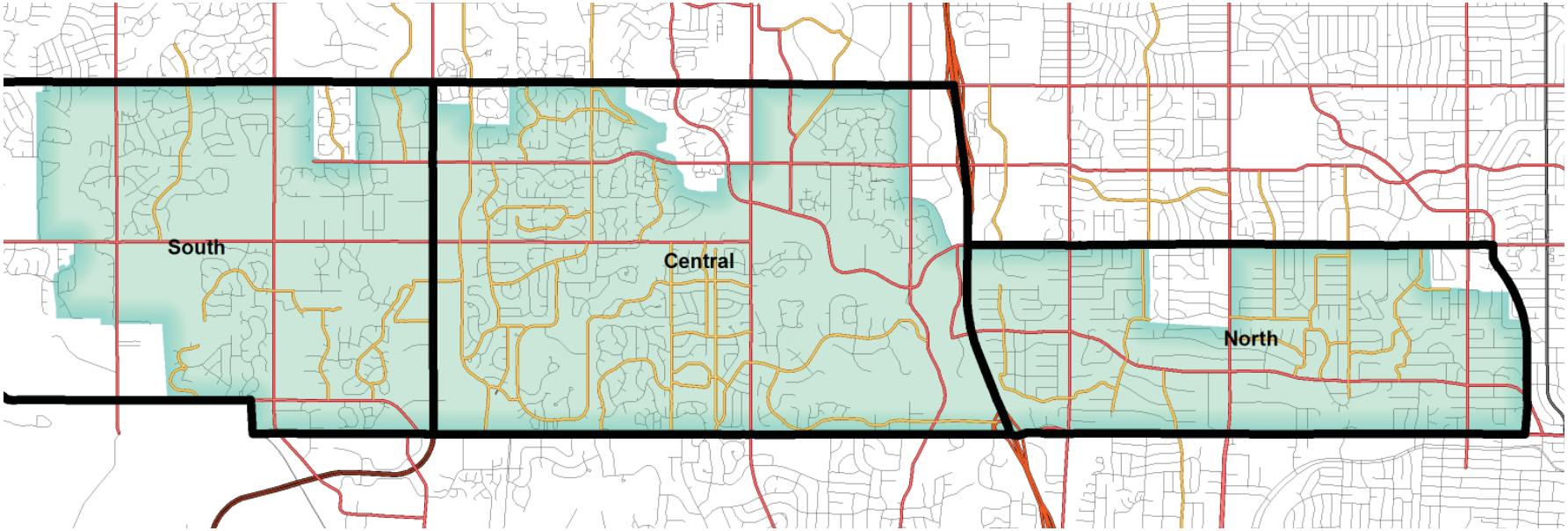
Preparing the opinion of costs was not part of the scope of the project, although provided to illustrate the magnitude of making Leawood a more walkable community. The opinion is based strictly on $25 linear foot and excludes costs related design, material, design, and engineering.

Linear Cost Assumption. Cost assumes a 5-foot wide walkway at $25 per linear foot (or $5 per square foot of concrete). Alternatively, the cost assumes a 4-foot wide walkway at $25 per linear foot (or $6.25 square foot).

Material Cost. Cost of concrete is subject to change. Linear distances are provided in subsequent tables to adjust costs.

Engineering. Retrofitting areas where gaps exist require case-by-case review. Completing some of the gaps will be difficult as obstructions are present in the right-of-way, such as landscaping or slopes. These corridors case-by-case strategies.

Map 4.11: Sidewalk Evaluation by Region: South, Central, and North



Map 4.12: Sidewalk Evaluation by Subarea Zone 1 to 12

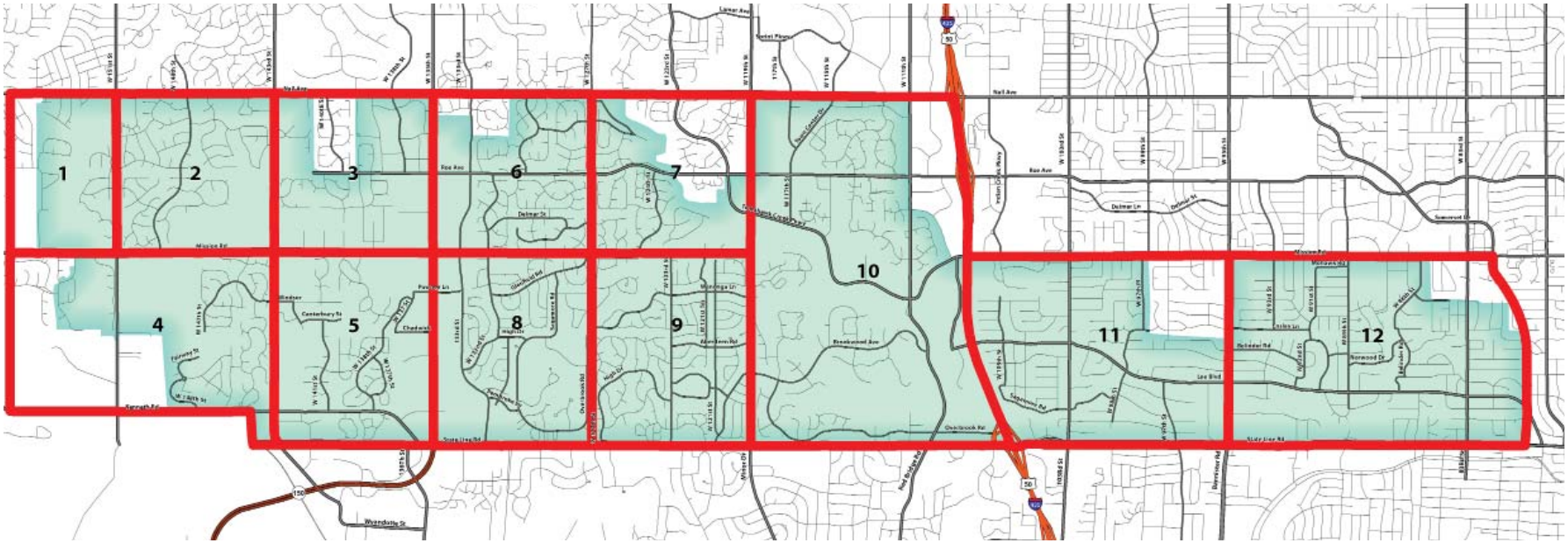
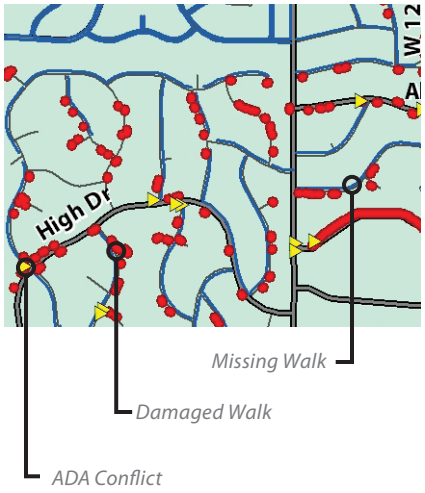


Table 4.3: Opinion of Costs for Improving **Intersections with ADA Conflicts**

	Frequency of ADA Occurrences				Conservative Cost				Contingency			
	High Priority Routes	Priority Routes	Remaining Routes	Total	High Priority Routes	Priority Routes	Remaining Routes	Low Estimate	High Priority Routes	Priority Routes	Remaining Routes	High Estimate
SOUTH												
1	2	0	2	4	$6,000	$0	$6,000	$12,000	$10,000	$0	$10,000	$20,000
2	1	8	5	14	$3,000	$24,000	$15,000	$42,000	$5,000	$40,000	$25,000	$70,000
3	5	0	1	6	$15,000	$0	$3,000	$18,000	$25,000	$0	$5,000	$30,000
4	1	0	0	1	$3,000	$0	$0	$3,000	$5,000	$0	$0	$5,000
5	8	7	1	16	$24,000	$21,000	$3,000	$48,000	$40,000	$35,000	$5,000	$80,000
Subtotal	**17**	**15**	**9**	**41**	**$51,000**	**$45,000**	**$27,000**	**$123,000**	**$85,000**	**$75,000**	**$45,000**	**$205,000**
CENTRAL												
6	1	25	37	63	$3,000	$75,000	$111,000	$189,000	$5,000	$125,000	$185,000	$315,000
7	4	2	2	8	$12,000	$6,000	$6,000	$24,000	$20,000	$10,000	$10,000	$40,000
8	1	2	0	3	$3,000	$6,000	$0	$9,000	$5,000	$10,000	$0	$15,000
9	2	21	4	27	$6,000	$63,000	$12,000	$81,000	$10,000	$105,000	$20,000	$135,000
10	15	1	14	30	$45,000	$3,000	$42,000	$90,000	$75,000	$5,000	$70,000	$150,000
Subtotal	**23**	**51**	**57**	**131**	**$69,000**	**$153,000**	**$171,000**	**$393,000**	**$115,000**	**$255,000**	**$285,000**	**$655,000**
NORTH												
11	18	0	0	18	$54,000	$0	$0	$54,000	$90,000	$0	$0	$90,000
12	44	0	0	44	$132,000	$0	$0	$132,000	$220,000	$0	$0	$220,000
Subtotal	**62**	**0**	**0**	**62**	**$186,000**	**$0**	**$0**	**$186,000**	**$310,000**	**$0**	**$0**	**$310,000**
TOTAL	**102** Occurrences	**66** Occurrences	**66** Occurrences	**234** Occurrences	**$306,000**	**$198,000**	**$198,000**	**$702,000**	**$510,000**	**$330,000**	**$330,000**	**$1,170,000**

Cost assumption:

$3,000 - $5,000 per corner. Corners with steep grades and complex alignments will require additional engineering, adding an additional 20% to the cost.



Missing Sidewalks or Gaps. Completing missing segments of sidewalks assumes a rate of **$25 a linear foot.** The opinion of cost excludes detailed review of any single route, and requires consideration to property ownership and right-of-way, slopes, drainage, and careful review of any obstacles. The **opinion is strictly to indicate the possible magnitude for completing the gaps in the system** and not a cost estimate.

ADA Conflicts. Installing or retrofitting existing intersections for people with disabilities.

Table 4.4: Opinion of Costs for Completing the **Missing Sidewalks in the System**

	Approximate Linear Feet of Missing Sidewalk				Cost Assumption based on $25 Linear foot			
	High Priority Routes	Priority Routes	Remaining Routes	Total	High Priority Routes	Priority Routes	Remaining Routes	Total $
SOUTH								
1	0	0	22,182	22,182	$0	$0	$554,542	$554,542
2	6,483	5,157	34,930	46,571	$162,084	$128,935	$873,261	$1,164,281
3	4,086	0	31,311	35,396	$102,139	$0	$782,770	$884,910
4	8,431	5,914	30,762	45,107	$210,785	$147,838	$769,052	$1,127,676
5	9,412	13,381	22,992	45,784	$235,291	$334,521	$574,800	$1,144,612
Subtotal	**28,412**	**24,452**	**142,177**	**195,041**	**$710,300**	**$611,294**	**$3,554,425**	**$4,876,020**
CENTRAL								
6	3,252	9,472	49,022	61,746	$81,304	$236,793	$1,225,542	$1,543,640
7	3,453	6,570	22,953	32,976	$86,324	$164,254	$573,814	$824,392
8	4,921	28,684	55,476	89,080	$123,025	$717,089	$1,386,893	$2,227,007
9	0	26,311	89,261	115,571	$0	$657,764	$2,231,523	$2,889,287
10	393	0	17,362	17,755	$9,825	$0	$434,061	$443,886
Subtotal	**12,019**	**71,036**	**234,073**	**317,128**	**$300,478**	**$1,775,900**	**$5,851,834**	**$7,928,212**
NORTH								
11	13,329	30,693	139,821	183,843	$333,220	$767,327	$3,495,532	$4,596,079
12	18,962	52,462	195,127	266,551	$474,048	$1,311,562	$4,878,174	$6,663,784
Subtotal	**32,291**	**83,156**	**334,948**	**450,395**	**$807,268**	**$2,078,889**	**$8,373,707**	**$11,259,864**
TOTAL	**72,722** Linear Feet	**178,643** Linear Feet	**711,199** Linear Feet	**962,564** Linear Feet	**$1,818,047**	**$4,466,083**	**$17,779,966**	**$24,064,096**

Table 4.5: Opinion of Costs for Replacing the **Damaged Sidewalks in the System**

	Approximate Linear Feet of Replacing Sidewalk				Cost Assumption based on $25 Linear foot			
	High Priority Routes	Priority Routes	Remaining Routes	Total	High Priority Routes	Priority Routes	Remaining Routes	Total $
SOUTH								
1	38	0	193	231	$946	$0	$4,831	$5,777
2	5	262	1,607	1,874	$127	$6,561	$40,173	$46,860
3	2,049	0	194	2,242	$51,215	$0	$4,844	$56,059
4	786	196	207	1,189	$19,651	$4,909	$5,175	$29,735
5	3,377	338	75	3,790	$84,418	$8,459	$1,877	$94,754
Subtotal	**6,254**	**797**	**2,276**	**9,327**	**$156,356**	**$19,929**	**$56,900**	**$233,184**
CENTRAL								
6	48	511	2,431	2,990	$1,193	$12,767	$60,779	$74,739
7	0	56	1,414	1,470	$0	$1,390	$35,353	$36,743
8	0	289	887	1,176	$0	$7,226	$22,169	$29,395
9	44	2,638	2,111	4,793	$1,109	$65,949	$52,769	$119,826
10	**244**	**179**	**2,131**	**2,554**	**$6,105**	**$4,467**	**$53,268**	**$63,840**
Subtotal	336	3,672	8,974	12,982	$8,406	$91,799	$224,338	$324,543
NORTH								
11	663	0	0	663	$16,586	$0	$0	$16,586
12	1,710	31	0	1,741	$42,741	$772	$0	$43,513
Subtotal	**2,373**	**31**	**0**	**2,404**	**$59,326**	**$772**	**$0**	**$60,099**
TOTAL	**8,964** Linear Feet	**4,500** Linear Feet	**11,250** Linear Feet	**24,713** Linear Feet	**$224,089**	**$112,499**	**$281,238**	**$617,826**

Damaged Sidewalks. Replacing damaged segments of sidewalks assumes a rate of **$25 a linear foot**. Damaged walks were documented through a windshield survey. An approximate linear distance was recorded to make the path more passable.

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CHAPTER 5

BICYCLE INFRASTRUCTURE: DESIGN CONCEPTS AND GUIDELINES

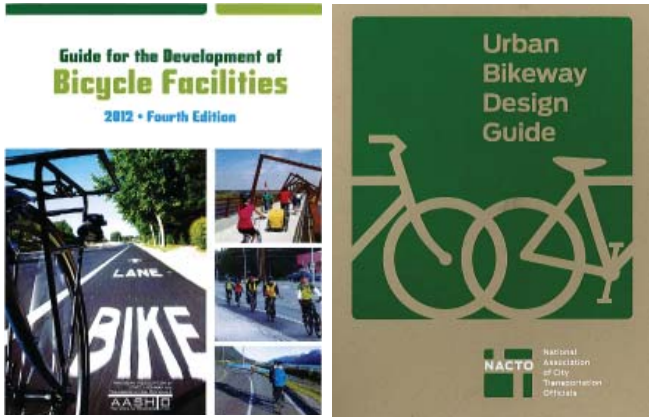
THIS CHAPTER PRESENTS THE INFRASTRUCTURE OF THE LEAWOOD BIKEWAY NETWORK, INCLUDING FACILITY TYPES AND DESIGN GUIDELINES APPROPRIATE TO THE CITY'S VARIOUS STREET CONTEXTS AND ENVIRONMENTS.

These facility types form the building blocks of the network, and become the individual design components of the system's routes. These facilities also meet pedestrian needs and that many of the off-street and intersection recommendations and facilities for bicycles also serve pedestrian needs. In addition, corridors included in the basic bicycle system also require pedestrian accommodations, typically continuous sidewalks in a state of good repair and barrier-free intersection crossings.

The Leawood bikeway network will be implemented on the ground by a variety of features: pavement markings, signs, capital projects like paths and trails, and supporting improvements. Each of these will increase the comfort and safety of cyclists traveling along the system and encourage prospective riders to use the bicycle for transportation. These solutions are adapted to the characteristics of Leawood's streets: their roles in the street system, traffic volumes, widths, parking conditions, urban contexts, intersections, and linkages. In this chapter, we discuss the infrastructure components that are the building blocks of the route network, and present guidelines for their design. We show how these elements are assembled route-by-route to create the completed system

Facility types in the overall system and its individual routes should be relatively consistent. Because Leawood has several street and pathway contexts, the bikeway network combines more than one facility type even along specific routes. However, the system should use a common vocabulary for clarity and should avoid "choppiness" - changing frequently from one facility to another or forcing frequent street crossings. Both of these conditions work against the requirements of integrity, comfort, and safety.

These guidelines are intended to complement three authoritative sources of guidance for the design of bicycle facilities: the new Urban Bikeway Design Guide, published in 2014 by the National Association of City Transportation Officials (NACTO); the Guide for the Development of Bicycle Facilities: Fourth Edition, released in 2012 by the American Association of State Highway and Transportation Officials (AASHTO); and the 2009 edition of the Manual of Uniform Traffic Control Devices (MUTCD) by the US Department of Transportation. It is important to note that individual routes require specific design, requiring flexible adaptation of these guidelines to individual conditions. Most situations are clear enough that guidelines can be applied directly. But more complex conditions require more customized solutions.



This chapter complements guidance and standards from authoritative national sources, adapting them to conditions found in Leawood.

FACILITY TYPES

Most of the Leawood network uses the following types of facilities:

- **Shared Streets.** A condition in which bicyclists and motor vehicles operate in common right-of-way. These streets usually have relatively low volumes and adequate continuity to be useful parts of the system. In many cases, they have on-street parking and are not wide enough to provide specific space for bicyclists. Shared streets include bicycle boulevards, using distinctive signage and design features to distinguish them as facilities that give special attention and even priority to the bicycle. Much of Leawood's total street mileage is in quiet local streets, many of which were designed to discourage through traffic and restrict speeds. This makes many of these facilities ideal for bicycling and pedestrian use. As such, most of the mileage in the proposed Leawood network utilizes shared streets.

- **Bicycle Lanes.** A facility in which bicyclists share the street right-of-way but operate within marked lanes reserved for their use. Bicycle lanes usually provide for one-way movement in the same direction as motor vehicles, although counterflow lanes are used on occasion. Bicycle lanes are appropriate on streets that can comfortably accommodate bicyclists, but have higher traffic volumes than shared streets; provide adequate width in their current channels for both motor vehicles and bicycles; or as part of new street construction projects that integrate pedestrians, bicycles, and transit into their design (complete streets). Some contemporary bike lane installations are using new techniques to increase visibility and separation. These include buffered bike lanes, providing a painted separation between the bicycle and travel lanes, and colored or "green" bike lanes, painting all or part of the bike lane. Leawood has installed "conventional" bike lanes on 123rd and 127th Streets. Bike lanes will also be included in the planned widening of 143rd Street.

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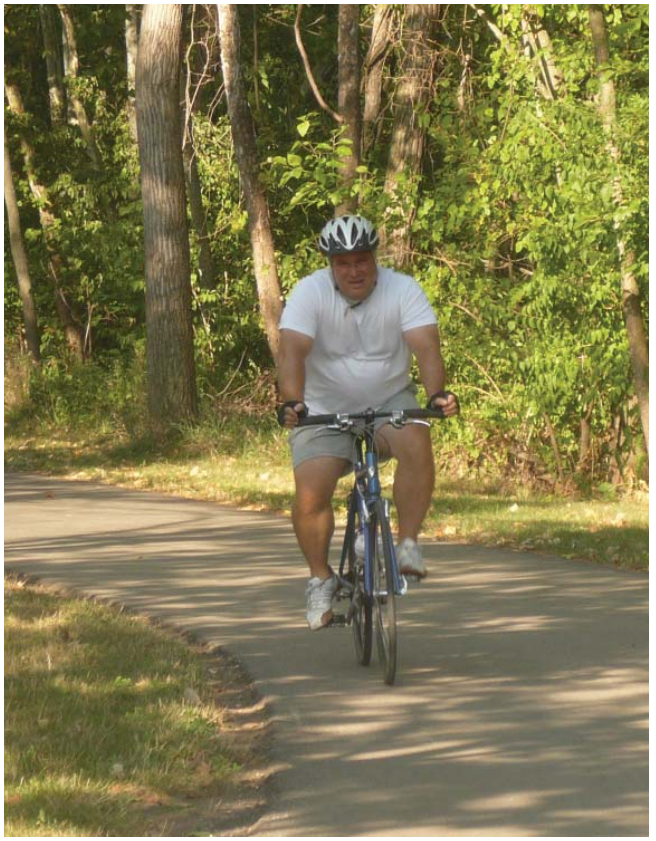
Facility Types with Leawood Applications

1. *Shared street with sharrow, Omaha, NE*
2. *Bike lane on existing street, Leawood*
3. *Complete street conversion, Green Bay, WI*
4. *Green bike lane, Los Angeles, CA*
5. *Sidepath, Leawood*
6. *Cycle track, Evanston, IL*
7. *Multi-use trail, Tomahawk Creek, Leawood*
8. *Buffered bike lane on arterial street, Atlanta, GA*
9. *Bicycle Boulevard, Yucca Street, Los Angeles, CA*
10. *Street sign on bicycle boulevard, Los Angeles, CA*

- **Sidepaths and Cycle Tracks.** Sidepaths are wide paths located within a street right of way but fully separated from travel lanes, usually by curbs. They are sometimes referred to as "widened sidewalks" or "sidewalk trails." These facilities are widely used in both Leawood and the United States. Local examples include Nall Avenue, 133rd Street, and a new installation along Town Center Drive as part of the Park Place mixed use development. These facilities are popular with road designers and provide a degree of separation that many users find comfortable. However, they have been controversial because of potential bicycle-motor vehicle conflicts at intersections of streets and driveways, uncertainties about who has the right-of-way, and lack of visibility or awareness of drivers of the presence of the path. These facilities are especially useful along the street frontages with long distances and controlled access.

  Cycle tracks are one- or two-way paths or "tracks" within street channels, buffered from moving traffic by horizontal barriers or buffers, including parked cars, painted buffers with flexible bollards, and other devices. These provide a degree of separation that many users find increases their comfort level and sense of safety, consistent with findings in the Leawood survey. They have grown in popularity in large American cities, especially in dense urban districts. While the street system and development form of Leawood afford relatively few opportunities for cycle tracks, there are some special possibilities such as the definition of a cycle route on the edges of unused parking lots.



- **Multi-use Trails.** Trails on rights-of-way separated from streets and primarily along the Indian and Tomahawk Creek greenways remain Leawood's most heavily used bicycle and pedestrian facilities. Other trails include the Mission Farms path, connecting that mixed use development to 105th Street. Leawood offers few opportunities for additional, long-distance multi-use trails, but several key pathway sections can fill significant connectivity gaps and dramatically increase the utility of the system.

LOCAL SHARED STREETS

Shared, low-volume streets will make up the majority of on-street mileage in the Leawood bikeway system. On these streets, bicycles and motor vehicles operate within the same area. These streets should also have continuous sidewalks in good repair with barrier-free access on at least one side.

Shared streets will be marked by shared lane markings, or sharrows, a new pavement marking now recognized in the Manual of Uniform Traffic Control Devices (MUTCD). Sharrows, made up of a bicycle symbol and a directional chevron, fill three primary functions:

- They provide route continuity for cyclists. The sharrow helps assure riders that they are on the bikeway system and moving along a street that is intended for bicycle use.
- Along with other signage, they increase motorist awareness of bicycles on the street.
- Properly placed, they help bicyclists position themselves safely on a street away from the "door zone" of adjacent parked cars.

Application to Leawood's Street Contexts

Characteristics of streets in the Leawood system that adapt to shared use include:

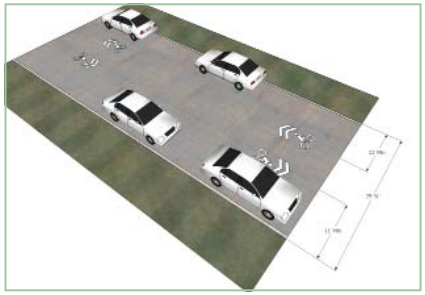
- **Low traffic volumes.** Streets with average daily traffic (ADT) below 5,000 vehicles per day (vpd), and preferably below 3,000 vpd are most appropriate for shared use. Most of the streets identified as part of the Leawood network fall well within these limits. Generally, streets over these levels require some degree of facility separation to be comfortable for many riders. Relatively low speeds. The MUTCD recommends that sharrows not be placed on roadways with speed limits over 35 mph. A better maximum speed limit for streets with sharrows for Leawood is 30 mph.
- **On-street parking.** Many low-volume streets have on-street parallel parking on at least one side. The sharrow is useful in helping bicyclists position themselves away from the hazards of opening car doors.
- **Inadequate space for bike lanes.** Bike lanes, providing reserved space in the street channel for bicyclists, are often desirable, but many streets in the Leawood system are not wide enough to accommodate bike lanes, travel lanes, and on-street parking on both sides. On some corridors, sharrows may be a good initial solution that can be upgraded to bike lanes.

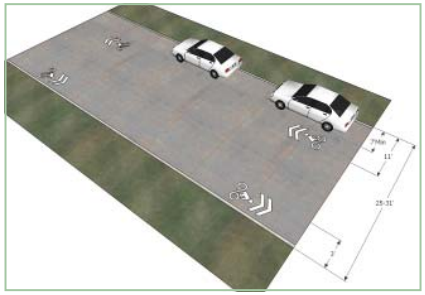
Figure 5.1: Typical Designs for Shared Streets

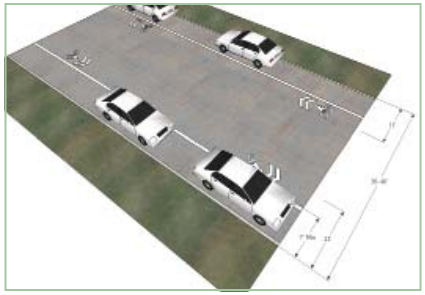
These conditions are typically found in Leawood on continuous local streets or neighborhood collectors. Markings are unnecessary on very short segments, other than to provide directional guides to users. Sharrows may be used on streets with somewhat higher volumes and speeds up to 30 mph where necessary to provide system continuity or to fill short gaps in the network. However, these routes will not be comfortable for all riders.

Left: Narrow local or neighborhood collector street with two-sided parking.
Center: Narrow local or neighborhood collector street with one-sided parking.
Right: Wide neighborhood avenue with two-sided parking.

Figure 5.2: Design Guidelines for Shared Streets







Design Condition	Pavement Marking and Signage	Typical Street Type	Comments
Two-sided parking/ 25-31 foot width	Sharrows with center of chevron a minimum of 11 feet from the face of the curb	Continuous local, continuous neighborhood collector, neighborhood parkway	
One-sided parking/ 25-29 foot width	Sharrows with center of chevron a minimum of 11 feet from the face of curb on the parking side, minimum of 4 feet from face of curb on the no parking side	Continuous local, continuous neighborhood collector, neighborhood parkway	
One-sided parking/ 29-32 foot width	Sharrows with center of chevron a minimum of 11 feet from the face of curb on the parking side, minimum of 4 feet from face of curb on the no parking side. Painted white line to define parking lane, with outside edge 8 feet from face of curb	Neighborhood collector, neighborhood parkway, neighborhood avenue	White line should be used when the remainder of the street channel is at least 21 feet wide. Parking line helps define parking area and aids in bicyclists positioning themselves safely away from parked cars. In addition, when curbside parking is lightly utilized, the parking lane can serve as an informal bike lane for some cyclists.
Two-sided parking/ 36-42 foot width or divided parkway	Sharrows with center of chevron a minimum of 11 feet from the face of curb on the parking side, minimum of 4 feet from face of curb on the no parking side. Painted white line to define parking lanes, with outside edge 8 feet from face of curb.	Neighborhood avenue	White line should be used when the remainder of the street channel is at least 21 feet wide. Parking line helps define parking area and aids in bicyclists positioning themselves safely away from parked cars. In addition, when curbside parking is lightly utilized, the parking lane can serve as an informal bike lane for some cyclists.

BICYCLE BOULEVARDS

Signage concepts for bicycle boulevards. Signs are the least expensive solution but can be very effective in distinguishing these multi-use streets.
Top to bottom: Street signs with bicycle boulevard designations on Russell Street in Berkeley, CA and Wilson Street in Madison, and a bicycle boulevard identifier in Berkeley.

Left to right: intersection crossing caution in Portland, OR, and share the road sign in Leawood.

As noted in Chapter Three, bicycle boulevards are a central part of the proposed Leawood system. Typically, "bicycle boulevards" are direct segments that parallel to higher order streets, and serve the same destinations as busier arterials. In Leawood, the bicycle boulevards are combinations of streets and in some cases paths that together create destination-based routes for local transportation. Bicycle boulevards utilize the pavement marking conventions discussed above, but include other identifying and functional enhancements. These vary in level of capital investment and complexity, and include (in relatively ascending order of complexity):

- **Signage.** Signage has the advantage of being highly visible and low in cost. Bicycle boulevard signs include identification signs (special street signs and bicycle boulevard identifiers) and advisory or caution signs (share-the-road signs). The entire system will also use a common signage system that incorporates identifying, directional, and wayfinding signs, discussed in Chapter Six.

- **Intersection and road priority.** Bicycle boulevards should provide reasonable through priority to bicyclists, and by extension other users of the street. These include turning stop signs, to stop traffic on cross streets in favor of bicyclists and other users of the boulevard, and installing signs that explicitly give priority to cyclists.

- **Traffic calmers.** These features slow motor vehicle traffic at key points to equalize speeds between bicycles and cars. These techniques may include corner nodes with well-defined crosswalks, mini traffic circles, speed tables, and patterned or textured pavements at crosswalks or in intersections. Leawood has used a number of these

devices within its residential areas. In addition to aiding bicyclists, they provide a better pedestrian environment and tend to discourage unwanted through traffic from using continuous neighborhood streets.

- **Arterial street crossing installations.** These features at crossings of bicycle boulevards and major streets help bicyclists cross arterials and preserve system continuity and safety. Techniques include installation or tuning of induction loops sensitive enough to detect bicycles; pedestrian and bicyclist activated hybrid beacons, possibly using bicycle loop detectors; and crossing refuge medians, short medians that allow bicyclists and pedestrians to negotiate one direction of traffic at a time. A special bicycle symbol is marked on the pavement to emphasize the point where the loop detects bicycles.

Increasing levels of intensity or investment on bicycle boulevards. Left: Bicycle priority sign on Wilson Street bicycle boulevard in Madison. Center: Mini-traffic circle in Berkeley. Right: Hybrid beacon signal in Tucson

Arterial street crossings for bicycle boulevards and pedestrian corridors. From left: Median installation in Las Vegas; Crossing median concept for urban corridor by RDG.; diverter island in Los Angeles.

BIKE LANES

Bike lanes provide reserved (but not always exclusive) space for bicyclists operating within the street channel. Because they delineate a specific area for bicyclists, bike lanes provide an on-street environment both safer and more comfortable for cyclists on higher volume and/or higher speed roads than shared streets. The Leawood Bikeways Survey indicated that bike lanes provided a preferred facility for many prospective cyclists.

Urban streets experience a number of demands that create potential conflicts, including traffic volume, on-street parking, and turning movements. Most bike lane candidates in the proposed Leawood system either do not permit parking or have enough off-street parking available that parking is not a significant issue. Bike lanes will be incorporated into Leawood's streets in three different ways:

Retrofits of existing streets. These projects, involving the least cost and difficulty, will reconfigure existing right-of-way to provide bike lanes as well as adequate capacity to meet traffic demands. Leawood has already retrofitted 123rd and 127th Street with bike lanes. The 32-foot width of streets and lack of on-street parking produce conditions that encourage bike lane retrofits.

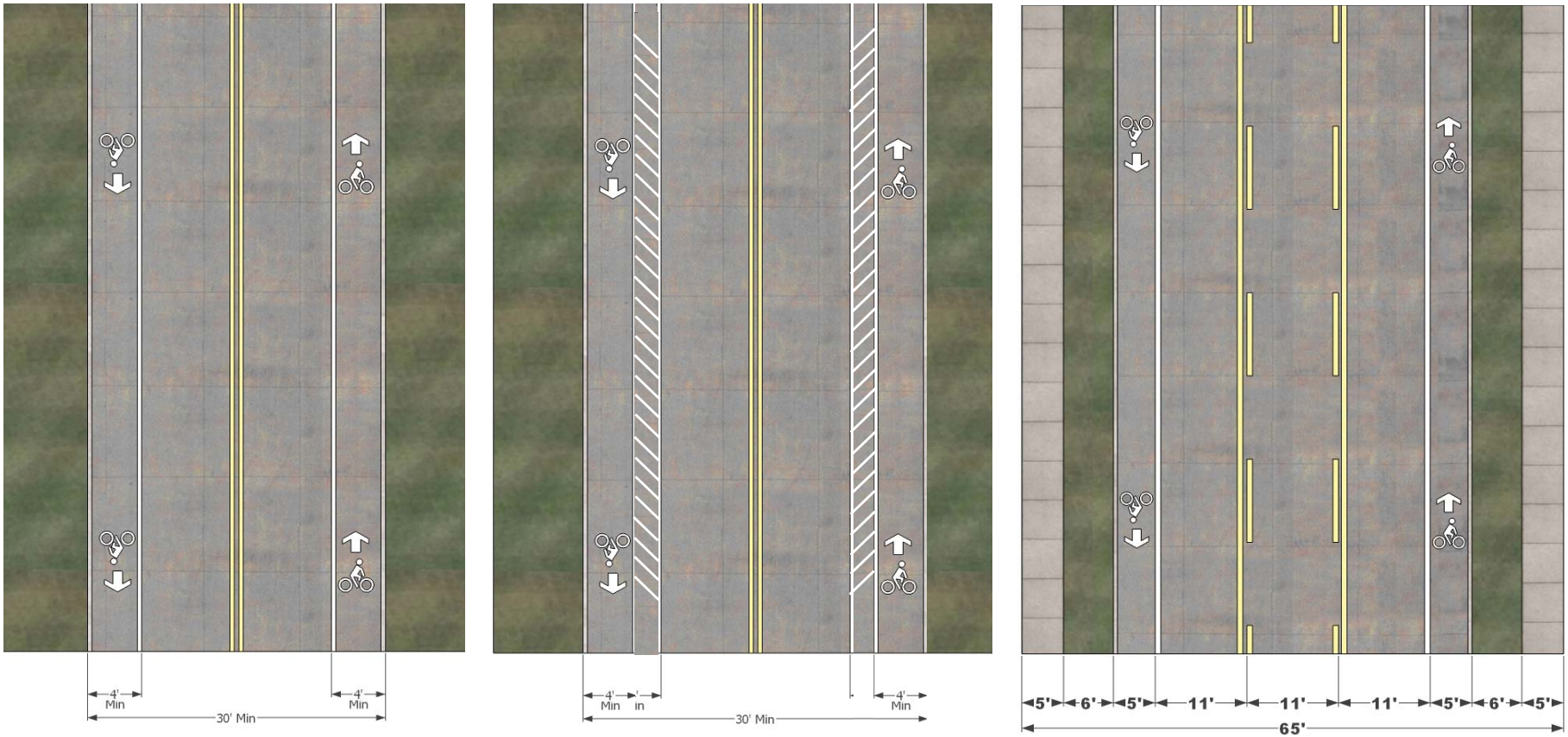
Minor street widenings. These projects would widen existing street channels to add bike lanes, and may also adjust existing travel lanes.

New streets or street reconstructions. These major investments address streets that need reconstruction to meet traffic demands or new corridors, anticipating development as "complete streets," designed to accommodate all modes of travel. The current 143rd Street project will include bike lanes, and a future reconstruction of Lee Boulevard should similarly be multi-modal.

Application to Leawood's Street Contexts

Characteristics of streets in the Leawood system that adapt to bike lanes include:

- **Higher traffic volumes.** Bike lanes become more necessary as volumes increase, typically applying to streets with average daily traffic above 3,000 to 5,000 vehicles per day. These higher volumes require greater degrees of separation to maintain comfort for a maximum number of cyclists. Streets proposed for bike lanes in the Leawood system generally display volumes between 5,000 and 10,000 vpd. At higher volumes, separated or buffered lanes become more advisable.
- **Medium speeds.** Speed differentials are generally more important than traffic volume in determining the application



Left: Two-lane, two-way traffic with no parking (Mission Road south)
Center: Two-lane, two-way traffic with buffered bike lane (Lee Boulevard concept)
Right: Three-lane, two-way traffic with conventional bike lanes (buffered bike lanes add six feet to total street width, with 3-foot buffers).

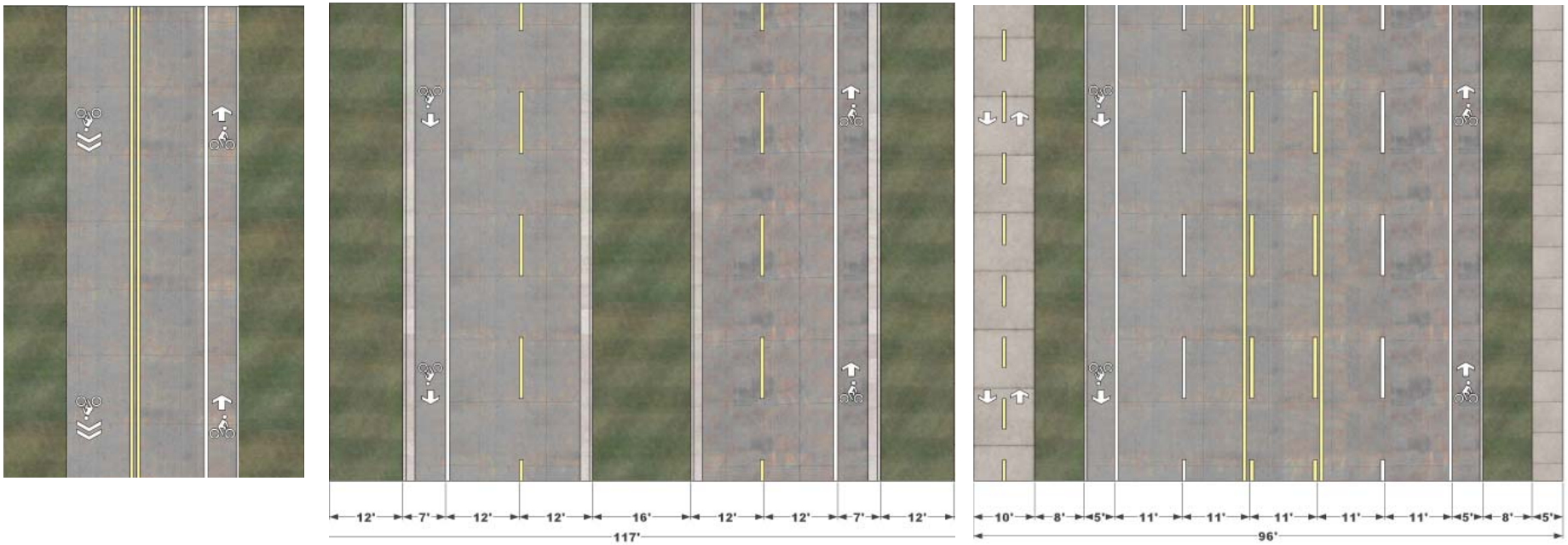
of bike lanes. However, lanes are most appropriately utilized on streets with typical speeds between 25 and 45 miles per hour. Above 45 mph, margins for error and, consequently, user comfort and safety decline.

These conditions are typically found on minor arterials with minimum widths of 30 to 32 feet and no parking, including Mission Road south of 119th Street, Tomahawk Creek Parkway, and 83rd Street. Bike lanes on one side may be used when space is not adequate for lanes in both directions.

Overall Design Guidelines

In the Leawood system, streets proposed for bike lanes typically vary from 30 feet (83rd Street) to four lane divided parkways with rural sections (Tomahawk Creek Parkway). Figures 4.3 and 4.4 illustrates typical design contexts and bike lane dimensions for the Leawood system, with guidelines summarized in Figure 4.5. However, general design principles include the following:

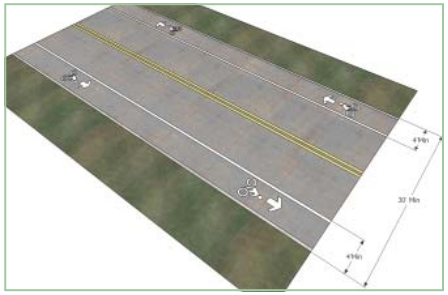
Figure 5.4: Typical Bike Lane Designs for Leawood



Left: Two-lane traffic with bike lane on one side, sharrow in opposing direction (83rd Street). May be used in a street as narrow as 28 feet.
Center: Bike lanes in a divided parkway (Tomahawk Creek Parkway)
Right: Five lane arterial with bike lanes and side-path (potential future 151st Street section)

- Conventional bike lanes should operate in a single direction, flowing with traffic.
- Bike lanes will typically be provided on both sides of two-way streets. In situations where bike lanes are needed but right-of-way only accommodates a single directional lane, a sharrow should be used in the opposite direction. The bike lane should be provided in the direction most likely to slow or create conflicts with other traffic, such as an uphill grade or when traffic issues are most severe in one direction.
- Normally, bike lanes will be located on the right-hand side of the street, consistent with traffic conventions and motorist expectations. Bike lane pavement markings should be used at the entrance and departure of each intersection.

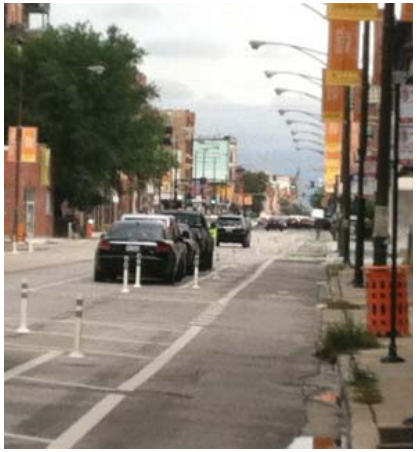
Figure 5.4: Design Guidelines for Bike Lanes



Design Condition	Pavement Marking and Signage	Typical Street Type	Comments
Two-Way Traffic, no parking	Four-foot minimum bike lanes, excluding gutter pan. Total minimum street width (face to face of curb: 30-32 feet for two-lane plus 11 feet for each additional travel lane.	Minor arterials with ADT between 5,000-10,000 vpd	
Two-Way Traffic, no parking with buffered bike lane	Four-foot minimum bike lanes, excluding gutter pan. Three foot minimum buffers, should be cross-hatched and may include vertical elements such as rubber bollards. Total minimum street width (face to face of curb: 38-40 feet for two-lane plus 11 feet for each additional travel lane.	Major bikeway such as Lee Boulevard.	
Single direction bike lane with no parking and opposing shared lane.	Street channels require a minimum of 28 feet from face of curbs with no parking. The bike lane should be placed on the side of the street where cyclists in a shared lane would be most likely to delay traffic (such as an uphill or rising grade).	Minor arterials with bike lane demand but inadequate width for lanes in both directions.	

General Notes:
1. Typical recommended placement of standard bike lane pavement markings is at the entrance and departure from each intersection.

2. Standard bike lane sign (R3-17) may be placed with an AHEAD plaque at the approach to the lane and with an END plaque at the terminus of the lane. Pavement markings should be used more frequently than signs and marking locations should be coincident where possible.



Left: Five-lane section with buffered bike lanes on Ponce de Leon Avenue in Atlanta.

Center: Rubber bollards used to define cycle track and parking areas in Chicago.

Right: Buffered bike lane on a two-lane corridor in Brooklyn.

Intersection Design

Intersection design is important to the safe operation of on-street facilities. Consistent practices should address conflicts between turning traffic and bicyclists proceeding straight ahead. In urban bicycling situations, bicyclists are advised to position themselves in the right-hand third of the lane that serves their destination. While this maximizes safety, many cyclists tend to move to the extreme right of an intersection, placing them in a position to be hit by turning motor vehicles. Leawood has many offset intersections, where a local or collector street does not align directly north and south of an intersecting arterial.

Intersection solutions for on-street bicycle facilities include:

- Typical intersection markings
- Right-turn pockets
- Bike boxes for left turns
- Intersection offsets

Intersection treatments recommended for bicycle boulevards, including refuge medians, are also applicable to streets with bike lanes.

Typical Intersection Markings

Figure 4.6 illustrates typical pavement markings in various situations including intersections. Problems have emerged with bike lane installations that maintain solid lines up to the intersection. This encourages some cyclists to consider the bike lane to be inviolate, and opens them to the possibility of being hit by right-turning traffic. In response, current practice is to replace the solid white line with a dashed line, suggesting that the lane alignment should not be rigidly followed. This also encourages cyclists to behave like other traffic by leaving the right-hand bike lane to make left turns.

Right-Turn Pockets

Some major intersections include right-turn only lanes to allow right turns on red signals or otherwise separate right turning movements from the direct flow of traffic. This creates a potential issue for bicyclists who are used to positioning themselves "as far to the right as practicable" in the language of many state laws, again exposing themselves to collision with right-turning motor vehicles. Figure 4.6 illustrates the recommended pavement markings position the bicyclists continuing straight ahead to the left of the right turn only (RTO) lane, providing a dashed stripe through the conflict zone. The solid stripe resumes on the other side of this conflict zone. Many cities are coloring the surface of this zone to increase motorist awareness of a potential collision hazard, A standard sign, advising motorists to yield to bikes on a direct route (R4-4) should also be installed.

Bicycle Boxes for Left Turns

Bicycle boxes are used at signalized intersections to extend a bike lane to the front of a traffic queue. The box sets the stop bar for motor vehicles behind the stopped bicycles. They provide clear visibility for bicyclists, minimize the problem of cyclists hugging the right-hand curb, and expedite left-turning bicycle movements. The boxes are defined by stripes and may be colored for greater visibility.

Recommended depth of the box is 14 feet from the edge of the crosswalk.

Offset Intersections

Because many of Leawood enjoys the benefits of a good local street grid, many of these streets are offset as they cross major arterials, typically at section lines. Most of these intersections are controlled by stop signs and, in most cases, the bicycle route is on the secondary street. These offsets place through cyclists on continuous, low-volume routes in a precarious position, often forcing them to attempt to join the traffic stream on the primary street.

Figure 4.7 illustrates three concepts that address this barrier issue. At low volume intersections, using chevrons to define the bike route is satisfactory. At unsignalized intersections with major arterials, a short one-way track allows the cyclist to track a straight line across the intersection and continue to the opposite leg without being forced into a heavy traffic stream. At signalized intersections, a two-way track aligns the cyclist with the continuation of the bike route.

Developing Bike Lanes in the Network

As mentioned, bike lane installations in the Leawood system will be implemented in three ways: retrofits to existing streets, minor widenings, and major construction or reconstruction to complete street standards. This discussion considers how these techniques apply to the Leawood bikeways network.

Retrofits

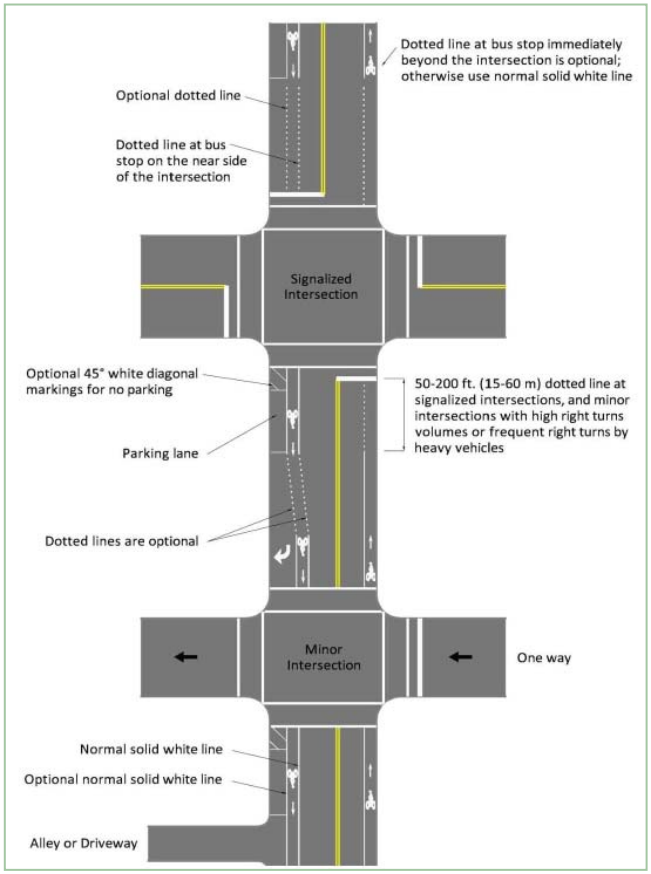
Street retrofits with bike lanes are relatively inexpensive projects because they simply reconfigure the existing road section without significant capital construction. Retrofits can be accomplished by:

- Adding bike lanes by using excess street width
- Road diets
- Parking and lane reconfigurations

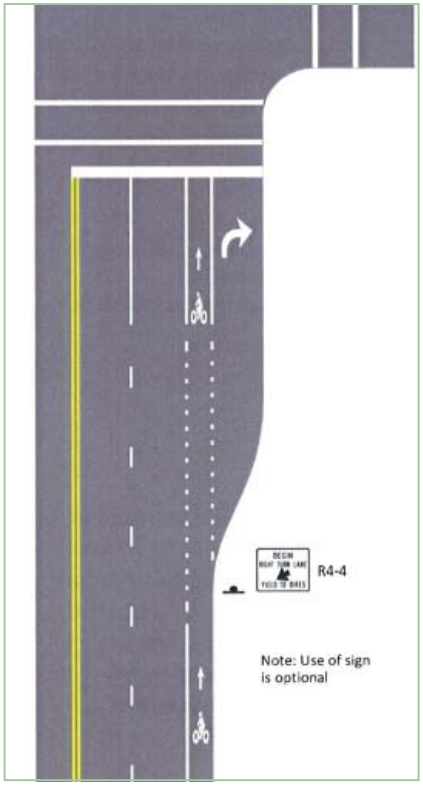
Using Excess Width

Some streets in the Leawood system are wide enough that bike lanes can be added with no significant change in the existing street layout. Examples include Mission Avenue between 119th and 135th, and 83rd Street. Bike lanes on these streets also have the advantage of managing traffic, reducing speeds to desirable levels, and preventing passing on the right.

Figure 5.6: Lane Markings at Intersections



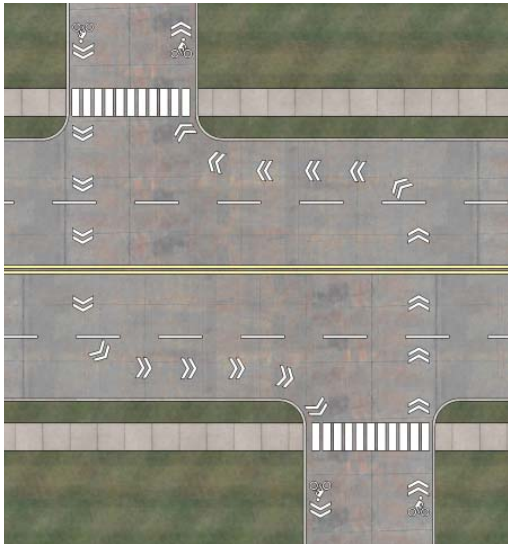
Source: AASHTO Guide for the Development of Bicycle Facilities, 2012.



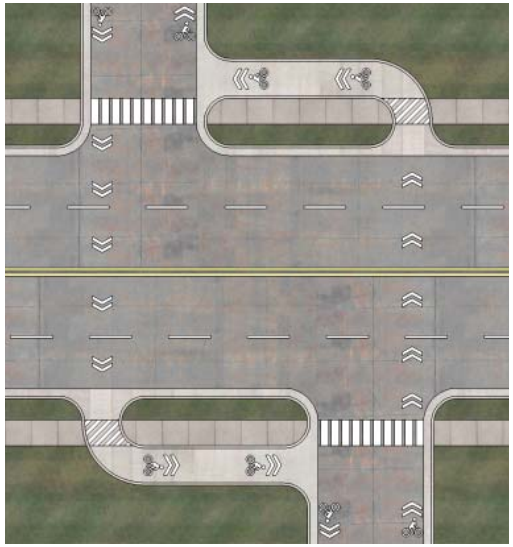
Bicycle box on Commonwealth Avenue in Boston. Bike lanes here are on the left side of the street channel, adjacent to the median.

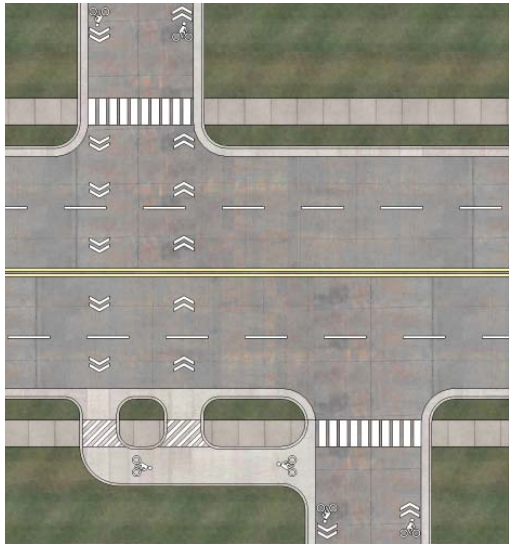
Figure 5.7: Offset Intersections

Crossing offset intersections. Concepts are designed for three different situations. Case (1) illustrates an offset crossing with low cross traffic, where use of chevrons to mark a path through the intersection is sufficient.



Case (2) illustrates an unsignalized intersection with a major street, employing a one-way cycle track to permit the cyclist to ride directly across the intersection and proceed without merging into the traffic stream.





Case (3) addresses a signalized intersection, aligning the cyclist using the non-signalized leg to align with the signal and proceed on green across the street.

Road Diets

Road diets in Leawood, most notably will be more likely to involve narrowing or defining wide lanes than reducing the actual number of travel lanes. Lane narrowing or definition, already employed along 123rd and 127th, reduces travel lanes to from 12 feet or more to 11 feet. The excess width is then devoted to bike lanes. Reductions in the number of travel lanes has far less application to Leawood, since most multi-lane corridors either require the capacity or are likely to need it to accommodate future growth.

Parking and Lane Reconfigurations

Parking reconfigurations pick up road space by consolidating existing on-street parking. In these situations, which may involve relatively wide neighborhood streets such as State Line Road, underutilized two-sided parking is combined on one side of the street. On streets in excess of 35 feet wide, this provides an opportunity for a bike lane on one side of the street and a shared lane with a painted parking lane in the opposite direction. A lane reconfiguration may change the location of lanes on the street to accommodate mixed traffic.

Minor Widenings

Minor widenings include construction of dual purpose paved shoulders on streets without curbs or relocating curbs on urban streets, most feasible as part of another improvement project. Tomahawk Creek Parkway provides an opportunity for such a minor widening. Shoulder bikeways should be six feet wide to accommodate bicycles and disabled vehicles comfortably on these relatively high speed corridors. Shoulders should also be marked with bike lane pavement markings.

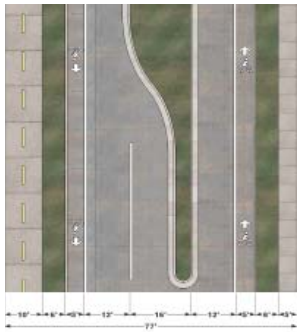
Major Reconstructions/Complete Streets

These major projects include either new corridors or upgrades to existing obsolete streets that no longer meet traffic requirements. They would be upgraded to complete street standards, providing bike lanes or comparable facilities. Because complete streets may also include off-road facilities, recommended guidelines are presented later in the discussion of sidepaths and cycle tracks. Probable future complete street corridors include Mission Road south of 137th Street and 151st Street. A current project will reconstruct 143rd Street as a multi-modal street.

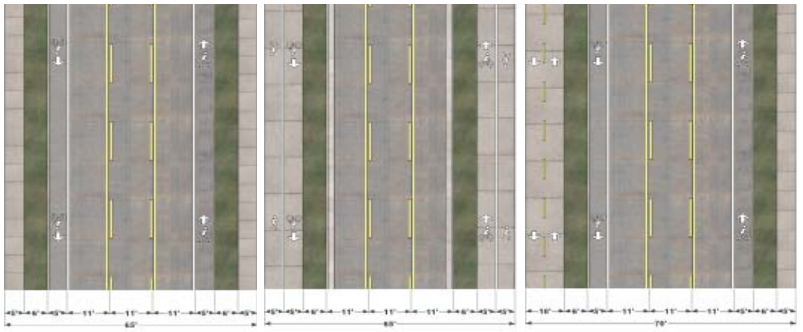
Figure 5.8: Complete Street Dimensions and Sections

Section Type	Sidewalk/ Sidepath	Parkway Setback	Bicycle Lane or Shoulder	Street Channel width	Bicycle Lane or Shoulder	Parkway Setback	Sidewalk/ Sidepath	Total Minimum ROW
2 lane divided with sidepath	10	6	5	40	5	6	5	76
3 lane, no sidepath (35 mph)	5	6	5	33	5	6	5	65
3 lane, 1-way sidepaths (35 mph)	10	6	5	33	5	6	10	75
3 lane, 2-way sidepath (35 mph)	10	6	5	33	5	6	5	70
4 lane divided, 2-way sidepath (45 mph)	10	12	7	64	7	12	5	117
5-lane, no sidepath (35 mph)	5	8	5	55	5	8	5	91
5-lane, 1-way sidepaths (35 mph)	10	8	5	55	5	8	5	101
5-lane, 2-way sidepath (35 mph)	10	8	5	55	5	8	5	96

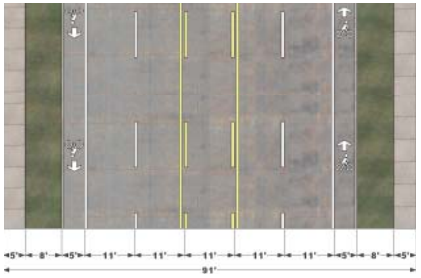
Two-lane divided section with sidepath.

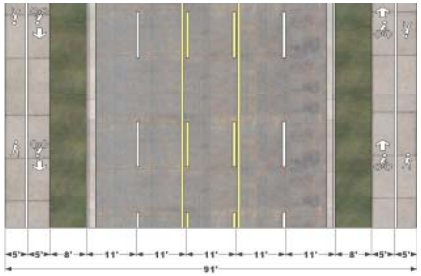


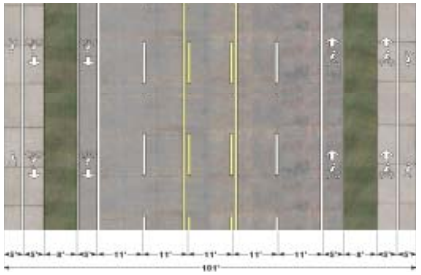
Three-lane sections: From left, bike lanes; one-way sidepath without bike lanes; and two-way sidepath with bike lanes.

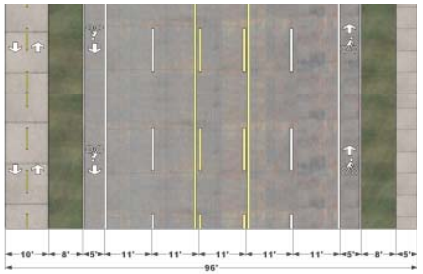


Five-lane sections:
From left, bike lanes; one-way cycle tracks with bike lanes; one-way sidepaths with bike lanes; and two-way sidepath with bike lanes









SIDEPATH AND CYCLE TRACKS

Sidepaths are paths separated from the stream of traffic but within the right-of-way of a street or road. They are a staple of European bicycle systems, but are controversial among facility designers and urban bicyclists. They present significant challenges at intersections but allow cyclists to operate comfortably on direct major routes. They are used extensively in Leawood and in the Kansas City area, and have a continuing role in the Leawood system.

Cycle tracks generally refer to protected paths within the street channel but physically buffered from travel lanes. These facilities are becoming increasingly popular in American cities and may have some specific applications in Leawood.

While the Leawood survey indicates that many current and potential cyclists are comfortable operating in mixed traffic, many others want to be separated from motor vehicles. The sidepath has been a response to this concern, using road right-of-way to accommodate a multi-use path. The extra cost of these facilities is relatively small, since sidewalks are already required in most urban street projects.

Yet sidepaths have been controversial as well. The 1999 AASHTO standards generally advised against their use. The new 2012 standards are somewhat more tolerant, but still include major reservations about these roadside facilities. Objections to the use of sidepaths in this country are based on conflicts with dominant motor vehicle traffic and include:

- **Hazardous intersections.** On two-way paths, motorists do not expect, and often do not see, bicyclists in the counterflow direction. Right-turning motorists in many cases ignore path users moving straight ahead, creating the possibility of a crash. This always places path users on the defensive.
- **Right-of-way ambiguities at driveways and intersections.** Usually, cyclists on a sidepath along a major street are forced to yield to intersecting traffic. Cyclists traveling on streets, on the other hand, have the same right of way rights as motorists.
- **Path blockages.** Cross traffic on driveways and intersecting streets frequently blocks the sidepath by stopping across it.

As a result, experienced cyclists usually prefer on-road facilities to roadside facilities. Yet, sidepaths, despite their shortcomings, are used frequently and remain popular with many users.

Variations on the cycle track theme. Top: An urban cycle path in Amsterdam. Middle: A popular cycle path in New York's East Village, with parking buffering cyclists from moving motor vehicles. Bottom: Colored crosswalk on the Trolley Trail at Taft Avenue in Mason City, IA.

Many cyclists justifiably fear rear-end (or overtaking) crashes or distracted drivers wandering into even a well-designed bicycle lane. Sidepaths accommodate pedestrians and other wheeled users who cannot use streets. Also, auto-era development, displayed by Leawood's street pattern, replaced the traditional grid of local streets with cul-de-sacs and short curvilinear streets, causing through connections to depend solely on the arterial system. Sidepaths along major streets provide continuity where other alternatives, including trails or parallel local streets, are not available.

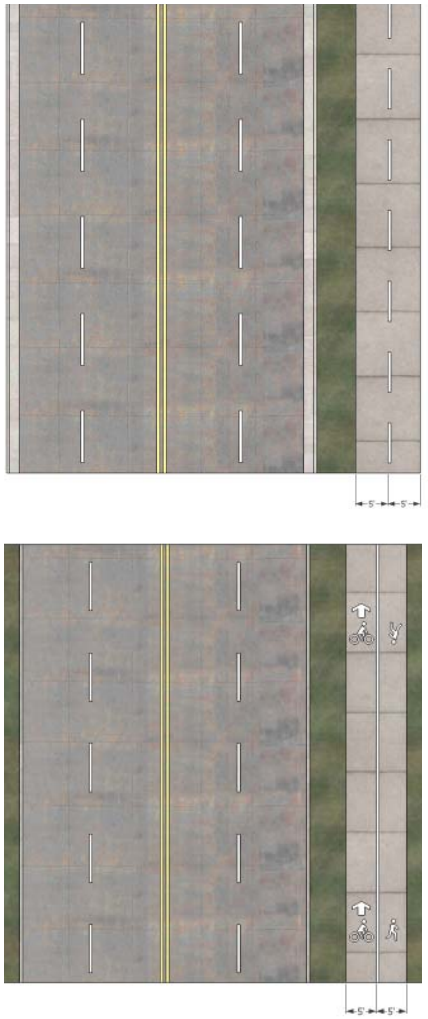
Roadside paths and cycle tracks are integral to the national bicycle system of the Netherlands, one of the world's premier cycling countries, and work because of careful design and motorist respect and acceptance of bicyclists. While research on American sidepath safety is scarce, a recent Harvard University study based on the Montreal system compared crash rates on sidepaths to on-street facilities. It suggested that sidepaths had higher crash rates at intersections and lower rates along their main line, producing about the same overall crash rates as on-street facilities. Since crashes at speed in mid-block areas have a higher probability of fatality than lower speed crashes at intersections, the study indicated that these facilities should not be excluded from urban bicycle systems in this country. They do in fact play a strategic role in the Leawood network, and have been successfully used in the past (Nall Avenue, 133rd Street, Town Center Drive, Roe Avenue between 133rd and 137th).

Figure 5.9: Recommended Sidepath Separations

Adjacent Road Speed Limit (mph)	Recommended Sidepath Separation (feet)
35	5-8
45	12-14
55	20-24

Application to the Leawood System

- Conventional multi-use sidepaths, typically wide paths parallel to arterial streets, should ideally be used in corridors with few driveway or street interruptions, and should not exclude use of on-road facilities when bike lanes and shoulders are feasible.
- Complete streets should include both on-street facilities and paths for pedestrians and bicyclists who are uncomfortable with riding even in protected, on-street bike lanes. Innovative concepts, like one-way cycle tracks on new or existing streets, can combine the safety benefits of off-road riding between intersections and vehicular cycling through intersections.
- The objective of sidepath design guidelines should be to make these facilities as safe as possible, specifically by addressing their greatest weakness: road and driveway intersections.
- Sidepaths are safest when driveway and cross-street interruptions are fewest. Therefore, they work best along arterial streets that have long stretches of relatively uninterrupted frontage, like parks, campuses, and cemeteries. Leawood has a number of such strategic opportunities, including the west side of State Line Road and Kenneth Road in places, and Nall and Roe Avenues. When used along streets, access management becomes especially important.



Sidepath sections. Sidepath width and construction standards are similar to those for multi-use trails.
Top: Two-way sidepath along an arterial, a typical accommodation on contemporary streets. Above: One-way cycle track concept separates pedestrian from bicycle traffic. Bicycles move in the direction of traffic.

Sidepaths and Cycle Tracks.
Top: Two-way sidepath along Town Center Drive and adjacent to Park Place in Leawood.

Middle: Broadway in Boulder, CO, defining pedestrian and bicycle domains along a roadside trail.

Lower: One-way cycle track and pedestrian path in Amsterdam.

Design Guidelines for Cycle Tracks/ Sidepaths

Pathway Standards

Cycle tracks and sidepaths may be developed as two- or one-way facilities. Most US applications of off-road sidepaths are two-way facilities, adhering to a standard ten-foot width, typical of other multi-use trails. A one-way cycle track combined with a sidewalk should separate territory allocated to bicyclists and pedestrians, and include directional markings for bicyclists. These territories can be defined by paint or changes in pavement color. Minimum width for a one-way cycle track is four feet (five feet recommended) with an adjacent pedestrian path of similar width. Structure and materials for sidepaths should follow standards for multi-use trails on separated right-of-way.

Pathway Setbacks

Research conducted for the Florida Department of Transportation indicates that, to maximize safety, separation of the sidepath from a roadway should increase as road speeds increase. The Florida data suggest that at lower adjacent road speeds, a smaller separation produces crash rates lower than those of the adjacent road, while that threshold is reached at greater separations for high speed facilities. AASHTO 2012 recommends a minimum separation of five feet without a physical barrier. Figure 4.9 displays a standard separation for sidepaths based on the Florida findings.

Access Management

Access management makes sidepaths safer. There is no one clear standard for frequency of access points. Reasonable guidance is provided by the Idaho Department of Transportation, recommending a maximum of eight crossings per mile, with a preferred maximum of five crossings per mile. This access management policy should apply to the primarily arterial streets proposed for these corridors.

Sidepath Concepts and Adjacent Roadway Character

As mentioned earlier, two-way sidepaths, in common use in American road design as "multi-purpose paths," set up an unexpected counterflow direction that creates the possibility of crashes. Florida DOT research indicates that two-way sidepaths appear safer along two-lane and three-lane roadways and less safe along multi-lane roads with 2 or more lanes in each direction. In addition to the higher speeds typical of wider roads, this phenomenon can be explained by:

- The field of vision of motorists opposite the sidepath. On wider roadways, motorists cannot see or are less aware of a sidepath on the opposite side, creating a particular crash hazard between path users and left-turning traffic.
- Motorists exiting intersecting driveways or streets are looking for oncoming traffic at a shallower angle because of the greater street width, directing attention away from the already unexpected sidepath traffic to their right.

The previously discussed Harvard study on the Montreal system also suggests that sidepaths are safer than on-street operation between intersections, but more hazardous at street crossings. The one-way cycle track, in combination with bicycle lanes or shoulders on the adjacent road, addresses these issues, and AASHTO 2012 tends to recommend this design (Figure 4.10) Before reaching a major intersection, the cycle track is directed to and merges into the bicycle lane which, at major intersections, is located to the left of a right-turn only (RTO) lane. Inexperienced bicyclists have the option of becoming pedestrians and using the crosswalk. Thus, the one-way sidepath concept combines the relative mid-block security of the sidepath to many users with the safer options of behaving like other vehicles or as pedestrians at street intersections.

The one-way sidepath should be considered:

- Along four-lane divided or five-lane corridors with local street accesses.
- When a sidepath is recommended but, for various reasons, access cannot be closely managed.

In-line Crossings at Driveways and Streets

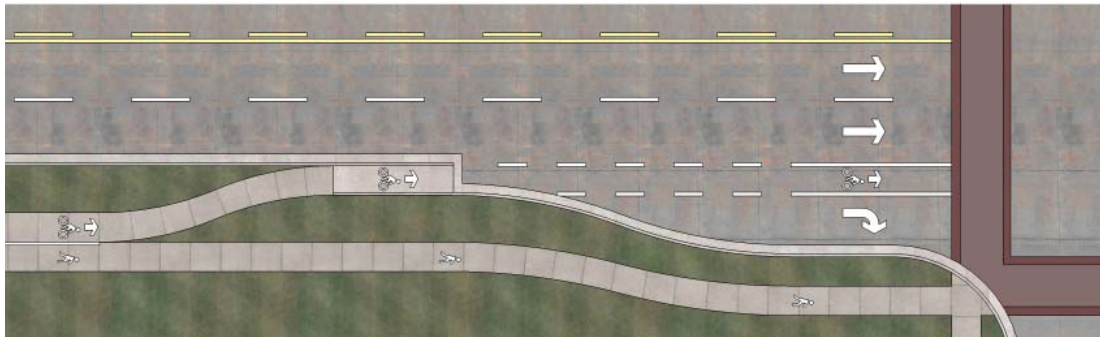
Cycle tracks/sidepaths and multi-use trails share design characteristics at intersections. Guidelines for multi-use trails are presented later in this section. However, roadside facilities have special problems not experienced by the largely grade-separated trail system. Recommendations for the special conditions presented by sidepath crossings are presented here.

Ramp Design

Curb/intersection cuts or ramps must be logical and in the direct travel line of bicyclists. We suggest avoiding the common practice of placing the ramp on a diagonal at the corner, tending to direct users into the middle of the intersection rather than to a crossing.

A design that places a curb in the direct travel line of bicyclists is hazardous. The intersection area must be free of obstructions, such as poles for traffic signal mast arms or lighting standards.

One-way sidepath merge without bike lane



One-way sidepath merge with bike lane

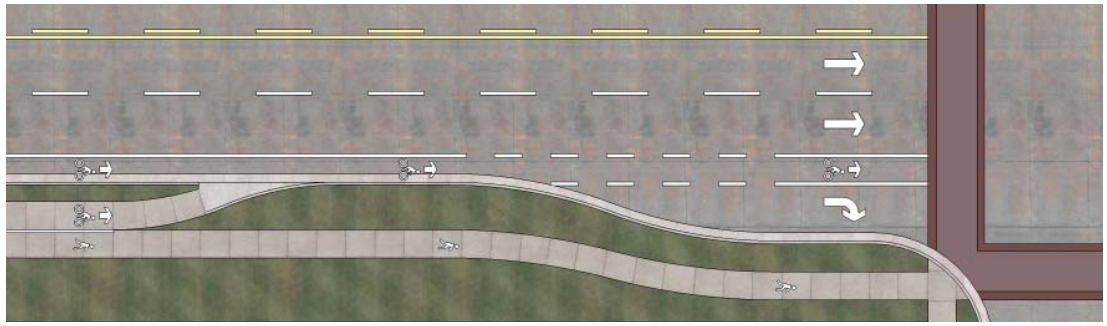


Figure 5.10: One-Way Sidepaths

A system of paired one-way sidepaths can minimize some of the operating hazards of two-way paths in certain settings. The one-way sidepath concept can be used both on streets without (top) and with bike lanes. Without bike lanes, the sidepath is the street's bicycle facility, but becomes a bike lane as it enters the intersections. If bike lanes are provided along the street, the cycle track merges into the bike lane. Left: Merger from street to one-way cycle track at Vassar Street cycle track on the MIT campus in Cambridge.

Poor Sidepath Intersection Design. Top: Ramps are narrow and located off line from a bicyclists normal path, creating a potential hazard. Above: The base of a signal mast arm obstructs the logical path through the ramp.

Excellent intersection design at an arterial. Clear crossings and a generously sized right-turn median tame this intersection for sidepath users.

Separation Distance

The separation of the trail crossing from the edge of the roadway is a troublesome issue. Some sidepath designs put users in serious jeopardy by placement that either provides poor visibility or inadequate reaction time. Based on specifications in Finland and the Netherlands, where sidepaths are prevalent, the Florida DOT's path intersection design manual proposes three discreet and mutually exclusive separation distance categories:

- 1-2 meters (0-6.56 feet)
- 5-10 meters (16.4-32.8 feet)
- more than 30 meters (over 98.4 feet)

These distances are based on the interaction of five variables: motor vehicle turning speed, stacking distance, driver and/or pathway user awareness, and chance of pathway right-of-way priority. These categories are designed to prevent awkward conditions that may impair visibility and not give either the trail user or motorist opportunity to respond. Figure 4.11 summarizes the relative performance of each placement for these variables.

Defining Crossings

- All crossings across streets and major driveways should be clearly defined. Street intersection markings should utilize standard zebra or ladder markings incorporated at mid-block crossings and other major intersections. Colored concrete or asphalt surface treatments may also be used. A simpler dashed crosswalk boundary may be used as a convention at driveway crossings.
- At intersections controlled by stop signs or signals, stop bars should be provided for motor vehicles ahead of the crosswalk to discourage motorists from obstructing the path. Surface triangles that indicate a motorist yield may be used in place of stop bars. Unfortunately, many American motorists do not understand this marking.

Signage

Use warning signs along roads with sidepaths similar to advisories for parallel railroad tracks. This provides motorists with a background awareness of the parallel sidepath.

Figure 5.11: Performance Applications of Various Sidepath Separations

Parameter	1-2m 0-6.56 feet	5-10m 16.4-32.8 feet	over 30m over 98.4 feet
Motor vehicle turning speed	Lowest	Higher	Highest
Motor vehicle stacking space	None	Yes better at higher separation	Yes
Driver awareness of path user	Higher	Lower	High or Low
Path user awareness of driver	Higher	Lower	Highest
Chance of pathway ROW priority	Higher	Lower	Lowest

Source: *Intersection Design Manual, Florida Department of Transportation*

Right-of-Way Assignment

Ideally, pathway users paralleling a street with right-of-way priority should share that priority. However, sidepath users must be advised to ride defensively, and assume that they will often be forced to yield the right-of-way.

Overly frequent stop signs will cause many path users to ignore the traffic control entirely. The Florida manual states that path users may be intolerant to delay, wish to maintain momentum, or have limited traffic knowledge. When stop signs are installed on a path at extremely low volume intersections or even driveways, path users tend to disregard them. The wheeled user, cyclist or skater is, in effect, being taught this dangerous behavior by these "crying wolf" signs since he or she thinks there is little chance of cross traffic.

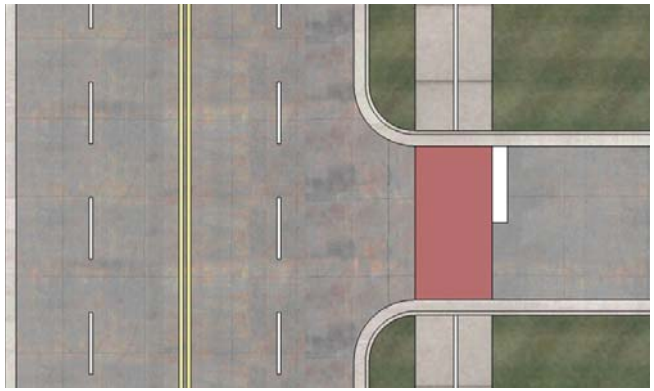
Intersection Geometrics

In addition to crossing visibility and access management techniques, the 2012 AASHTO advises the following design measures to address intersection and driveway crossing safety:

- Intersection and driveway design to reduce speed and heighten driver awareness of path users through tighter corner radii, avoidance of high-speed free flow movements, median refuge islands, and good sight lines.
- Design measures to reduce pathway user speed at intersection approaches, being certain that designs do not create hazards.
- Calming traffic speeds on the adjacent roadway.
- Designs that encourage good cyclist access between roadway and sidepaths at intersections.
- Keeping approaches to sidepaths clear of obstructions, including stopped motor vehicles, through stopbars and yield markings.

Signal Cycles

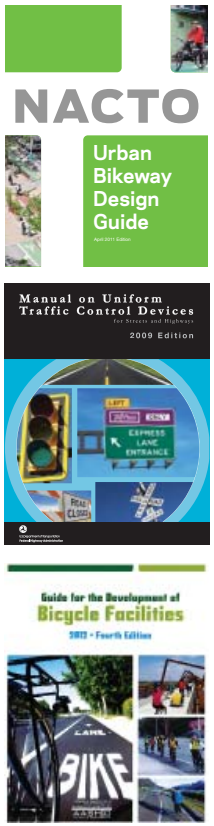
- Avoid permissive left turns on busy parallel roads and sidepath crossings. Use a protected left-turn cycle with a sidepath-oriented bicycle/pedestrian signal, giving a red signal to the sidepath user when left turns are permitted.
- Prohibit right turns on red at intersections with a major sidepath crossing.



Top: Crossing Definition. Sidepath/cycle track crossings should be defined for maximum visibility. Colored or textured surfaces can be effective in these situations. A clear stop bar should also be used with advisory signage, to discourage motorists from blocking the track.
Above: Intersection crossing of a sidepath on Martin Luther King Drive in Des Moines.

Sidepath Advisory Sign. Variation of the MUTCD's Railroad Advance Warning Sign, modified as a sidepath advisory. This sign should be used on both sides of a road with sidepaths. This installation is on Speer Boulevard in Denver, advising of the parallel Cherry Creek Trail. Florida DOT advises a similar sign.

Crossing Definition Treatments.
From left: StreetPrint, an imprint and coloring applied to heated asphalt paving on the New Berlin Trail near Waukesha, Wisconsin.; Colored concrete on Military Avenue in Green Bay.



A Reminder to Designers. Sources that establish detailed standards for the design of bicycle facilities include the recent Urban Bikeway Design Guide (National Association of City Transportation Officials, 2011), the Manual of Uniform Traffic Control Devices (Federal Highway Administration, 2009), and the Fourth Edition of the AASHTO Guide for the Planning, Design, and Operation of Bicycle Facilities (American Association of State Highway and Transportation Officials, 2012. Designers of facilities should use these primary sources. The guidelines and standards included in this plan are intended to provide guidance that augments these authoritative standards to specific situations within a Leawood bikeways network.

On-Street Cycle Tracks

The discussion above has focused on off-road sidepaths – paths separated from the road and usually above a curb. However, on-road cycle tracks, imported from Dutch and Danish practice, are gaining great popularity in America and can provide excellent environments for urban cycling. Features of these cycle tracks include:

- Buffering from travel lanes, usually by parking and physical space defined by paint, bollards, or median. These cycle tracks invert the typical position of parking and bike lanes, and keep the motor vehicle domain contiguous.
- One- or two-way operation. Most facilities provide one-way operation for clarity, greater pedestrian safety, and reduction of conflicts. Two-way operation is accelerating, but requires great care in design. Special signal cycles that control conflicting turns are highly advisable at major intersections. A special cycle for bicycles prevents turning cars from cutting off cyclists proceeding ahead on a green light.
- Two-way cycle tracks also work well at bridge crossings or in locations with very few traffic interruptions. An example is the controversial but very effective cycle track along Prospect Park in Brooklyn.
- Very good visibility at intersections. Parking is stopped at sufficient distance from the intersection to provide good visibility.
- Vertical separation in the buffer area. In winter climates, this can be provided by flexible bollards that are removable for winter plowing and maintenance.

Advantages of the on-street cycle track over bike lanes are elimination of conflicts between parked vehicles and cyclists, including door hazards and backing movements out of diagonal spaces. As such, on-street cycle tracks may substitute for a bike lane on a road dieted one-way street. Figure 4.12 illustrates dimensional standards for such a facility.

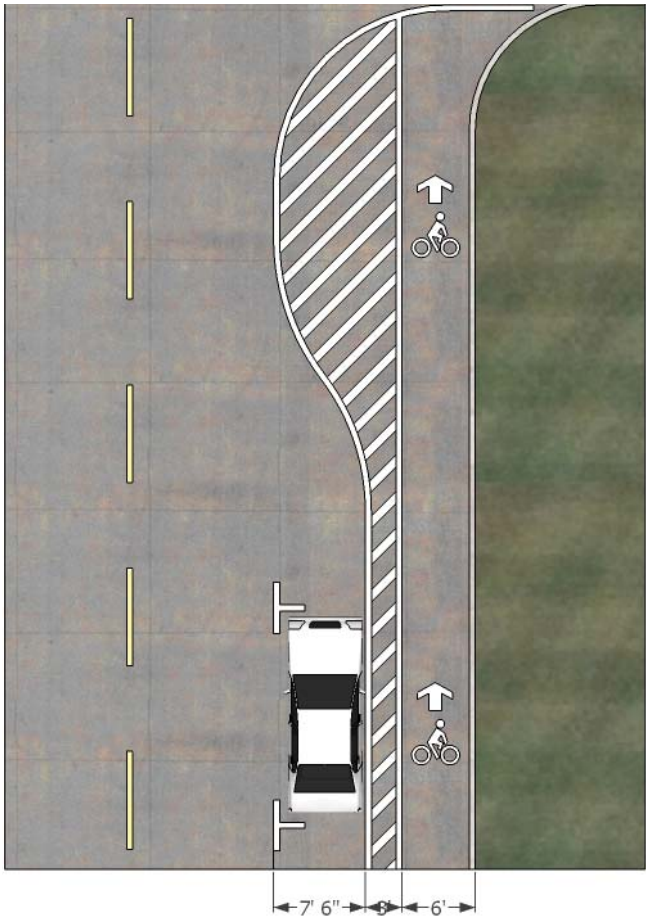


Figure 5.12: On-Street Cycle Track

This facility type inverts the usual location of parking and bicyclists, reducing conflicts between bicycle movements and adjacent parked cars.

On-Street Cycle Tracks. Clockwise from top left: Two-way cycle track along Prospect Park in Brooklyn; flexible bollards used in buffers in Chicago; crossing treatment on Dearborn Street in Chicago, also applicable to sidepaths; 9th Avenue in Manhattan, the nation's first true cycle track project; 2nd Avenue in Manhattan.

MULTI-USE TRAILS

Multi-use trails are important and popular resources for Leawood's residents and visitors, and should be fundamental parts of a bicycle and pedestrian transportation network. Two major regional trails, the Tomahawk and Indian Creek Trails, cross the city and will be fully integrated into the bicycle transportation network. New trail-related projects include improvements that improve connections to the existing trails, fill strategic gaps, and extend internal park trails into the broader community.

The Leawood bikeways system, and its pedestrian network, will make extensive use of multi-use trails on separated rights-of-way. The heavily used Indian and Tomahawk Creek Trails are already in place and are the core of the Leawood network. These trails are key recreational resources and, with strategic extensions, can expand their local and regional transportation functions. Anticipated trail projects fit within three categories:

- **Improvements to existing trails.** The heavily-used trail system does have some congested areas that could warrant separation of bicycle and pedestrian paths in some areas. In addition, wayfinding is needed to tell users where various trail branches are leading.
- **Short extensions that fill gaps and connect regional trails to the street system.** These extensions include paths, bridges, and improved intersection crossings.
- **Park trail extensions.** The most significant of these would extend the Ironwoods Park Trail into part of a citywide transportation system.

Design Guidelines for Multi-Use Trails

Standards for multi-use trail construction are established through past experience in the city, and contemporary practices are reflected in recent trail design. Many of these guidelines are included in this part of the bikeways plan, along with others that reflect contemporary practice.

ADA/AASHTO Compliance

Trails should comply with American Association of Street and Highway Transportation Officials (AASHTO) standards and Uniform Federal Accessibility Standards and the Americans with Disabilities Act Accessibility Guidelines.

Materials

Figure 4.13 reviews attributes of various trail surface materials. Many of the city's urban trails are asphalt-surfaced. Asphalt provides an excellent surface when new and is somewhat less expensive than concrete. Concrete is often thought to provide a more durable, longer-lived surfaces. Without prescribing specific regional standards, AASHTO 2012 recommends a six-inch minimum depth, including both surface and base courses, over

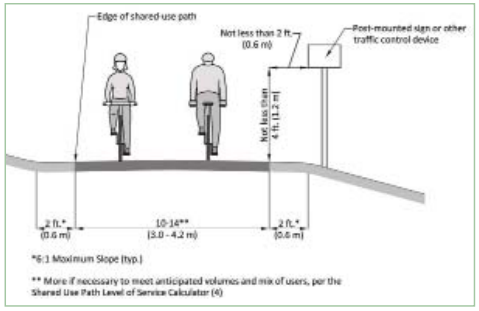
a compacted sub-base. A stable sub-base is especially important to the durability of both materials. This is especially important around drainageways, where stream banks tend to slough off and produce serious cracking and deterioration. Expansion joints on concrete trails should be used to provide room for movement and saw-cut contraction joints should be used to control cracking.

Trail Width and Clearances

- The accepted minimum width for two-way trails is 10 feet. Trails that experience congestion and conflicts between wheeled and non-wheeled users may warrant greater width, typically 12 to 14 feet. In some areas, right-of-way restrictions may require a much narrower track for trails and sidepaths. Eight feet is a desirable minimum for areas with these limits. Restricted areas do not safely accommodate passing of or by users such as in-line skaters, bicyclists with child trailers, recumbent bicycles and tricycles. An example of such a restricted situation is College Boulevard east of Mission Road. Here , signage should advise bicyclists of restricted width.
- A two-foot minimum shoulder (3-5 feet is more desirable) with a maximum 6:1 cross-slope should be provided as a recovery zone adjacent to trails.
- Signs or other traffic control or information devices should be at least two feet from the edge of the trail surface. The

Figure 5.13: Attributes of Trail Surfaces

Surface	Advantages	Disadvantages
Soil Cement	Natural materials, more durable than soil, low cost, relatively smooth surface	Uneven wear, erodible, difficulty in achieving correct mix
Granular Stone	Natural material, firm and smooth surface, moderate cost, multiple use	Erodible in storms, needs regular maintenance to maintain surface, discourages on-line skaters and some wheeled users
Asphalt	Hard surface, smooth with low resistance, stable, low maintenance when properly installed, multiple use	Relatively high installation cost, requires periodic resurfacing, freeze/thaw vulnerability, petroleum based material, construction access and impact
Concrete	Hardest surface, easy to form, lowest maintenance, best cold weather surface, freeze-thaw resistance	Highest installation and repair cost, construction access and impact
Native Soil	Natural material, very low cost, low maintenance, easy for volunteers to build and maintain	Dusty, ruts, limited use, unsightly if not maintained, not accessible
Wood Chips	Natural material, good walking surface, moderate cost	Decomposes when wet, requires regular maintenance and replenishment, not accessible



Source: AASHTO 2012

Different width conditions. From left to right: Typical 10 foot width along the Indian Creek Trail; restricted right of way along College Boulevard; and a 14-foot pathway along Atlanta's Belt Line.

bottom edge of any sign should be at least four feet from the grade of the trail surface.

- A soft surfaced two-foot extension to a paved trail can improve conditions for walkers and runners because of its resilience and lower impact.
- Minimum vertical clearance for trails is eight feet; 10 feet is recommended unless clearance is limited. When conditions, like the height of a culvert or bottom of a bridge structure, further limits clearance, cyclists must be advised to walk bicycles.

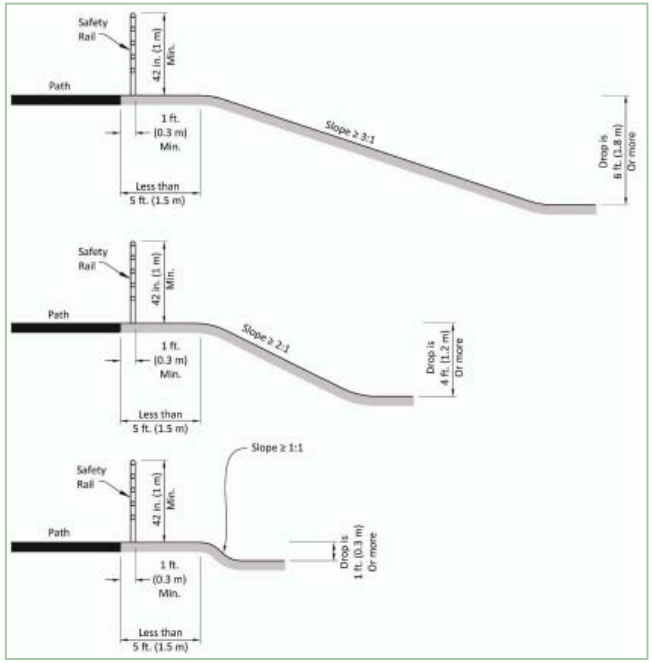
Grades and Grade Changes

- Recommended maximum grades for multi-use trails are 5 percent for any distance, 8.3 percent for distances up to 200 feet, and 10% for distances up to 30 feet (bicycles only).
- Grades over 5 percent must include landings and handrails compliant with the Americans with Disabilities Act.
- Ramps, bridges, and landings adjacent to abrupt grade changes must include 42-inch handrails, designed to meet AASHTO recommendations. Ramp surfaces should be slip-resistant.
- When underpasses require slopes over 5 percent, consider an alternate accessible route with reduced grades if possible, even if this route requires a grade crossing.
- Warning signs for trail users should be used on grades approaching 5 percent and greater.
- AASHTO recommends avoiding grades less than 0.5 percent because of ponding problems.

Subsurface and Drainage

- Typically use a four to eight inch compacted, smooth, and level subsurface. Individual conditions may require special design.
- Trail cross-section should provide adequate cross-drainage and minimize debris deposited by runoff. Typically, this involves a cross slope between 1 and 2 percent.

Figure 5.14: Railings and Trail Separations from Slopes



Source: AASHTO 2012

- When trails are adjacent to or cut into a bank, design should catch drainage on the uphill side of the trail to prevent slope erosion and deposits of mud or dirt across the trail.

Intersection Design

- Design speed of 20 mph, with horizontal and vertical geometrics and stopping sight distances consistent with AASHTO 2010 standards, as published.
- In most cases, trail traffic will be subordinate to motor vehicles on intersecting roads. Figure 4.15 illustrates crossing treatments at mid-block intersections.
- Align or widen trail at railroad intersections to permit perpendicular crossing of tracks.

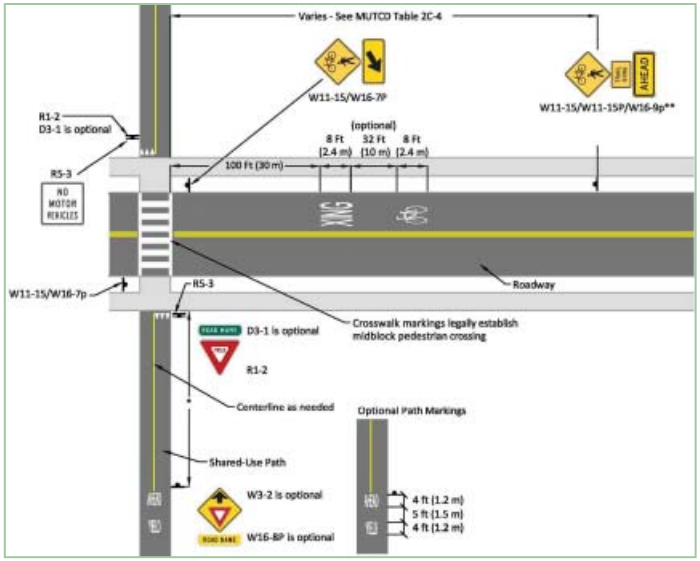
Crosswalk Delineation

- The crossing surface should clearly delineate the trail right-of-way.
- Trail crossings should be delineated with standard pavement markings, such as the "ladder" or "zebra" patterns. Another option is providing a contrasting surface that clearly defines the trail domain. These may include the use of stamped concrete, colored concrete, or pavement marking or patterning products such as StreetPrint or others.
- At midblock crossings of multi-lane roads, refuge medians should be used to reduce the distance that trail users must negotiate at one time.

Curb Cuts and Trail Access Points

- Avoid the use of bollards or obstacles at grade-level intersections unless operations prove they are needed. If necessary, use entrances with a median separating directional movements in place of bollards. Medians should be placed about 25 feet in from the edge of the roadway to permit space for cyclists to clear the intersection before slowing.
- When bollards or gateway barriers are used, provide a minimum opening of five feet, adequate to permit adequate clearance for all bicycles. Avoid poorly marked cross barriers that can create hazards for entering bicyclists, particularly in conditions of darkness.
- The bottom of the curb cut should match the gutter grade and have a minimal lip or bump at the seam. Truncated domes should be used to alert visually impaired users to the street crossing.
- The bottom width of the curb cut should be full width of the intersecting trail.

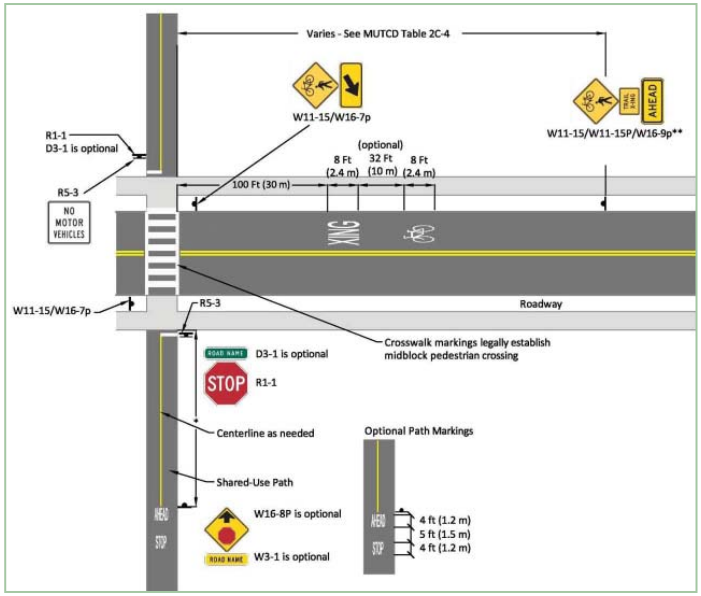
Figure 5.15: Intersection Designs and Signage for Trail/Road Intersections



Source: AASHTO 2012

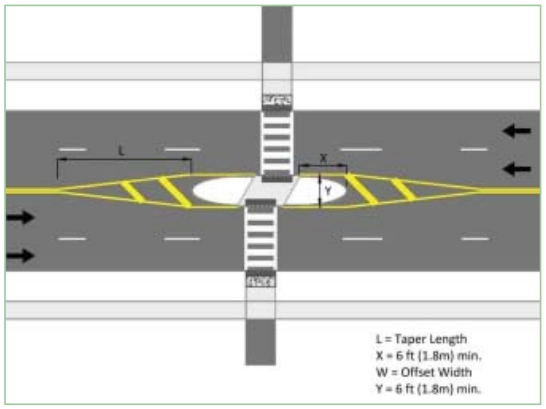
* Advance warning signs and solid centerline striping should be placed at the required stopping sight distance from the roadway edge but not less than 50 feet (15m).

**W11 series sign is required, supplemental plaques are optional



* Advance warning signs and solid centerline striping should be placed at the required stopping sight distance from the roadway edge but not less than 50 feet (15m).

**W11 series sign is required, supplemental plaques are optional



Midblock Refuge Medians. A crossing median provides refuge to trail users at mid-block crossings, reducing the distance that pedestrians and cyclists are exposed to traffic.

Contemporary trail crossing. This crossing of a major arterial includes a refuge median, defined crosswalk, effective warning signage, and the consultant's bike.

Signage

- Provide regulatory and warning signs consistent with the 2009 Edition of the Manual of Uniform Traffic Control Devices (MUTCD).
- Standard trail crossings signs, typically a bicycle in a diamond, should always be used to alert motorists of the trail crossing. See Figure 4.15 for suggested sign placement.

Traffic Control

- Right-of-way should be clearly established. Ordinarily, the trail will be stopped with right-of-way preference given defensively to the motorist.
- Controls for pedestrian signals should be easily accessible to trail users and should not require cyclists to dismount or move out of their normal path.
- New crossing technologies such as the hybrid beacon apply well to trail crossings.

Design for Maintenance

- Provide adequate turning radii and trailhead access to maintenance and emergency vehicles.

Information and Support Facilities

- Establish a consistent informational sign system that includes a Leawood Bikeways logo, an identifying trail name, trail maps at regular intervals, mileage markers for reference and locating emergency situations, directional signage to destinations, and safety rules and advisories.
- Provide periodic minor rest stops, including benches, shaded areas, picnic areas, and informational signing. Ensure reasonable access to water, restrooms, and shelter.

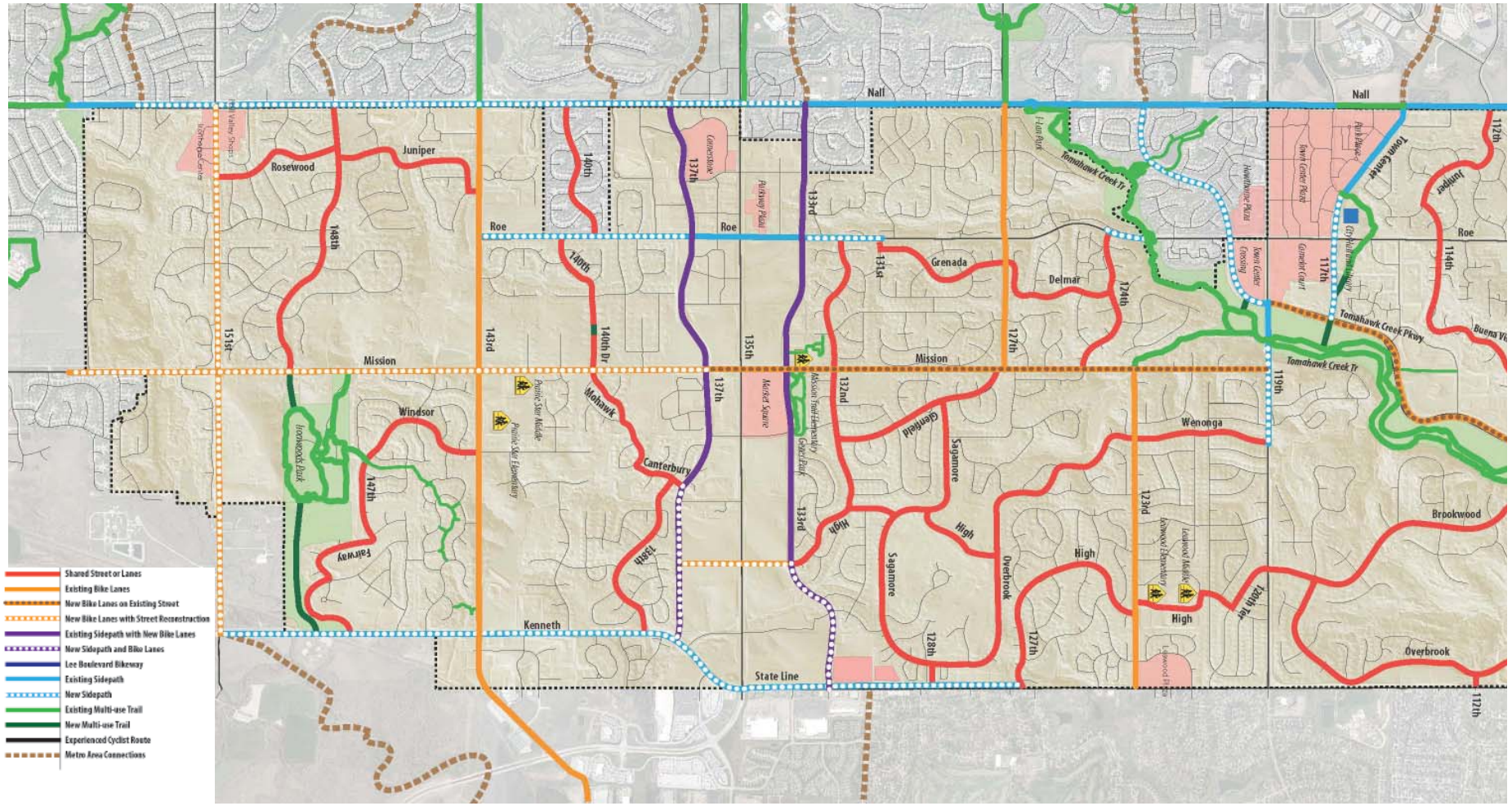
Hybrid Beacon. The hybrid beacon (or HAWK signal) functions somewhat like school bus warning signals. It is dark when not in use. When actuated by a pedestrian, a flashing and then solid yellow light warns motorists to slow; a solid red light paired with a walk signal stops traffic and gives the right-of-way to the pedestrian. Users report a high degree of motorist compliance and a positive effect on pedestrian safety.

HAWK signal with crossing refuge median on Buford Highway, Chamblee, GA.

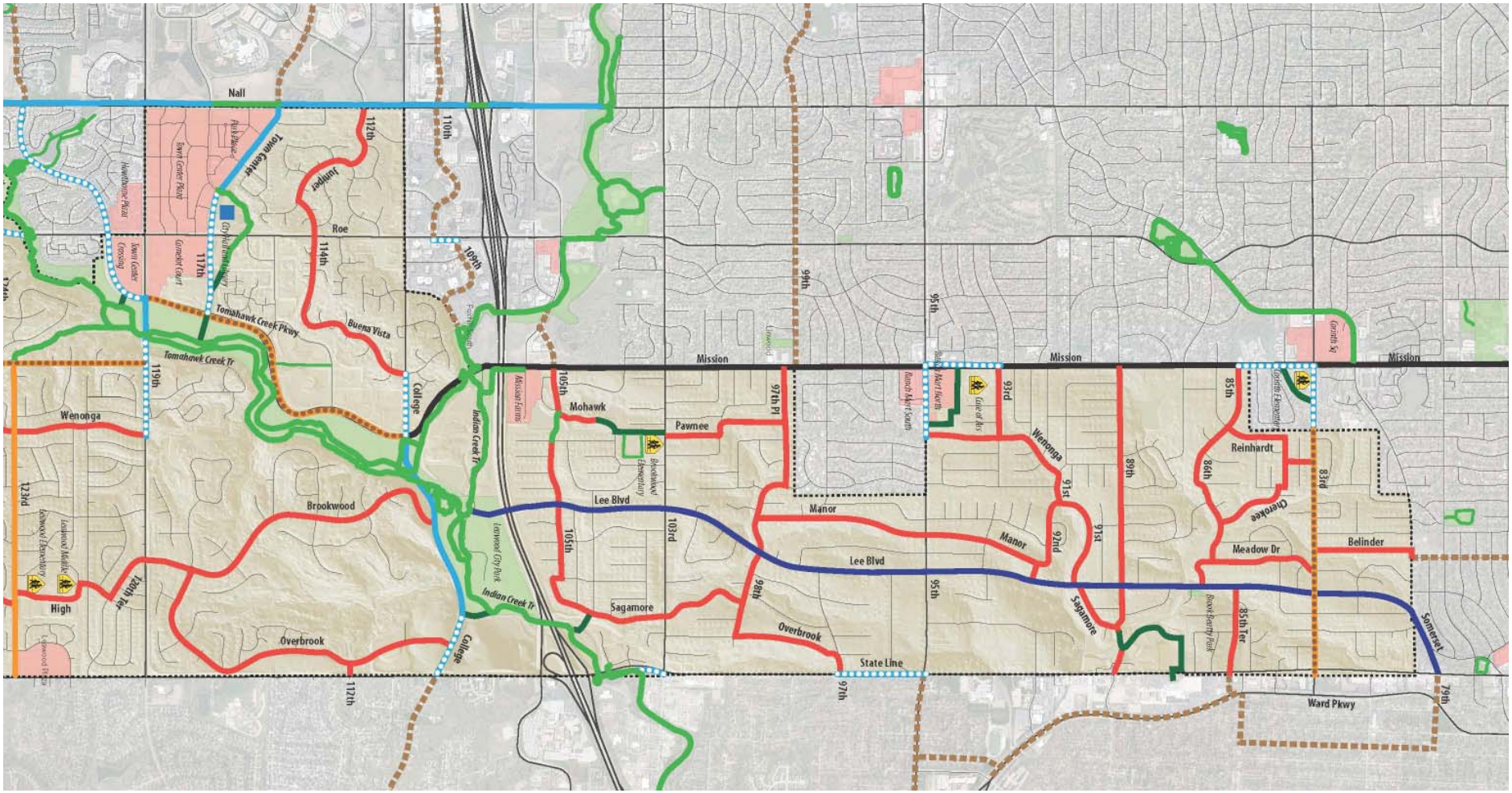
Infrastructure Design Applied to the Network

Figure 4.16 applies the trail design types to the entire Leawood system, showing the extent of different types of facilities, with the system map reproduced above for reference. The tables and maps in the next chapter detail each individual route and its specific features.

Figure 5.16: Infrastructure Design Applied to the Network



north →


Nall
Town Center
Juniper
Roe
112th
110th
109th
114th
117th
Tomahawk Creek Pkwy
Buena Vista
Tomahawk Creek Tr
119th
Wenonga
College
Indian Creek Tr
Mohawk
105th
Pawnee
97th Pl
Mission
99th
95th
93rd
91st
89th
85th
Reinhardt
86th
83rd
Cherokee
Meadow Dr
Belinder
Somerset
79th
Ward Pkwy
Lee Blvd
Manor
92nd
103rd
98th
Overbrook
Sagamore
State Line
97th
123rd
Brookwood
120th Ter
High
112th
Indian Creek Tr
College
Overbrook
Sagamore
95th
85th Ter

north →

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CHAPTER 6

ROUTE DETAILS AND SEQUENCING

ROUTE DETAILS AND SEQUENCING

THIS CHAPTER CONSIDERS EACH OF THE POTENTIAL ROUTES IN THE PROPOSED LEAWOOD BIKEWAYS SYSTEM IN DETAIL AND ALSO PRESENTS A DEVELOPMENT PLAN FOR THE TRAIL SYSTEM. It provides guidance on the specific design of each significant segment of each route. Finally, it presents methods for staging the system over time.

This presentation divides routes into north and south halves of the city for convenience, generally using the Indian Creek corridor as a dividing line. Each route includes a strip map that illustrates each street or pathway segment, key destinations along the way, and intersecting bikeway routes. The strip maps are keyed to the functional categories of each segment, as discussed in Chapter Three. The maps are divided into keyed segments, corresponding to key dividing points, milestones, or changes in infrastructure treatment. The number key for each segment corresponds to a row in the accompanying table.

The tables display:

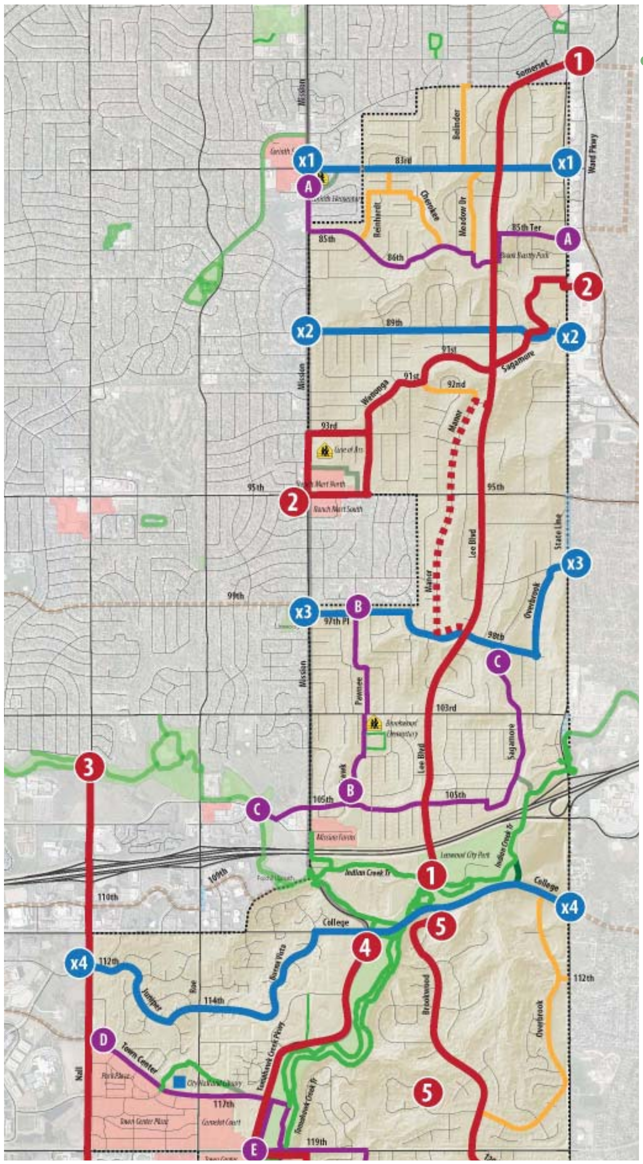
- **The endpoints and length of each segment.**
- **The nature of the existing facility.** Information also includes number of lanes and width of the street channel, using city records and plat maps, aerial photography, and field measurements.
- **The average daily traffic (ADT) on that specific segment for 2013 if available.**
- **Short-term options for bikeway development.** This presents relatively low-cost ideas for adapting a segment for safer and more comfortable bicycle use, in many cases using techniques such as sharrows that raise motorists' awareness of and a greater level of security for cyclists. Short-term options also include other pavement markings such as bike lanes and striped parking lanes, and in some cases minor capital projects that fill short but important gaps or take advantage of opportunities such as planned street reconstruction projects. In many cases, the short-term option is the final state of the facility; in others, it is a useful interim measure that provides real benefits to riders.
- **Ultimate design.** This describes the best final design configuration for the segment. The ultimate design sometimes includes significant lane reconfigurations, alterations in parking patterns, or substantial capital improvements such as widening a street to include paved shoulders. However, in many cases, the ultimate design is simply a refinement or expansion of a short-term option, made more feasible as urban bicycling in Leawood becomes more established and the demand for upgraded facilities increases.

These recommendations should be refined further as individual projects are implemented. However, they provide a starting point for the more detailed design process, and provide guidance in determining priorities and costs of various improvements.

The chapter continues with a capital implementation program that includes:

- Criteria for determining priorities.
- Evaluation of segments and routes of the proposed bikeways system based on their relative ease of development.
- An implementation sequence of the system, assuming full development in 15 years, with three phases.
- A pilot bikeway program, that serves all parts of the city with strategic routes and path segments. This program includes statements of probable cost, based on current (2014) construction costs.

ROUTES DETAILS: NORTH

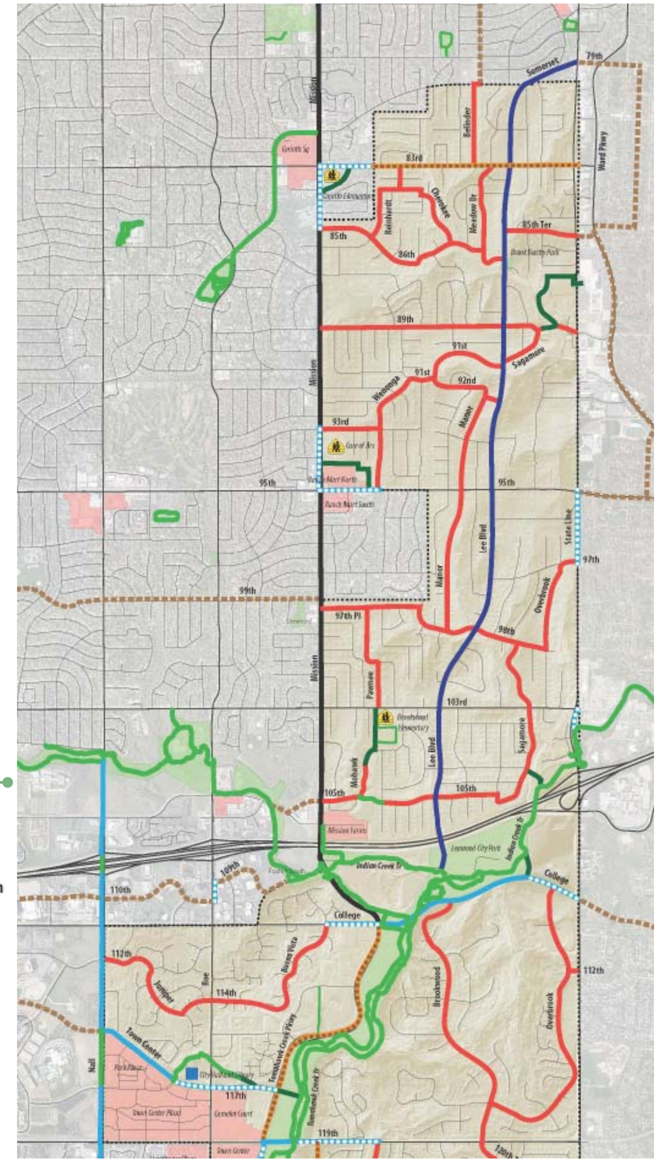


Route Designations

- Principal Routes
- Crosstown Routes
- Bicycle Boulevards
- Neighborhood Connections
- Multi-Use Trails
- Connecting Bike Routes

Infrastructure Types

- Shared Street or Lanes
- Existing Bike Lanes
- New Bike Lanes on Existing Street
- New Bike Lanes with Street Reconstruction
- Existing Sidepath with New Bike Lanes
- New Sidepath and Bike Lanes
- Lee Boulevard Bikeway
- Existing Sidepath
- New Sidepath
- Existing Multi-use Trail
- New Multi-use Trail
- Experienced Cyclist Route
- Metro Area Connections

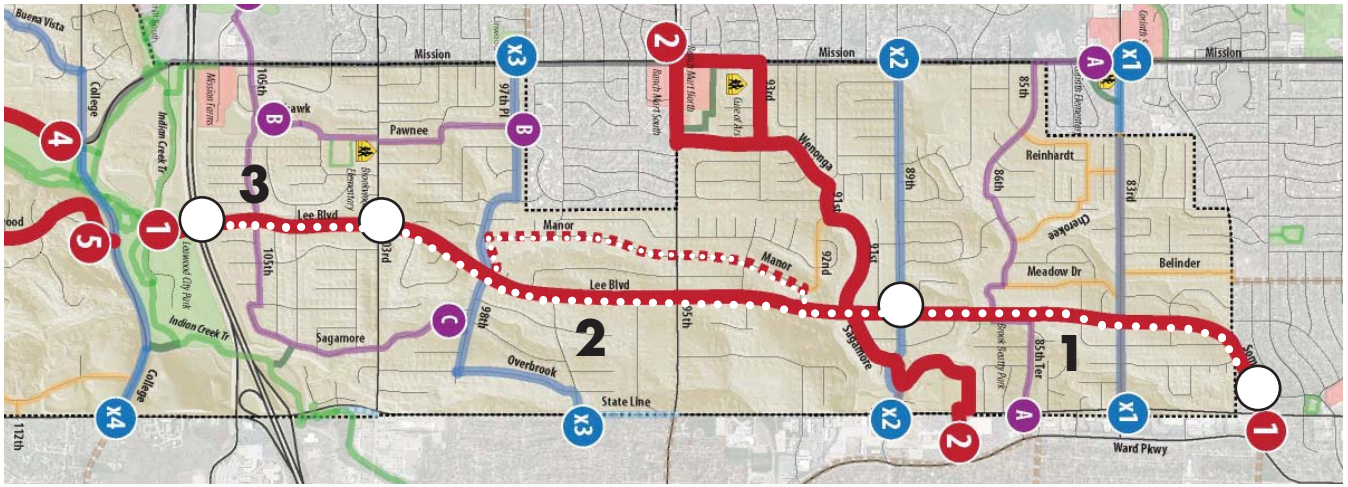


PRINCIPAL LINES

1

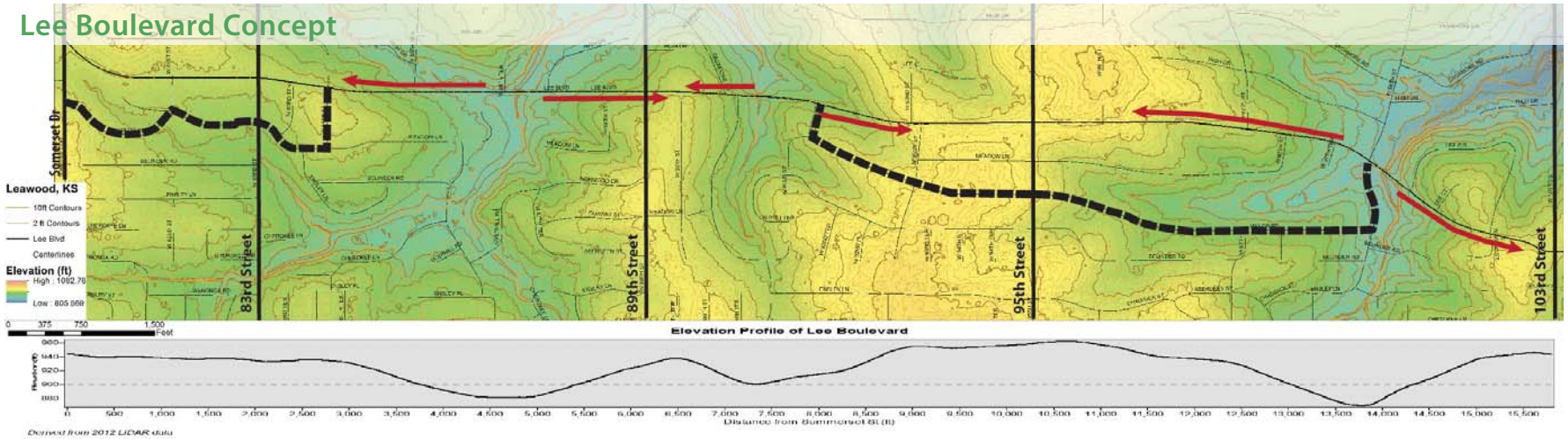
LEE BOULEVARD BIKEWAY

North



SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	Somerset to 89th Street	1.2	2-lane minor arterial, 28-30 feet	Existing sidewalks need improvement Address ADA issues No sidewalks on east side of Lee Boulevard	7,340	Centering 10.5-foot travel lanes in street channel, providing 3.5 to 4.5-foot shoulders for bicycle travel. On uphill stretches, widen shoulder in uphill direction to 5-foot minimum width. Provide quiet street option from 84th to Somerset using Meadow and Manor. Alternative is restriping to provide 10.5-foot travel lanes, with minor realignment on climbs to provide minimum 4-foot climbing shoulder in uphill direction.	Complete street reconstruction with two travel lanes and buffered bike lanes.
2	89th to 103rd Street	1.8	2-lane minor arterial, 28-30 feet	Existing sidewalks need improvement Address ADA issues No sidewalks on east side of Lee Boulevard and alternate route	5,565 at 103rd	Continuation of Somerset to 89th concept with minor widening where necessary to meet minimum standards. Provide quiet street option between 92nd and 98th Streets via Manor Road.	Complete street reconstruction with two travel lanes and buffered bike lanes.
3	103rd Street to Indian Creek Trail/City Park	.70	2-lane collector, 25-30 feet; 36 feet on I-435 bridge	Existing sidewalks need improvement Address ADA issues No sidewalks on east side of Lee Boulevard	NA	Sharrows on residential segment between I-435 and 103rd Street. Bike lanes on bridge. Bike lanes on 30-foot section south of I-435, with 10.5-foot travel lanes	Same as Short Term

Lee Boulevard Concept

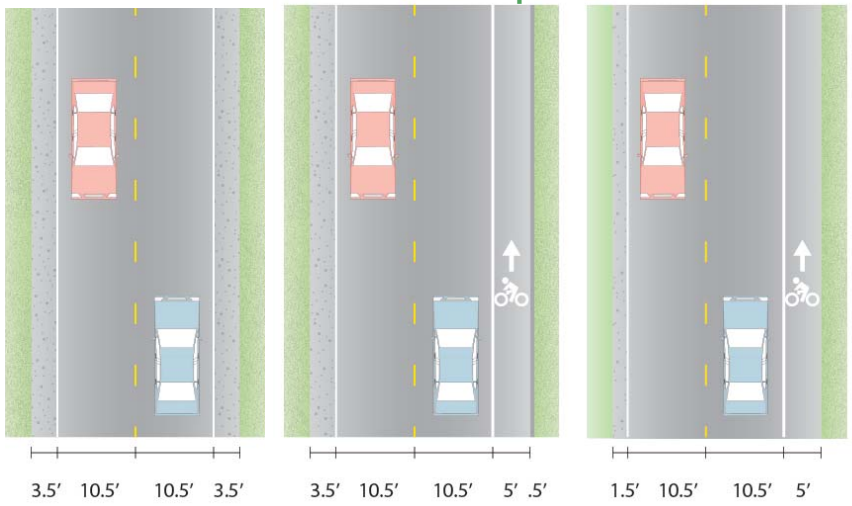


Climbing bike lane (directional)

Quiet Street Alternative

Profile of Lee Boulevard showing locations of climbing bike lanes and quiet street alternatives.

Lee Boulevard Short-Term Concept



Left: Standard modified section in existing 28-foot street channel.
Center: Street section on climbing segments with minor widening.
Right: Alternative street section on climbing segments with lane adjustment and no widening.

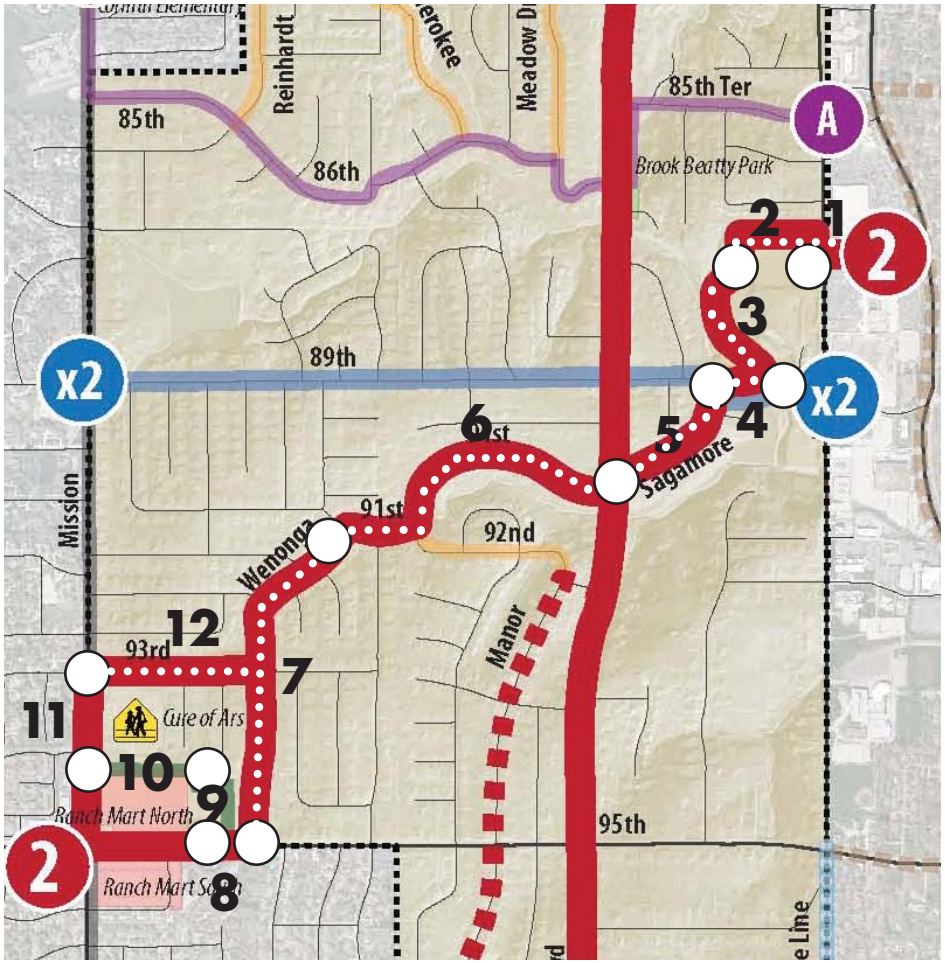
Lee Boulevard Bikeway Ultimate Concept

PRINCIPAL LINES

2

WARD PARKWAY TO RANCH MART

North



This important community route connects two major retail nodes, using a now unused pedestrian bridge and taking advantage of a scenic creek corridor and parking lot edges.

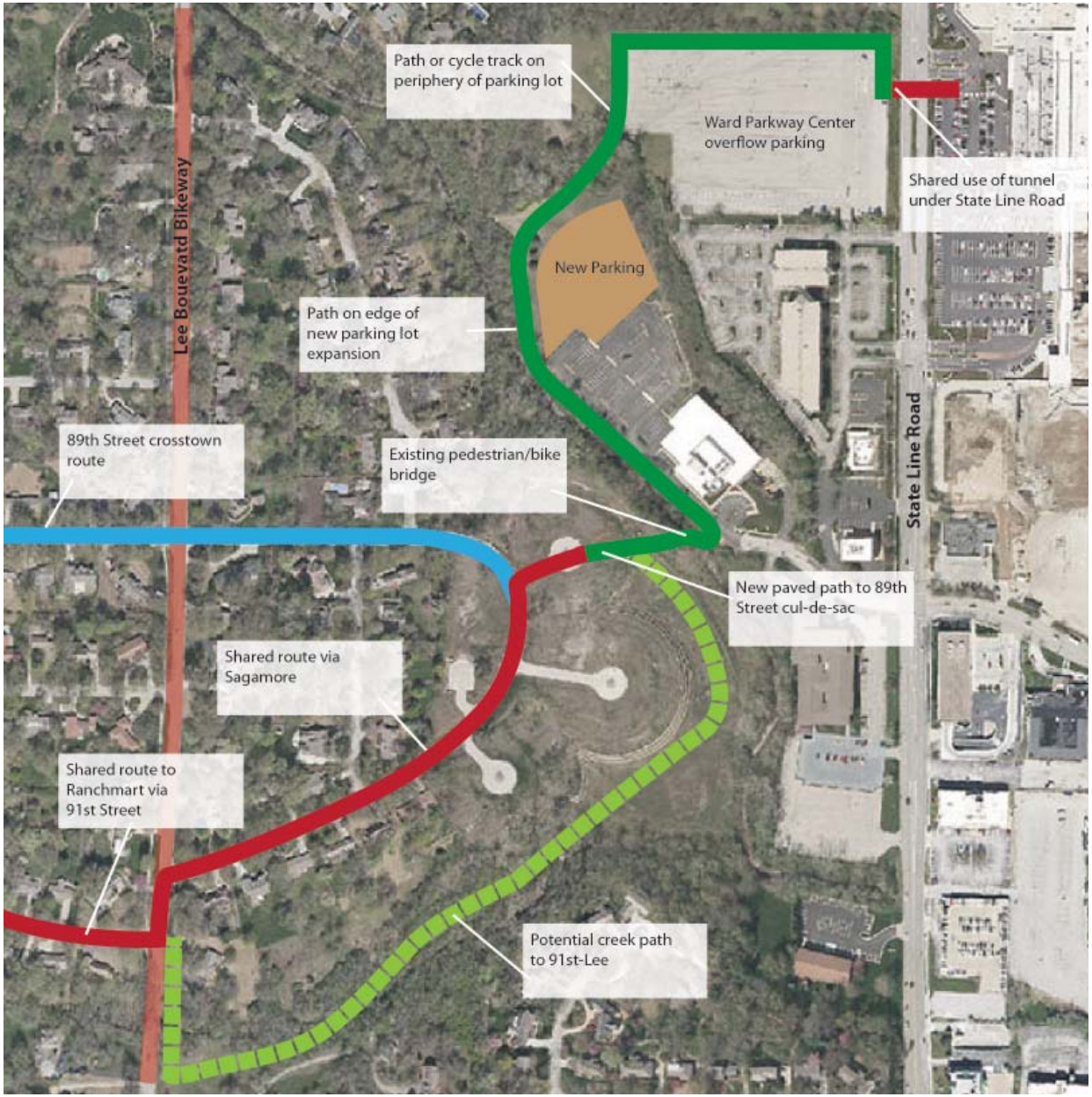
SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	Ward Parkway Tunnel	60 feet	Tunnel under State Line Road to overflow shopping center parking	No sidewalks	NA	Sharrows on roadway with consent of mall	Same as Short Term
2	Ward Parkway Center overflow lot	0.20	Parking lot	No sidewalks	NA	Cycle track using surplus pavement around periphery of lot. Alternative is to develop new path on open space around the lot.	Same as Short Term
3	Indian Creek Tributary/2020 Building parking lot	0.16	Creek and adjacent parking lot. Parking lot was expanded to the north in 2013	No sidewalks	NA	Multi-use path between parking lot edge and creek	Same as Short Term
4	Trail bridge and path to 89th Street	0.15	Existing pedestrian bridge and "goat path" to subdivision	No sidewalks	NA	Utilize existing bridge; new multi-use path with ADA compliant grades to 89th Street cul-de-sac	Same as Short Term
5	89th Street cul-de-sac and Sagamore Road, 89th to Lee Boulevard	0.26	2-lane local residential street, 25 feet	No sidewalks	NA	Sharrows; Lee Boulevard Bikeway treatment (Route 1) between Sagamore and 91st with marked pedestrian/bike crossing	Opportunity for creekside multi-use trail between the bridge and Lee Boulevard at about 92nd Street.
6	91st, Lee Boulevard to Wenonga Road	0.52	2-lane local residential street, 24 feet	No sidewalks	NA	Sharrows	Same as Short Term
7	Wenonga Road 91st to 95th	0.60	2-lane local residential street, 24 feet	No sidewalks	NA	Sharrows	Same as Short Term
8	95th, Wenonga to edge of Ranch Mart parking lot	0.04	4-lane urban arterial, tapering into median, 66 feet	Existing sidewalks need improvement Address ADA issues	13,000	Widen sidewalk to sidepath standards	Same as Short Term
9	Ranch Mart parking lot	0.16	Shopping center parking lot	No sidewalks	NA	Terminate path at parking lot, sharrows in drive aisles to define bike route. Improved pedestrian crossing of 95th Street using median as refuge.	New multi-use path in open space around the east and north edges of the parking lot.
10	Ranch Mart parking lot	0.17	Shopping center parking lot to Mission Road	No sidewalks	NA	Sharrows in drive aisle of rear bay of parking lot	Conversion of extra width of parking lot to a cycle track, or multi-use path between edge of parking lot and Cure of Ars. Defined crossing from path to shopping center walkway system.

PRINCIPAL LINES

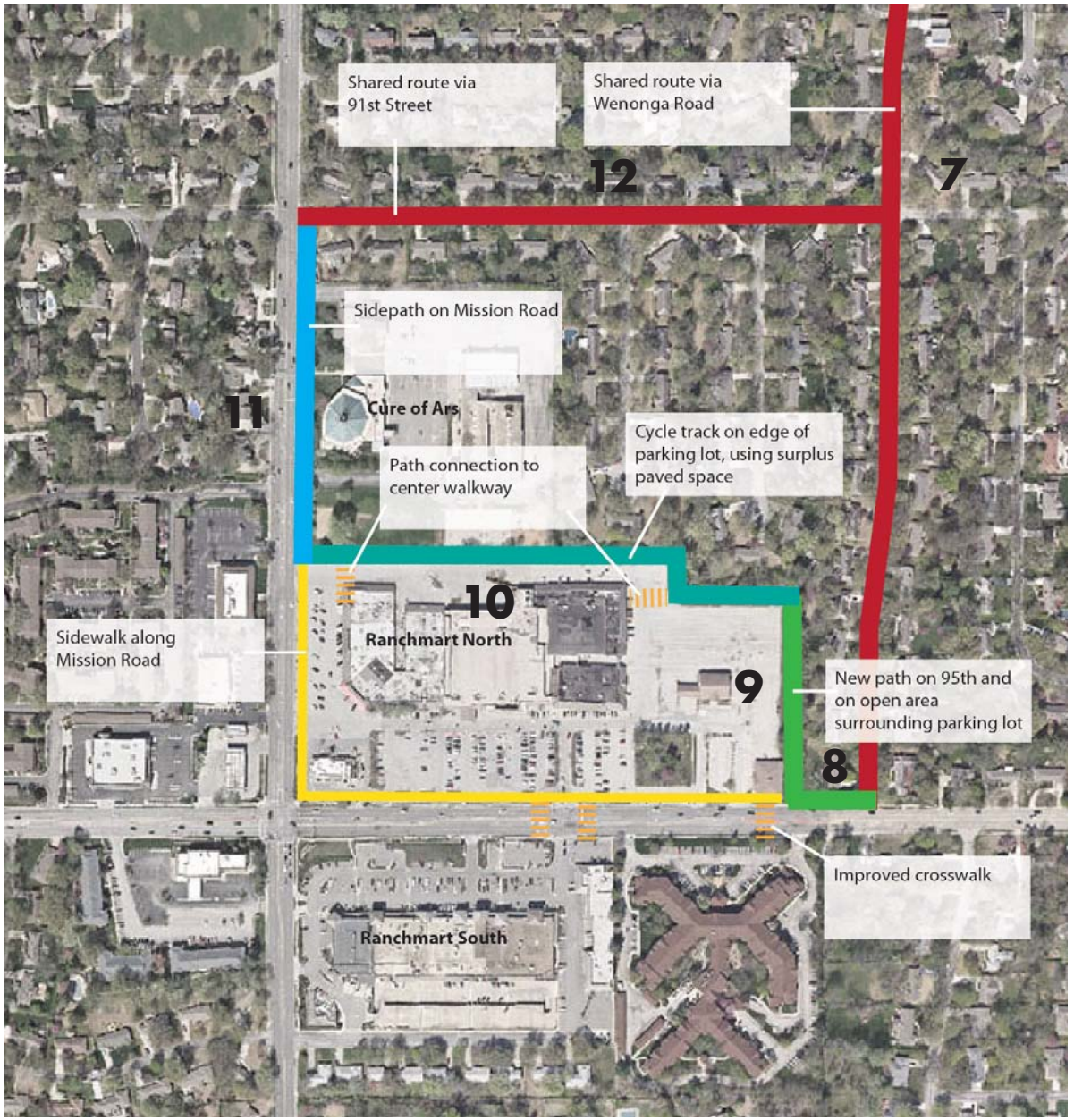
2

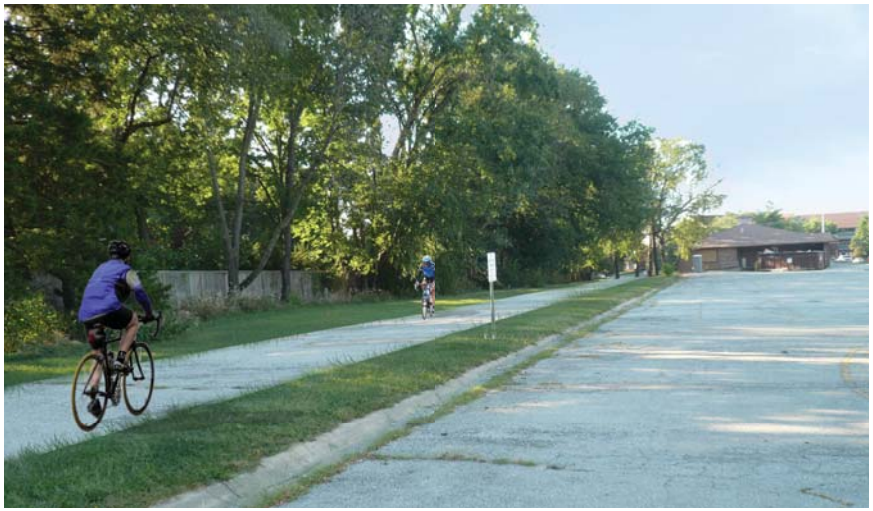
WARD PARKWAY TO RANCH MART

North



Using the edges of parking lots. The periphery of the underused Ward Parkway Center lot on the west side of State Line Road provides an inexpensive way to complete a critical link between the regional center, the northeastern part of Leawood, and the Ranch Mart/Cure of Ars district around 93rd and Mission. Ultimately, if this site is redeveloped, a more permanent trail would be incorporated into the project.


Shared route via 91st Street
Shared route via Wenonga Road
12
7
Sidepath on Mission Road
11
Cure of Ars
Path connection to center walkway
Cycle track on edge of parking lot, using surplus paved space
10
Ranchmart North
Sidewalk along Mission Road
9
New path on 95th and on open area surrounding parking lot
8
Improved crosswalk
Ranchmart South
North



Additional examples of using parking lot edges. Developing a cycle track for access to shopping and Cure of Ars, using the back side of the Ranch Mart North parking lot.

Creating linkages with parking lot buffers. A trail connection in landscaped area on the east side of the same Ranch Mart parking lot.

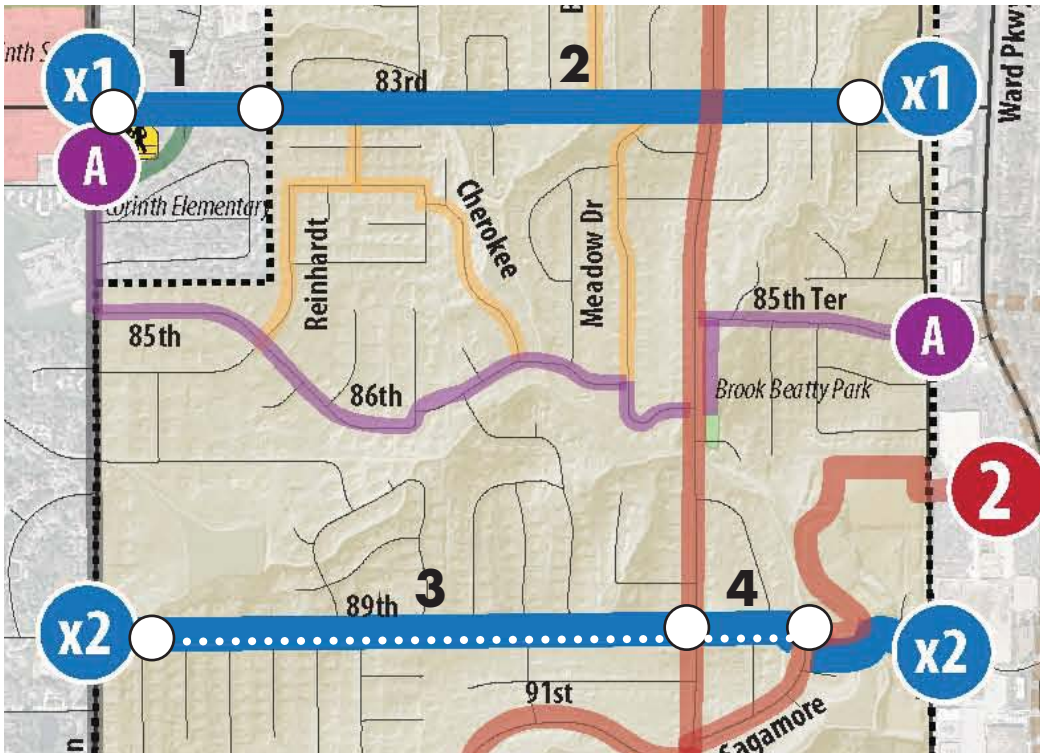
SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
11	Mission Road, Shopping center parking lot to 93rd Street	0.20	4- to 5-lane arterial, 48-60 feet	Existing sidewalks need improvement Address ADA issues	16,800	Widen east side sidewalk to sidepath standards	Same as Short Term
12	93rd, Mission to Wenonga	0.30	2-lane local residential street, 24 feet	No sidewalks	NA	Sharrows	Same as Short Term

CROSSTOWN

X1 83RD STREET

X2 89TH STREET

North

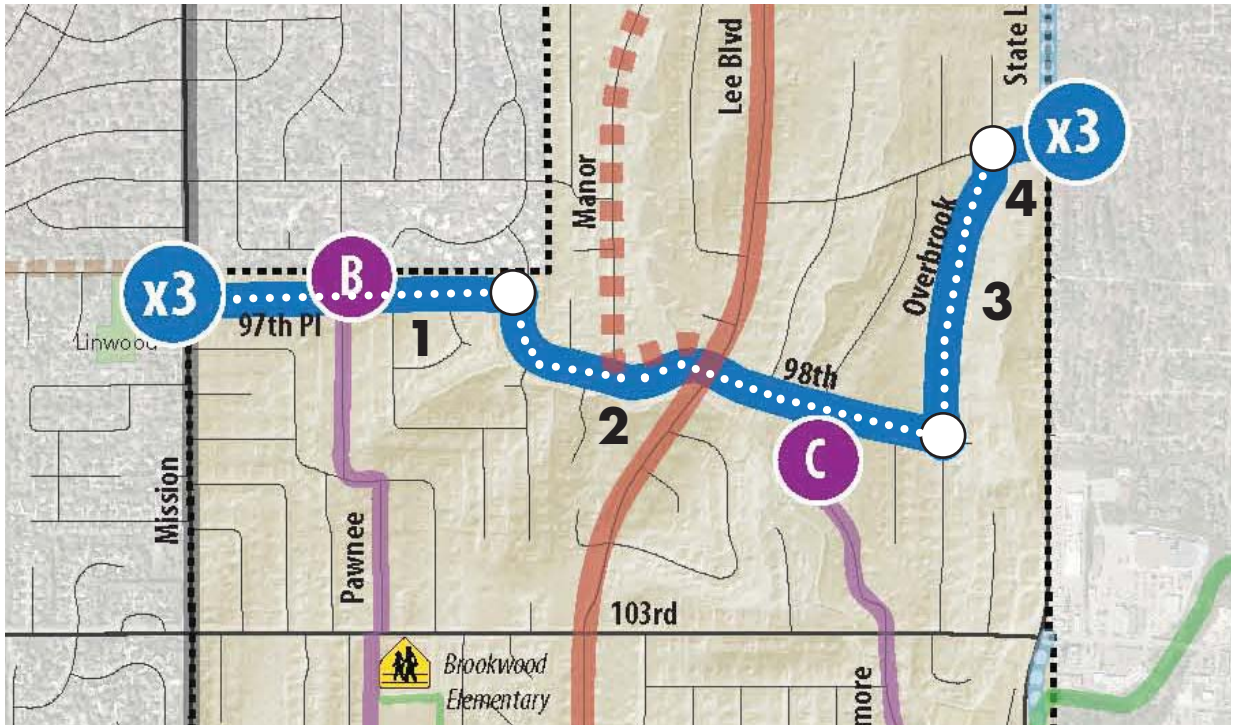


SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
X1 1	83rd, Mission to Overland Park/ Leawood City Line	0.20	3-lane minor arterial with left turn lane or painted median	Unknown	10,000	Sharrows. Cemetery restriction and necessity for a left-turn lane complicate adequate solution for less capable cyclists.	Same, within Overland Park jurisdiction
2	83rd, City Line to State Line Road	0.90	2-lane minor arterial, 32-36 feet	Existing sidewalks need improvement	9,280 at Lee Boulevard	11-foot travel lanes with bike lanes. Shared through lane where left-turn lane is provided.	Same as Short Term
X2 3	89th, Mission to Lee Boulevard	0.90	2-lane collector, 28 feet	Existing sidewalks need improvement No sidewalk on south side of 89th Street	2,610	10-foot travel lanes with 4-foot shoulder/bike lane; or sharrows with supporting share the road signage	Same as Short Term
4	89th, Lee to cul-de-sac	0.10	2-lane local, 25-feet	No sidewalk on south side of 89th Street	NA	Sharrows, merges with Principal Line 2 at cul-de-sac	Same as Short Term

CROSSTOWN

x3 98TH STREET

North



SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
x3 1	98th, Mission to Ensley Lane	0.50	2-lane local residential, 24-feet	No sidewalks	NA	Sharrows	Same as Short Term
2	Ensley/98th Street to Overbrook	0.68	2-lane local residential, 24-feet	No sidewalks	NA	Sharrows	Same as Short Term
3	Overbrook, 98th to 97th	0.40	2-lane local residential, 24-feet	No sidewalks	NA	Sharrows	Same as Short Term
4	97th, Overbrook to State Line	0.07	2-lane local residential, 24-feet	No sidewalks	NA	Sharrows	Same as Short Term

BICYCLE BOULEVARDS

A 85TH STREET

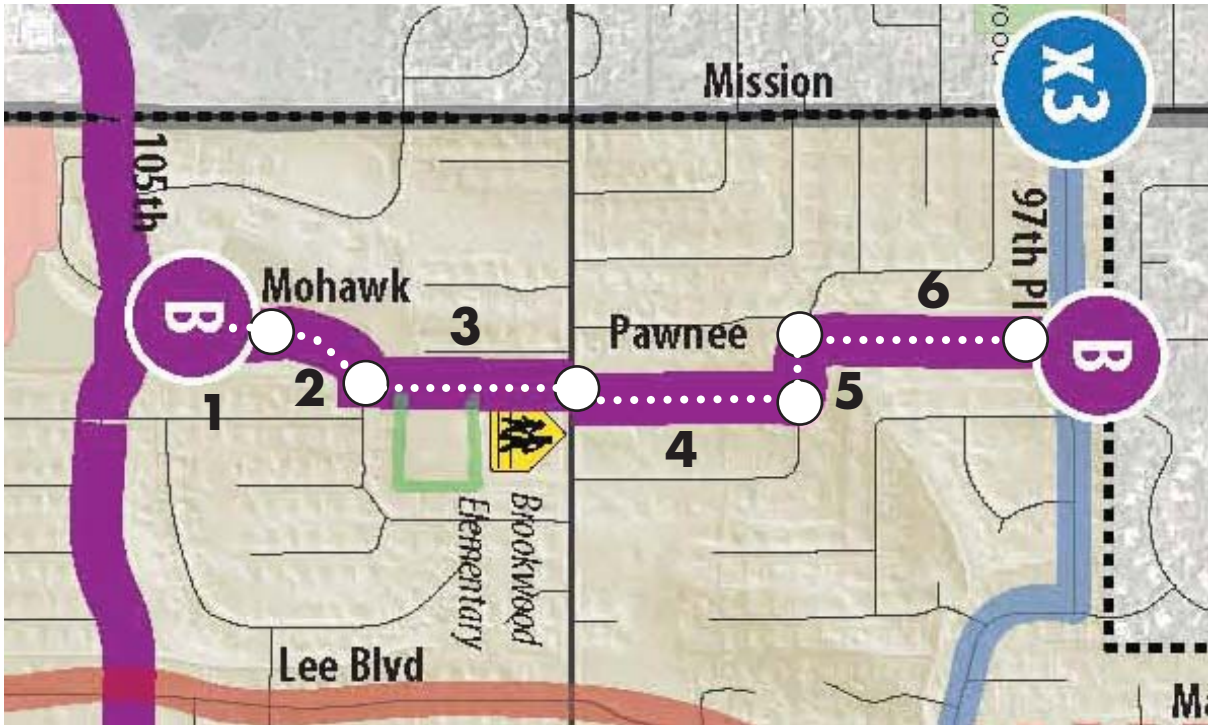
North

SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	Corinth School site, 83rd to Mission	0.25	School site	Unknown	NA	Path along south edge of school site, following Howe Drive	Same, within Prairie Village jurisdiction
2	Mission Road, Corinth site to 85th	0.20	5-lane urban arterial, 60 feet	Existing sidewalks need improvement Address ADA issues	17,000	Widen sidewalk to enhanced sidepath standards	Same, within Prairie Village jurisdiction
3	85th/Ensley/86th/ Meadow Drive, Mission to Lee Boulevard	0.90	2-lane local residential, 24-28 feet	No sidewalks	NA	Sharrows	Same as Short Term
4	Lee Boulevard, Meadow to 85th Terrace	0.10	2-lane minor arterial, 28 feet	Existing sidewalks need improvement No sidewalk on east side of Lee Boulevard	5,600	See Principal Route 1	Same as Short Term
5	85th Terrace, Lee to State Line	0.30	2-lane collector, 26-feet	No sidewalks	NA	Sharrows	Same as Short Term

BICYCLE BOULEVARDS

B BROOKWOOD

North

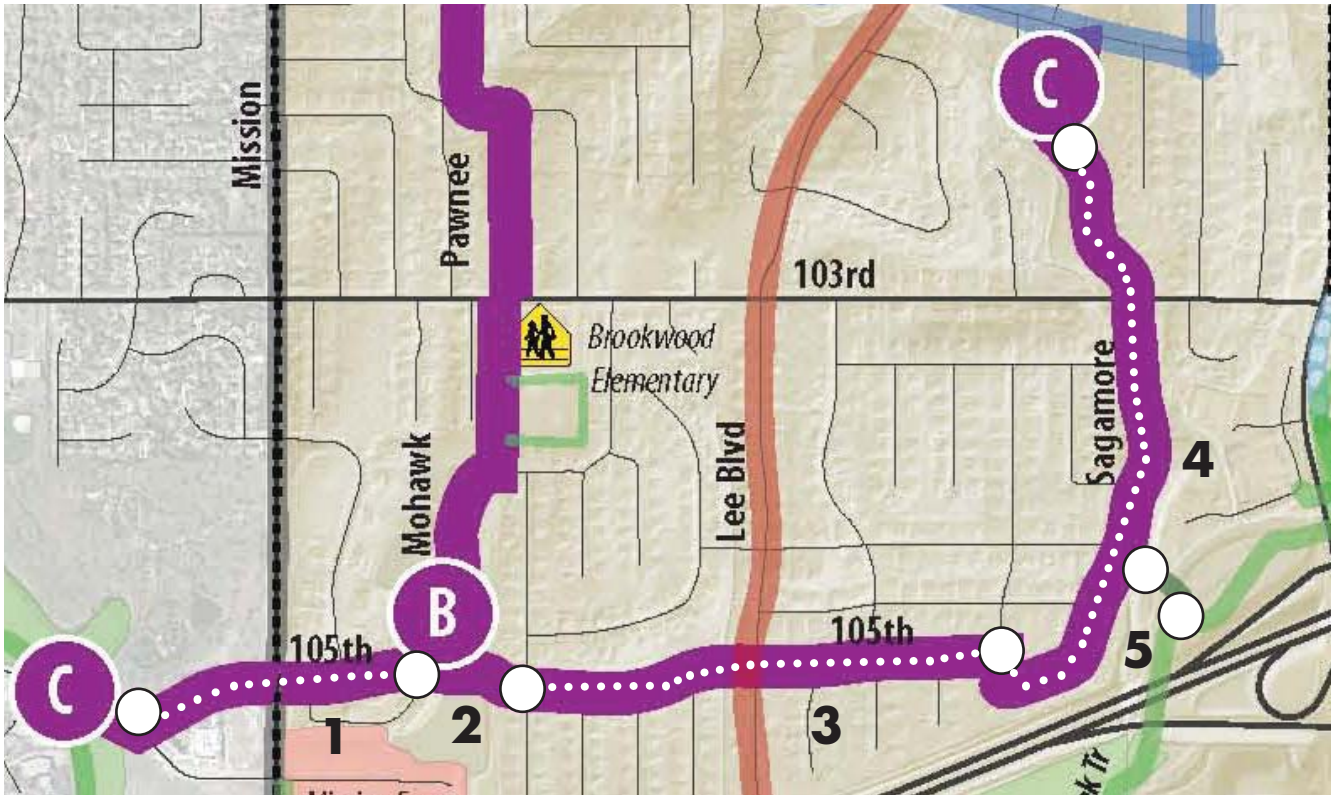


SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	105th/Mohawk, Mission to end of cul-de-sac	0.40	2-lane local residential, 25 feet	No sidewalks	NA	Sharrows	Same as Short Term
2	Mohawk, cul-de-sac to 103rd Terrace	0.10	Unpaved lane, 11 feet	No sidewalks	NA	Convert to paved, multi-use path	Same as Short Term
3	Brookwood School site, 103rd Terrace to 103rd Street	0.20	Open land and school site	No sidewalks	NA	New multi-use path through school site, probably on west side; connection to paths within school land.	Same, plus upgraded, signalized pedestrian crossing of 103rd.
4	Pawnee Lane, 103rd to 101st	0.20	2-lane local residential, 22 feet	No sidewalks	NA	Sharrows	Same as Short Term
5	101st, 101st Pawnee to 101st Mohawk	0.05	2-lane local residential, 27 feet	No sidewalks	NA	Sharrows	Same as Short Term
6	Mohawk, 101st to 97th Pl	0.20	2-lane local residential, 27 feet	No sidewalks	NA	Sharrows	Same as Short Term

BICYCLE BOULEVARDS

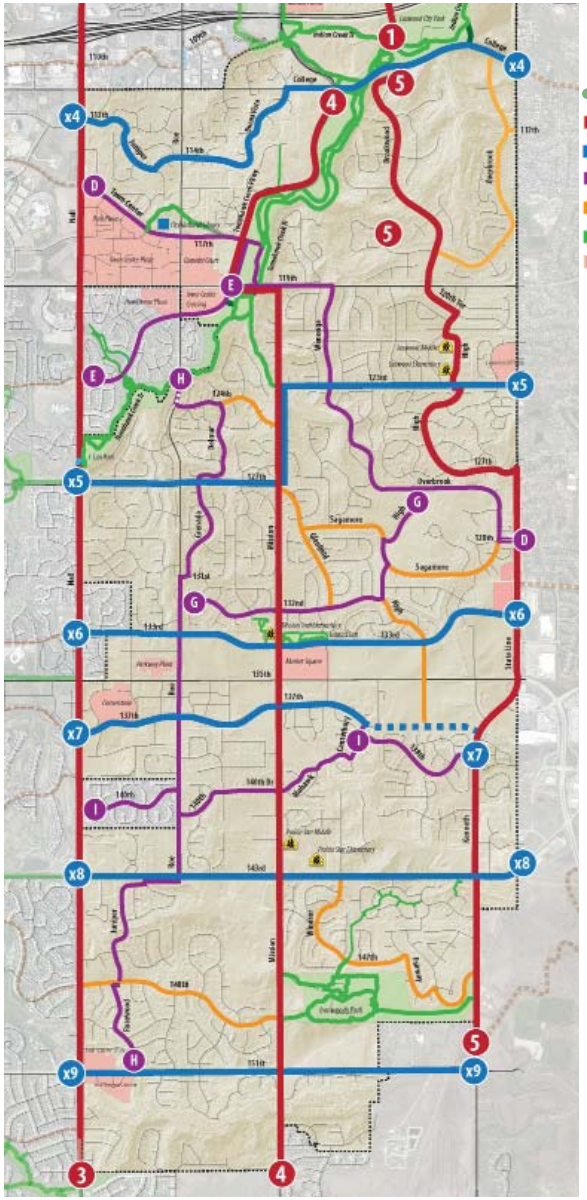
C 105TH/ SAGAMORE

North



SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	105th, Indian Creek Pkwy to Mission Farms access drive/Mohawk	0.40	2-lane, mixed use collector	No sidewalks	NA	Sharrows	Same as Short Term
2	Trail, Mohawk Street to 105-Mohawk Lane	0.09	10 foot trail	NA	NA	Same as existing	Same as existing
3	105th, Mohawk Lane to High Drive	0.60	2-lane residential collector, 25-27 feet	No sidewalks	NA	Sharrows	Same as Short Term
4	High Drive/Sagamore Road, 105th to 98th	0.94	2-lane residential collector, 25 feet	No sidewalks	NA	Sharrows	Same as Short Term
5	Trail link and bridge, Sagamore to Indian Creek Trail	0.08	NA	NA	NA	None	New trail link following sewer easement or willing property owner and bridge over Indian Creek, connecting to trail and 103-State Line retail centers

ROUTES DETAILS: SOUTH

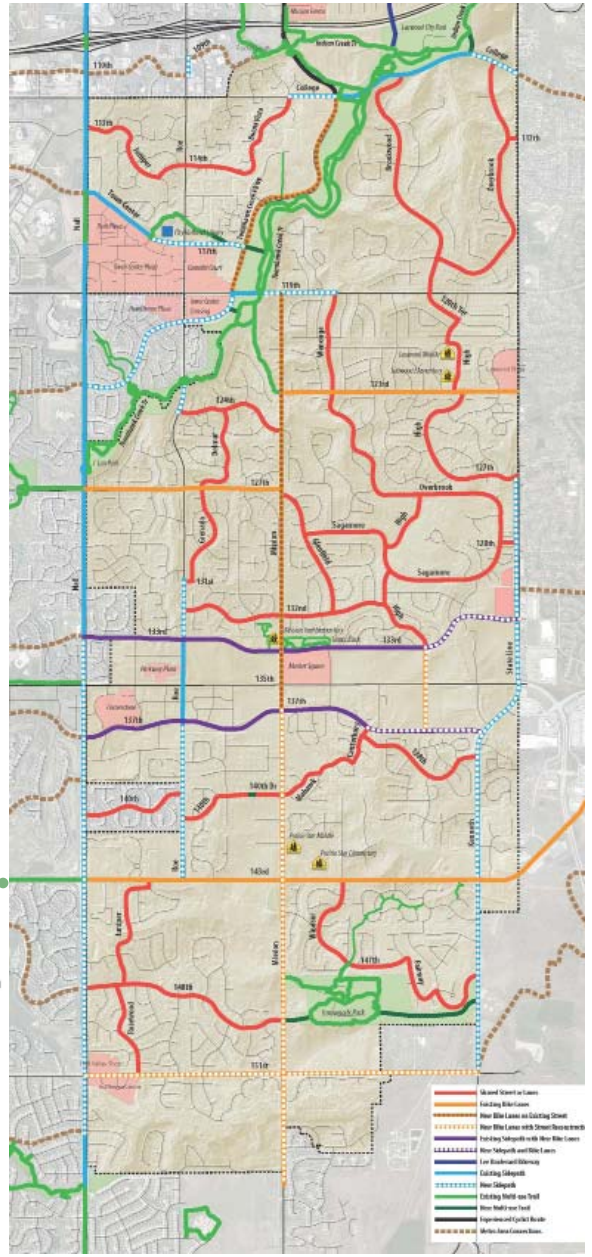


Route Designations

- Principal Routes
- Crosstown Routes
- Bicycle Boulevards
- Neighborhood Connections
- Multi-Use Trails
- Connecting Bike Routes

Infrastructure Types

- Shared Street or Lanes
- Existing Bike Lanes
- New Bike Lanes on Existing Street
- New Bike Lanes with Street Reconstruction
- Existing Sidepath with New Bike Lanes
- New Sidepath and Bike Lanes
- Lee Boulevard Bikeway
- Existing Sidepath
- New Sidepath
- Existing Multi-use Trail
- New Multi-use Trail
- Experienced Cyclist Route
- Metro Area Connections

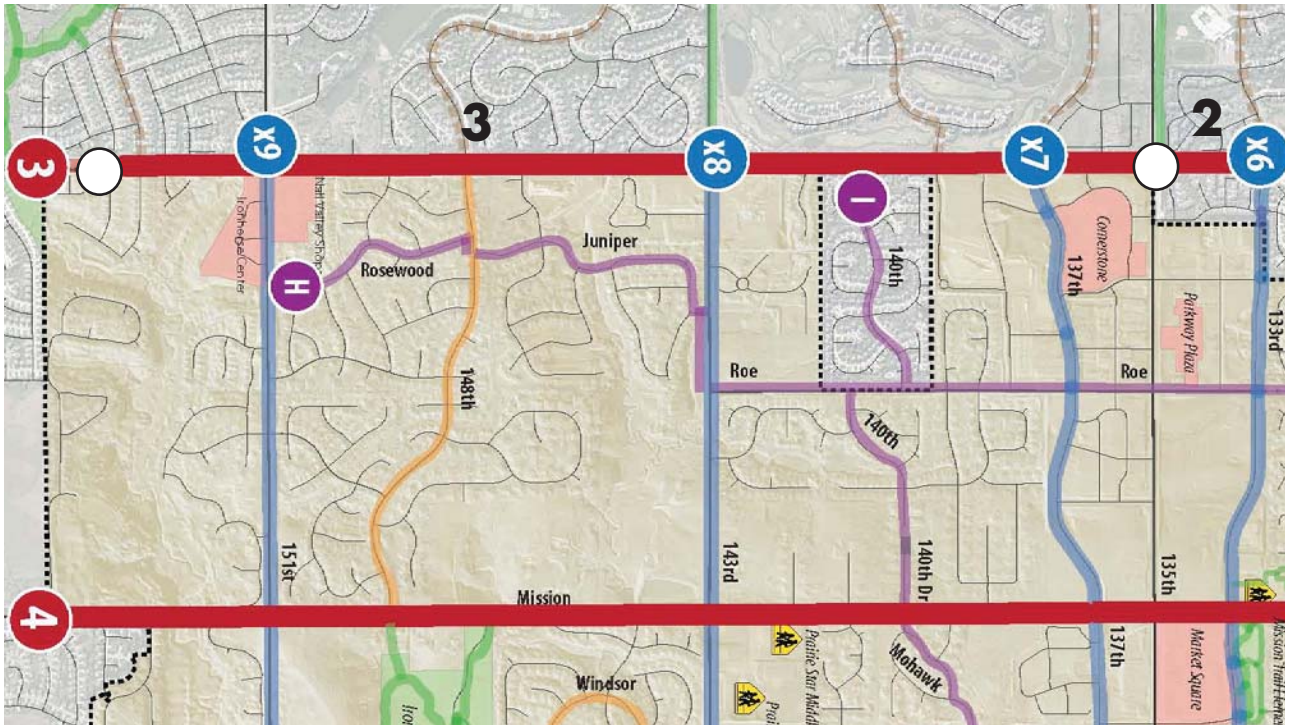


PRINCIPAL LINES

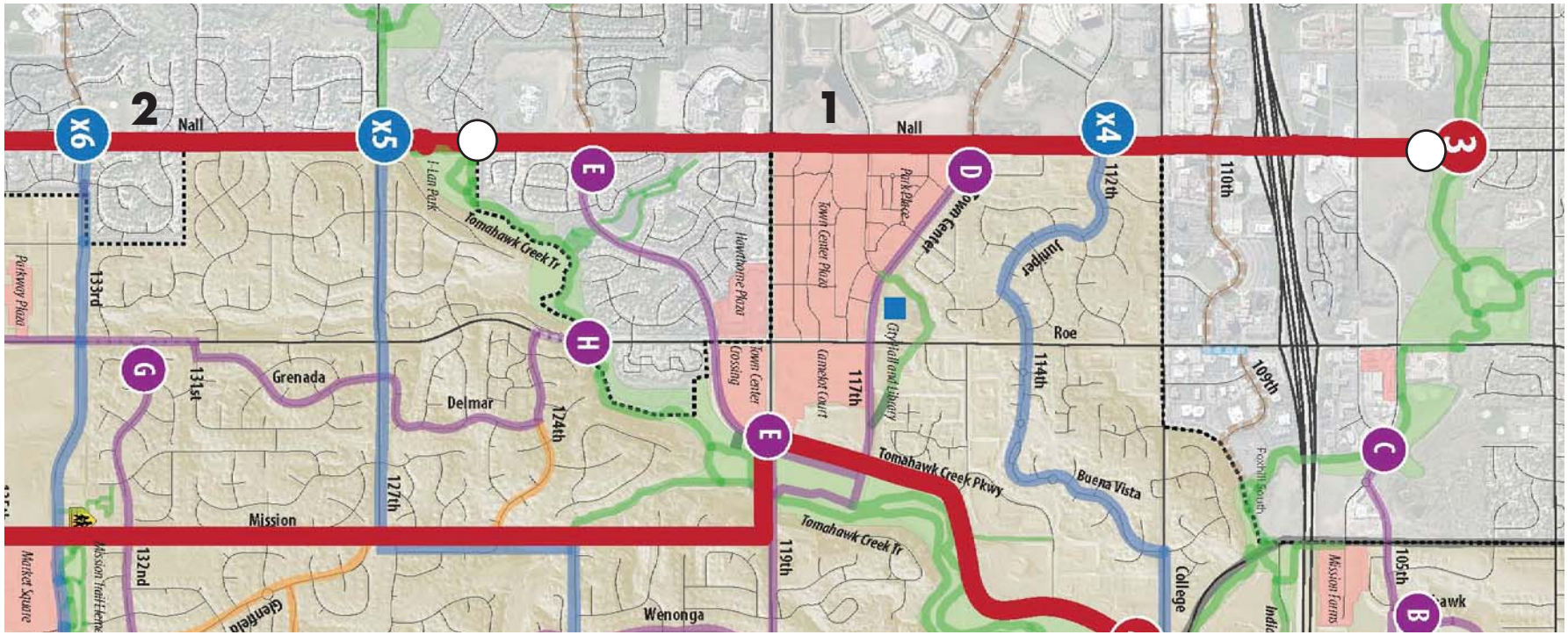
3

NALL

North



SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	Indian Creek Trail to Tomahawk Creek Trail (Common boundary between Leawood and Overland Park)	2.60	6-lane major arterial in commercial and office environments, usually with median divider and some multiple left-turn lanes. Typical width of 90 feet. Includes 10 foot sidepath on west side.	Good condition, continued maintenance	22,000-30,000	Enhanced sidepath with clearly demarcated crossings, advisory signage to motor vehicles at intersections and driveways of path presence. Improve wayfinding with directions to destinations and routes in both Leawood and Overland Park.	Reconstruction of key, multi-lane intersections to pedestrian and bicycle friendly designs. Concepts include separating right-turn movements out with pedestrian refuge islands. Rebuild areas where path is on back of curb to provide greater separation.
2	119th to 135th	1.20	4-lane divided major arterial with left turn pockets at major intersections. Typical width of 80 feet. Includes 10 foot sidepath on west side.	Good condition, continued maintenance	21,000	Enhanced sidepath with clearly demarcated crossings, advisory signage to motor vehicles at intersections and driveways of path presence. Improve wayfinding with directions to destinations and routes in both Leawood and Overland Park.	Reconstruction of key, multi-lane intersections to pedestrian and bicycle friendly designs. Concepts include separating right-turn movements out with pedestrian refuge islands. Rebuild areas where path is on back of curb to provide greater separation.



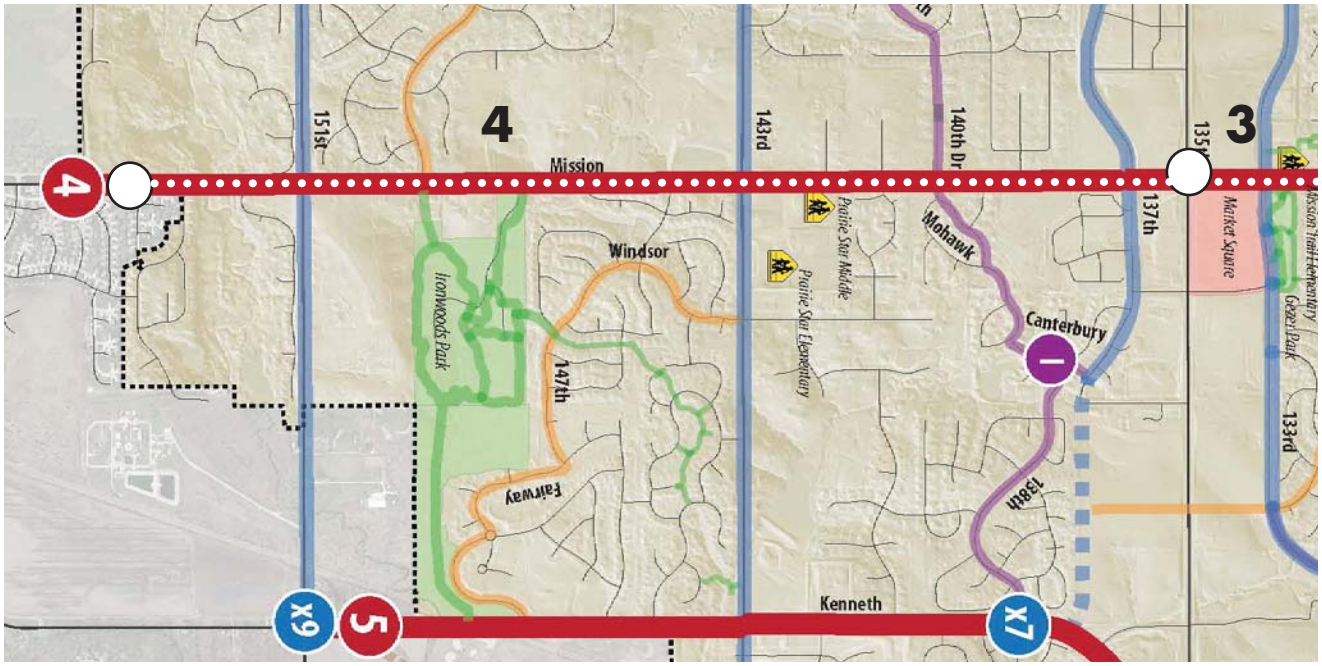
SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
3	135th to City Line	2.50	4-lane divided major arterial with left turn pockets at major intersections. Typical width of 80 feet.	Good condition, continued maintenance	12,000-21,000	Extend enhanced sidepath to city limit.	Same as Short Term

PRINCIPAL LINES

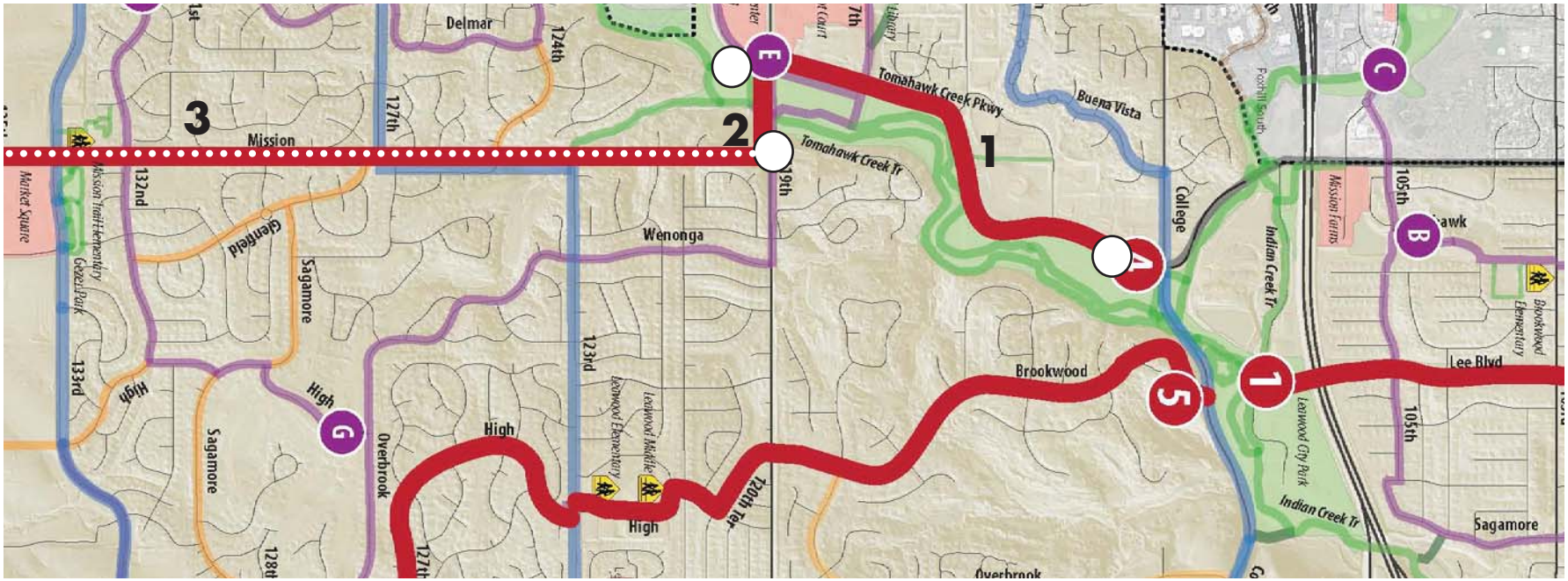
4

MISSION

North



SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	Tomahawk Creek Parkway, College to 119th	1.20	4-lane divided parkway, office/commercial environment, 2 24 foot channels with 50-75 foot median, no curbs	Address ADA issues at intersections	13,600	Use of adjacent Tomahawk Creek Trail from College to 119th Street	Bike lanes with buffer where possible. Buffers are probably not practical on southbound channel between College and 114th.
2	119th, Tomahawk Creek to Mission	0.20	4 to 5-lane major arterial, 50-66 feet	Good condition, continued maintenance	18,025	Path connection adjacent to park from TC Pkwy to Tomahawk Creek Trail. Existing bridge under 119th Street, with access to south side of street. Widen south side sidewalk to enhanced sidepath standard to Mission Road.	Same as Short Term
3	Mission Road, 119th to 135th	2.00	2-lane minor arterial, 32 feet	Existing sidewalks need improvement Gaps in sidewalk network	5,000-9,500	2 11-foot travel lanes with 4-5 foot bike lanes	Same as Short Term

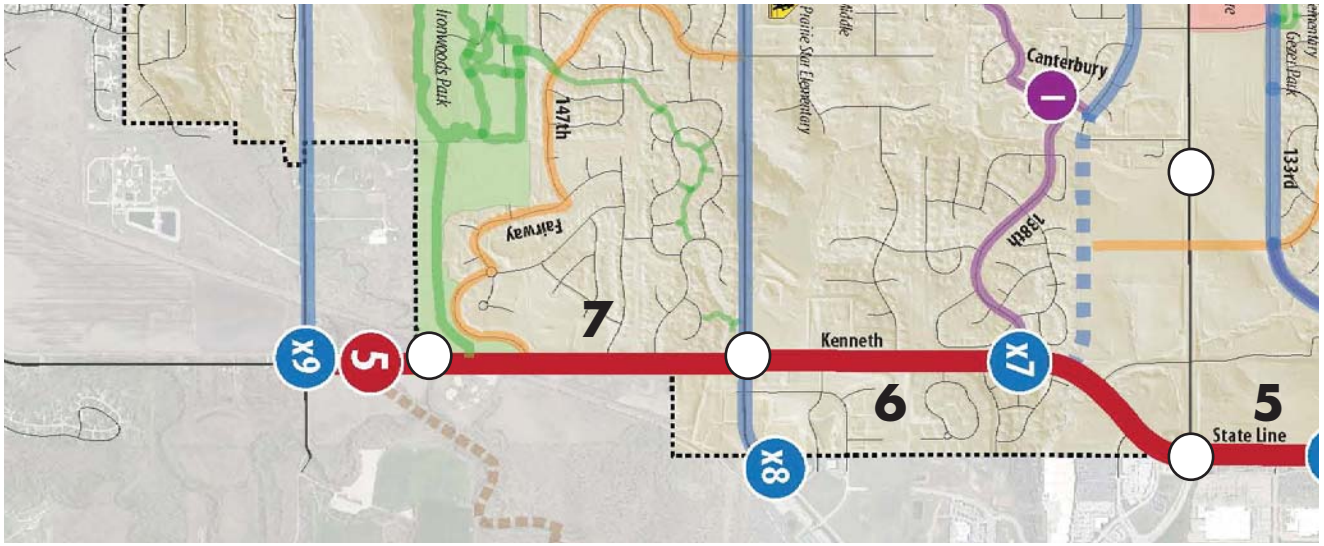


SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
4	Mission Road, 135th to City Line	2.50	2-lane minor arterial, rural section, 22 feet	Existing sidewalks need improvement Gaps in sidewalk network Address ADA issues	5,000	Possible widening of west side sidewalk to sidepath standard.	Complete street with two 11 foot travel lanes, one 11-foot left turn lane, and buffered bike lanes in both directions, Total street channel width of 50 feet. Sidepath may be included on one side.

PRINCIPAL LINES

5 EASTSIDE

North



SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	Brookwood, College to 119th	1.25	2-lane divided neighborhood parkway, 72-foot channel with dual 24-foot roadways	Existing sidewalks need improvement Address ADA issues	NA	Shared, striped parking/bike lane, eight feet on each roadway. Sharrows on segment with no median. Improved pedestrian crossing to College Boulevard, using median west of intersection as refuge area	Same as Short Term
2	Belinder Road/ High Drive, 119th to Leawood Middle School campus	0.30	2-lane local residential street, 26 feet	Existing sidewalks need improvement Gaps in sidewalk network Address ADA issues	NA	Improve pedestrian/bicycle crossing of 119th. Sharrows on streets.	Same as Short Term
3	School campus, High Drive to 123rd	0.35	6 foot wide path along west edge of school site	Address ADA issues	NA	Widen to standard ten foot path. Mark transition to 123rd Street bike lanes.	Same as Short Term
4	High Drive/127th, 123rd to State Line Road	1.00	2-lane residential collector, 32-36 feet with some divided parkway sections	Existing sidewalks need improvement Gaps in sidewalk network Address ADA issues	NA	Sharrows	Shared, striped parking/bike lane. Painted lane may be helpful for traffic calming.

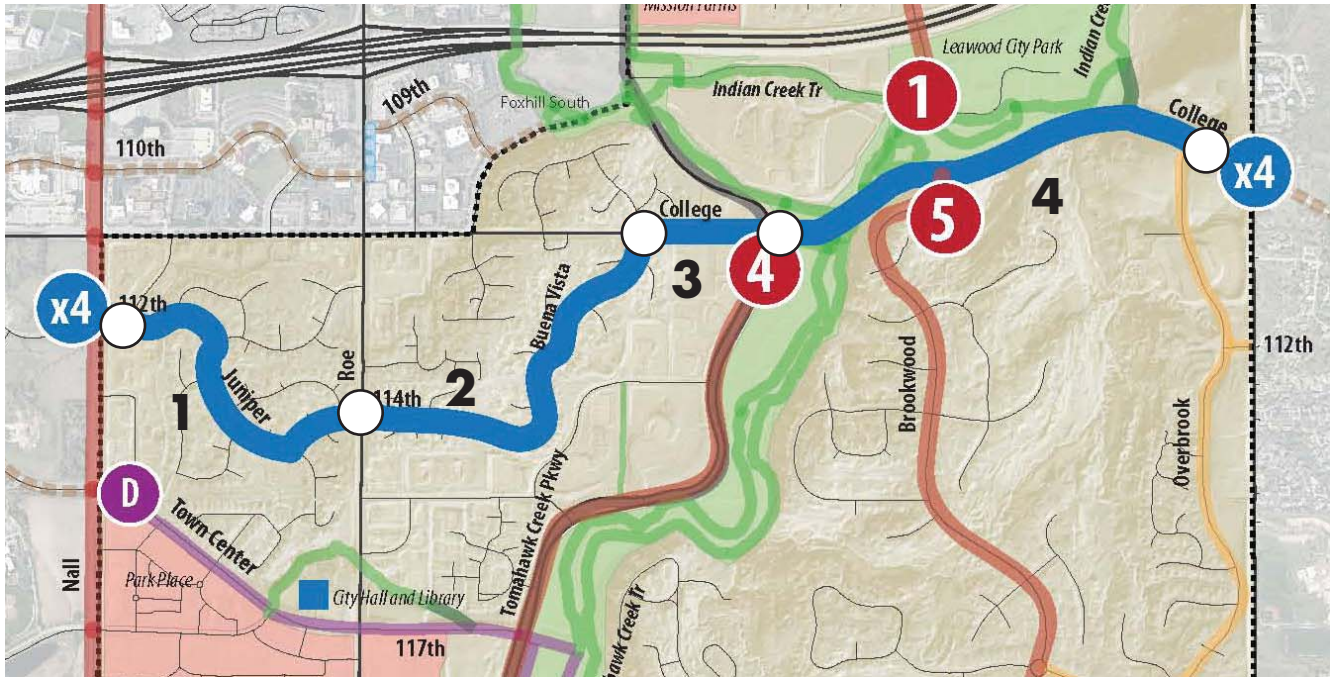
SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
5	State Line Road, 127th to 135th	1.10	5-lane major arterial, 60 feet	Good condition, continued maintenance	21,280	Enhanced sidepath, with improved crossing definition at 135th Street intersection.	Same as Short Term
6	State Line/Kenneth Road, 135th to 143rd	1.10	4-lane divided arterial with median at north, 65 foot width including median, tapering to 2/3-lane section south, 32-36 feet	Good condition, continued maintenance	8,000	Sidewalk use	Enhanced sidepath on west side.
7	Kenneth Road, 143rd to city line	0.70	2-lane rural section highway, 24 feet	Good condition, continued maintenance	8,000	None	Enhanced sidepath on west side. Design crossing of railroad tracks to 90 degrees. Ultimate Kenneth Road design should incorporate complete street standards.




CROSSTOWN

x4 COLLEGE

North

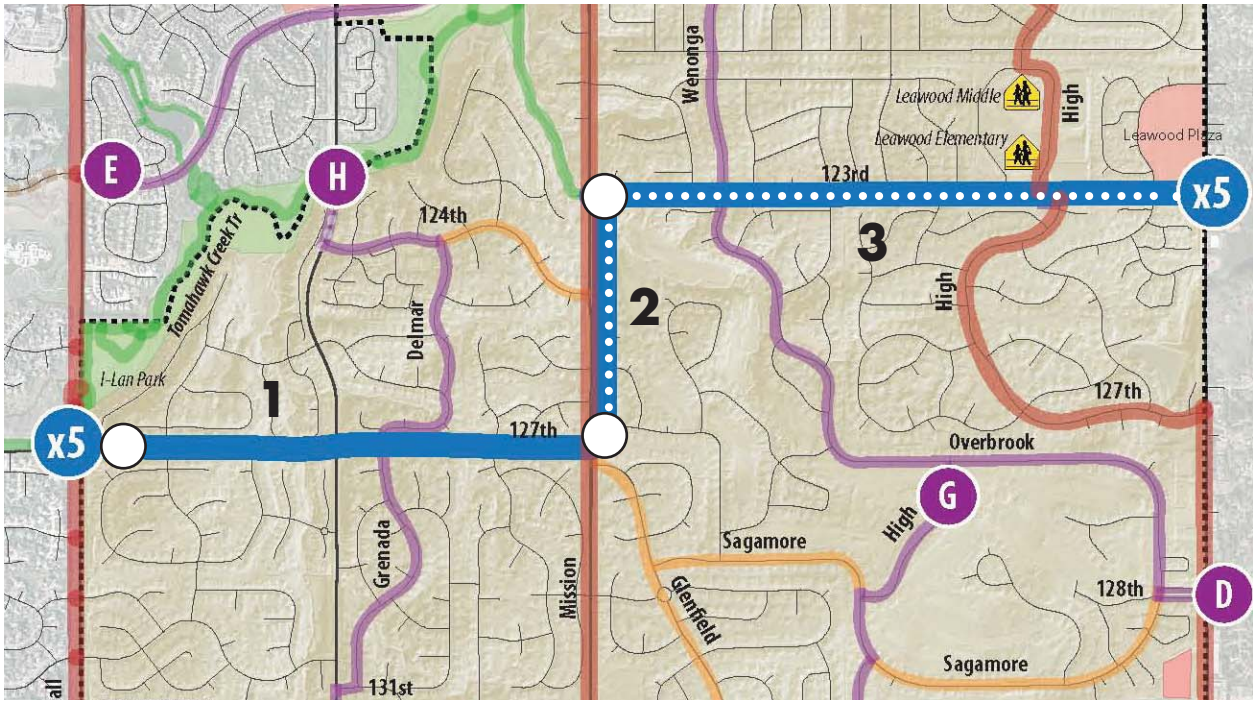


SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	112th/ Juniper/114th, Nall to Roe	0.68	2-lane, local residential, 24-28 feet	Good condition, continued maintenance	NA	Sharrows	Same as Short Term
2	114th/Buena Vista, Roe to College	0.83	2-lane local residential, 24 feet, with parallel 6 foot path	Good condition, continued maintenance	NA	Sharrows	Same as Short Term
3	College, Buena Vista to Mission/ Tomahawk Creek Pkwy	0.20	4-lane minor arterial, 52 feet	Address ADA issues at intersections	10,000	Expand sidewalk on south side to enhanced sidepath standard. Clarify trail access at Mission Road intersection.	Same as Short Term
4	College Boulevard, Mission to State Line	1.00	4-lane minor arterial with left turn lane at intersections, 52 to 64 feet, 6 foot walk/path on north side	Good condition, continued maintenance	12,000	Use north side sidewalk as combination walkway/bikeway with advisory signage. Improve park road west of Overbrook intersection to link path to Indian Creek Trail	Additionally, consider narrowing lanes to 11-feet, providing space for an eastbound buffered bike lane. Widen north sidewalk where possible to provide separate WB bike and two-directional pedestrian tracks.

CROSSTOWN

X5 123RD/127TH STREET

North

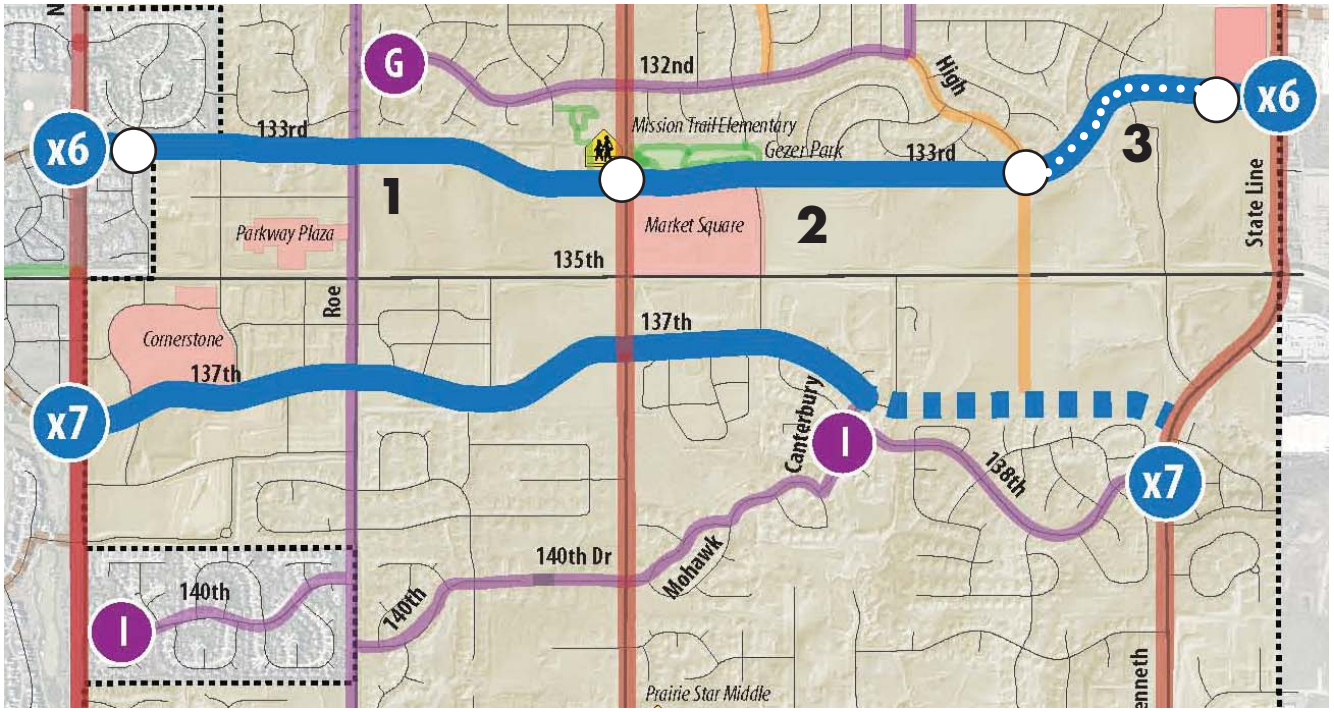


SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	127th, Nall to Mission	1.00	2-lane collector with bike lanes, 31 feet	Existing sidewalks need improvement	NA	Existing bike lanes	Redesign Nall Avenue intersection to improve transition from 123rd Street and Nall Avenue sidepaths to EB bike lane. Provide right-turn only lane for WB motor vehicles to the right of a direct bike lane transitioning to Overland Park sidepath or lane.
2	Mission, 123rd to 127th	0.50	2-lane minor arterial, 35 feet	Existing sidewalks need improvement Gaps in sidewalk network	8,000	Installation of bike lanes.	Minor widening at intersections with left turn lanes to maintain continuity for the bike lane.
3	123rd Street, Mission to State Line	1.20	-lane collector with bike lanes, 36-38 feet	Existing sidewalks need improvement Gaps in sidewalk network Address ADA issues	NA	Existing bike lanes	Transition bike lane to an off-road, single direction cycle track using a widened sidewalk east of High Drive.

CROSSTOWN

x6 133RD STREET

North

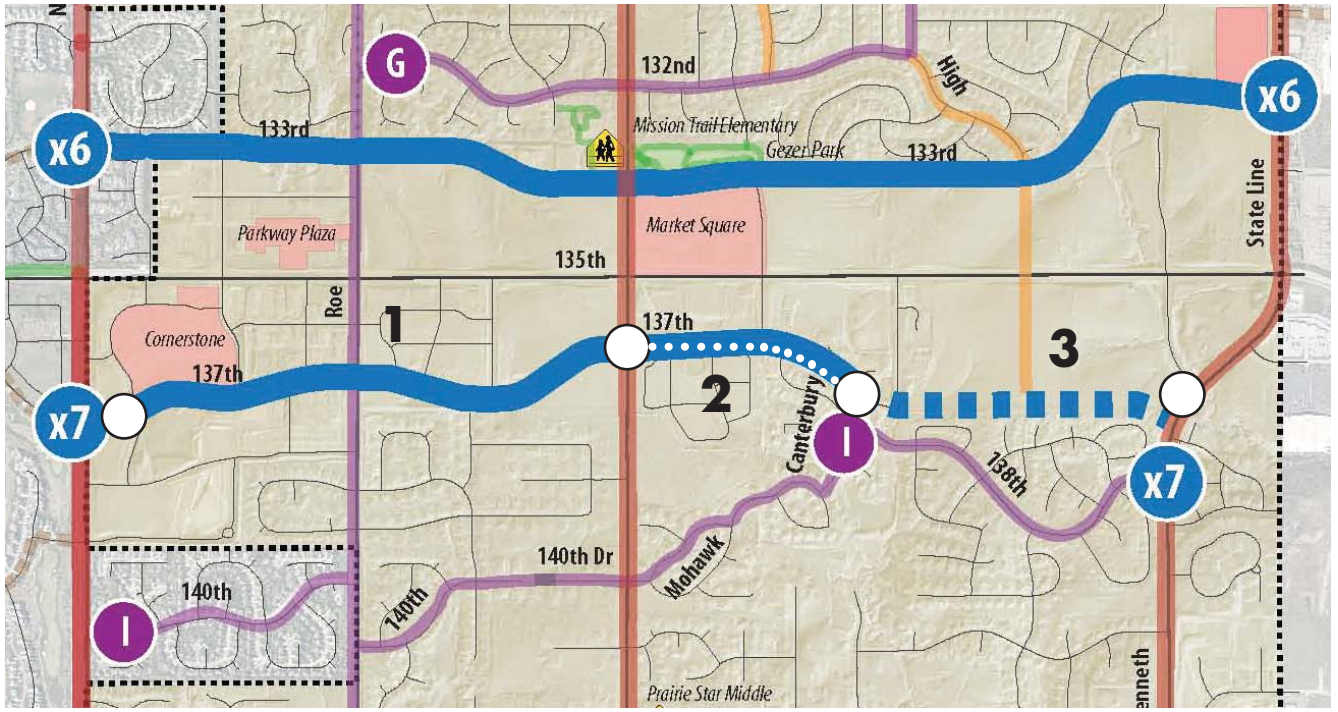


SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	Nall to Mission	1.00	2-lane collector providing local access to 135th Street corridor, with left turn lanes at key intersections; 38 feet. 10 foot sidepath on north side.	Good condition, continued maintenance	NA	Install bike lanes, converting to sharrows at intersections with left turn lanes.	Minor widening at some intersections to provide bike lane continuity.
2	Mission to High Drive	0.70	2-lane collector providing local access to 135th Street corridor, with left turn lanes at key intersections; 34 feet. 10 foot sidepath on north side.	Good condition, continued maintenance	NA	Install bike lanes, converting to sharrows at intersections with left turn lanes.	Minor widening at some intersections to provide bike lane continuity.
3	High Drive to State Line	0.60	2-lane collector providing local access to 135th Street corridor, with left turn lanes at key intersections; 34 feet.	Gaps in sidewalk network	NA	Install bike lanes, converting to sharrows at intersections with left turn lanes.	Provide protected pedestrian crossing to south side and develop new sidepath on the south to State Line. Future extension of High into new development area could serve as that crossing.

CROSSTOWN

x7 137TH STREET

North



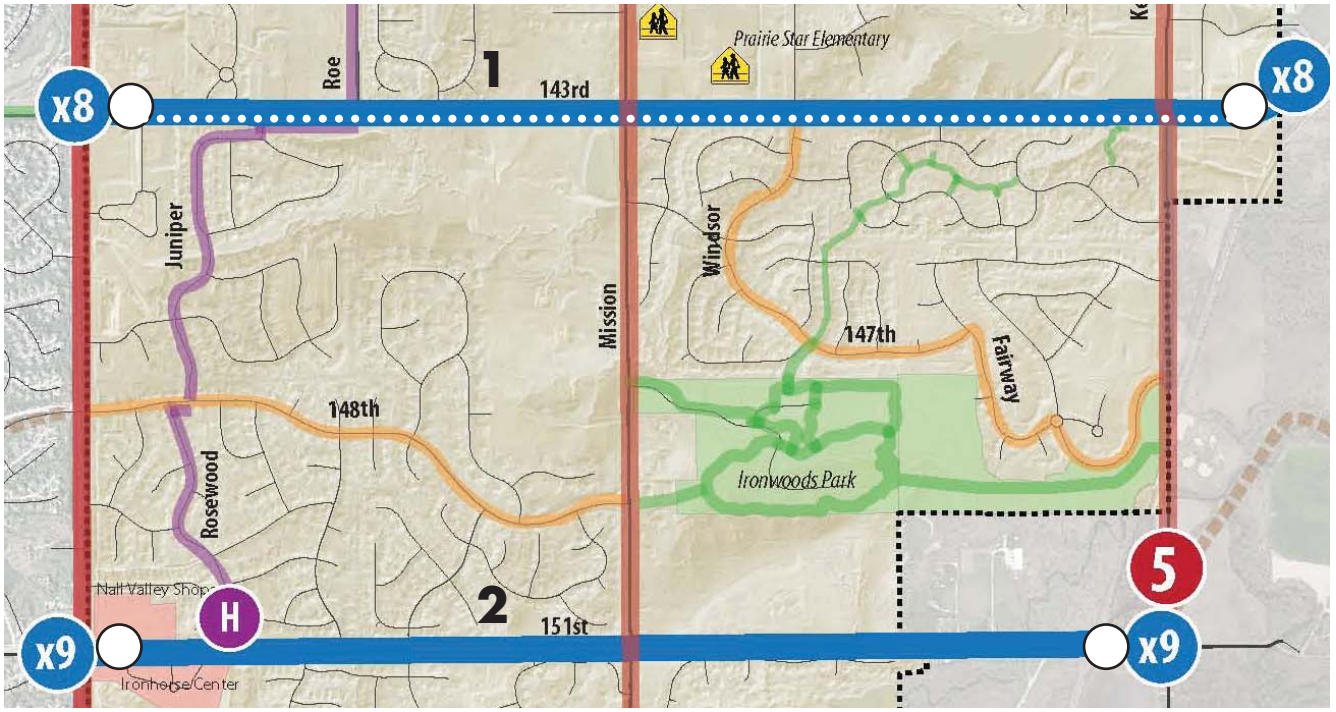
SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	Nall to Mission	1.00	2-lane collector providing local access to 135th Street corridor, with left turn lanes at key intersections; 36 feet. 10 foot sidepath on south side.	Good condition, continued maintenance	NA	Install bike lanes, converting to sharrows at intersections with left turn lanes.	Minor widening at some intersections to provide bike lane continuity.
2	Mission to Chadwick	0.60	2-lane collector providing local access to 135th Street corridor, with left turn lanes at key intersections; 36 feet. 10 foot sidepath on north side.	Gaps in sidewalk network	NA	Install bike lanes, converting to sharrows at intersections with left turn lanes.	Minor widening at some intersections to provide bike lane continuity.
3	Chadwick to Kenneth Road	0.50	Future street	NA	NA	Use Canterbury/138th Street route as shared right of way to Kenneth Road.	Develop to standards established by rest of 137th corridor

CROSSTOWN

X8 143RD STREET

X9 151ST STREET

North



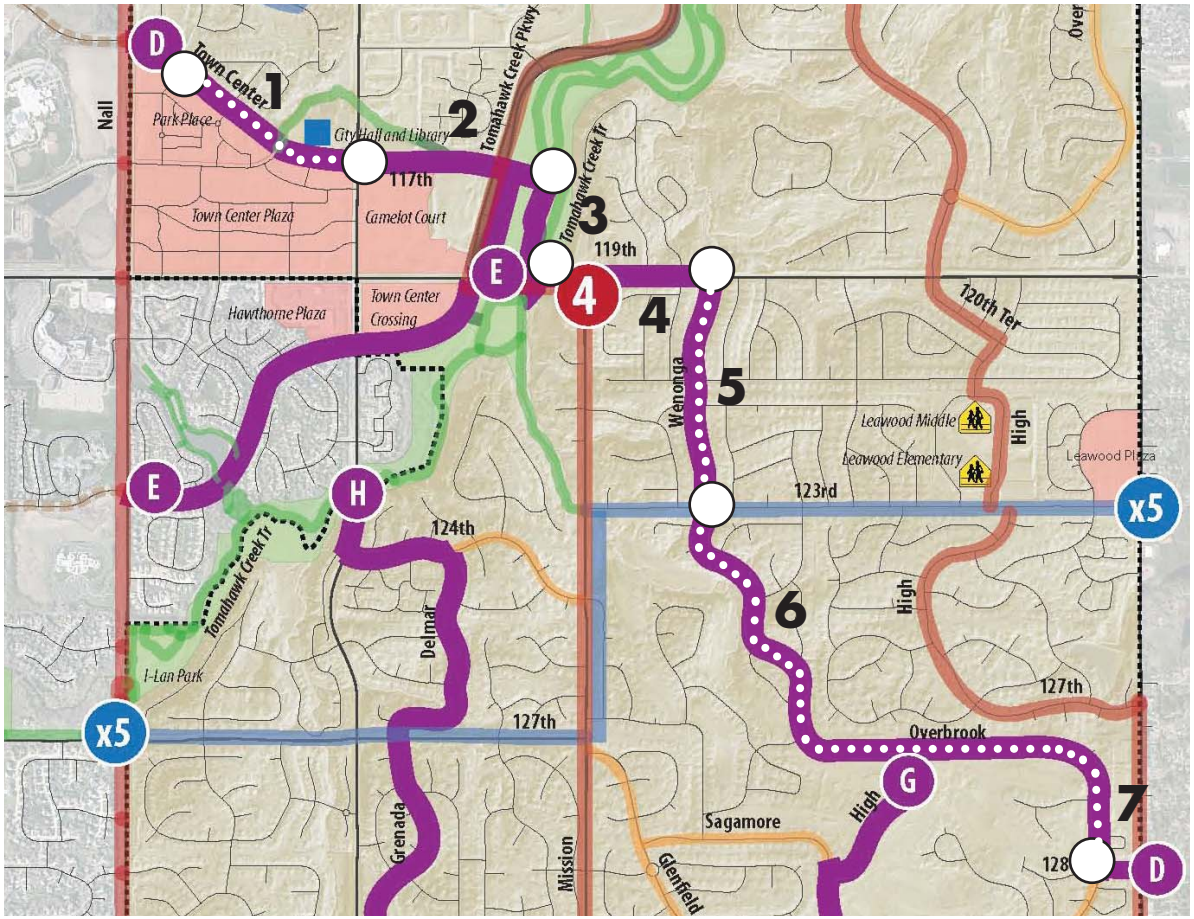
SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	143rd, Nall to Kenneth	2.00	2-lane arterial, rural section, 22 feet	Existing sidewalks need improvement No sidewalk on south side of 143rd Street Address ADA issues	7,235	In process of reconstruction with bike lanes.	Provide sidepath if not included in current (2014) project
2	151st, Nall to Kenneth	2.00	2-lane arterial, rural section, 24 feet	Address ADA issues	4,500 west of Kenneth	Direct bicycle use to 148th Street between Nall and Mission and through Ironwoods Park.	Reconstruct to complete street standard, preferably with buffered bike lanes and sidepath on one side.


SCHOOL
SPEED
LIMIT
20
7:15 - 9 AM
11 AM - 1 PM
2:30 - 4 PM

BICYCLE BOULEVARD

D TOWN CENTER

North



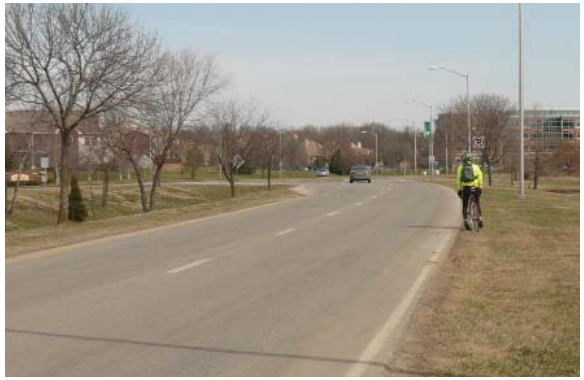
SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	Town Center Drive/117th Street, Nall to Roe	0.60	4-lane divided collector/ parkway, 63 feet. Sidepath on south side between Nall and 117th Street intersection	Gaps in sidewalk network	NA	Fill sidepath gap between 117th and Roe, probably on north side, Establish a well-defined crossing at trail access paralleling City Hall parking lot.	See Town Center area circulation concept
2	117th, Roe to Tomahawk Creek Parkway	0.40	3-lane collector, asymmetrical section, 45 feet with wide sidewalk adjacent to Law Enforcement Center.	Address ADA issues at intersections	NA	Sidepath on north side, with junction to City Hall Park Trail. Continue route with defined crossing of Tomahawk Creek Parkway. Use existing drive for access to Tomahawk Creek Trail.	New trail spur to Tomahawk Creek Trail

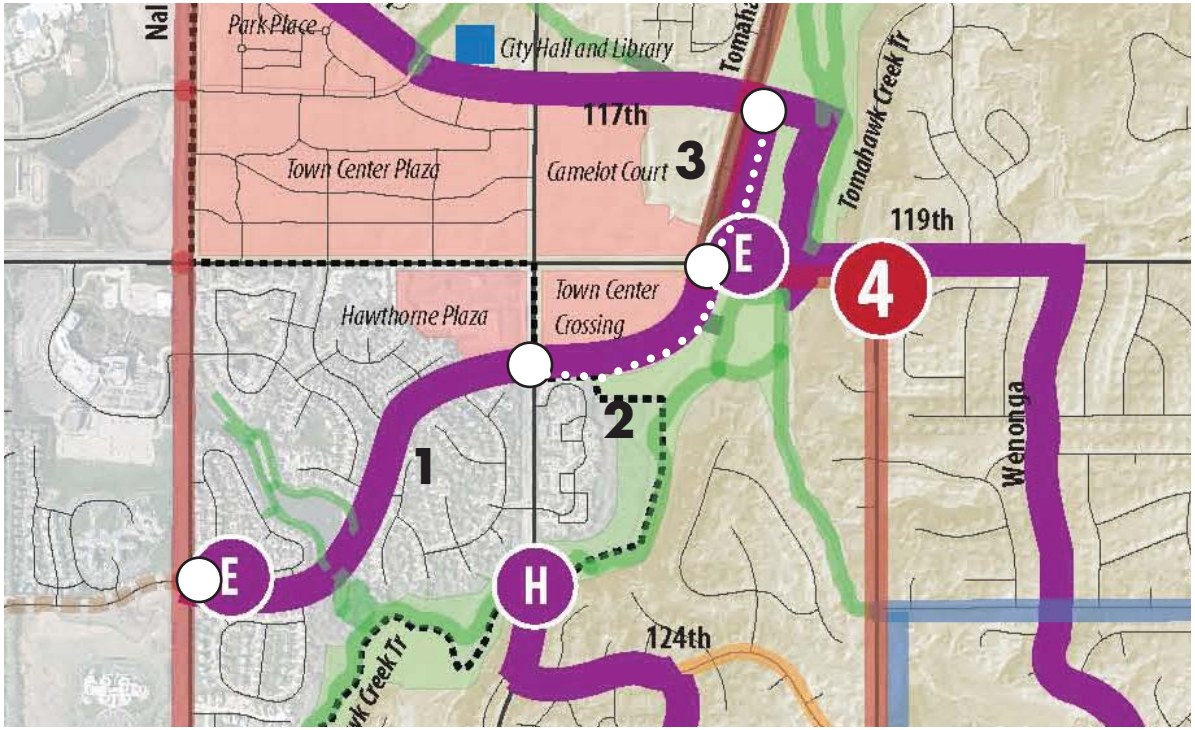


SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
3	Tomahawk Creek Trail, 117th to 119-Mission	0.46	Existing regional multi-use trail	Address ADA issues at intersections	NA	Existing trail with crossing under 119th Street and sidepath on south side of 119th to Mission.	Same as Short Term
4	119th, Mission to Wenonga	0.25	4-lane major arterial, 54 feet widening at intersections with left-turn lanes	Good condition, continued maintenance	18,000	Sidewalk use for connection	Widen sidewalk to maximum extent, providing a behind the curb sidepath. Provide intersection enhancements.
5	Wenonga Lane, 119th to 123rd	0.50	2-lane residential collector, 36 feet	Existing sidewalks need improvement Gaps in sidewalk network	NA	Striped combination parking lane 8 feet from curb. Sharrows in travel lane Lane also serves as pedestrian area when sidewalks are not present.	Same. Provide sidewalk continuity on one side.
6	Overbrook Road, 123rd to 128th	1.50	2-lane residential collector, 27-30 feet	No sidewalks	NA	Sharrows	Same as Short Term
7	128th, Overbrook to State Line	0.08	2-lane divided entry boulevard, dual 25-foot street channels with 75-foot median	No sidewalks	NA	Bike Lanes to announce bicycle boulevard	Same as Short Term

BICYCLE BOULEVARD

E TOMAHAWK CREEK PARKWAY





SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	TC Parkway, Nall to Roe (Overland Park)	0.70	4-lane divided collector/ parkway, 63 feet. 5-foot curving sidewalks on both sides.	Good condition, continued maintenance	NA	Sharrows	Sidepath, probably on south side of street.
2	TC Parkway, Roe to 119th	0.29	4-lane collector, 48 feet, sidewalk on north side	No sidewalk on south side of Tomahawk Creek Parkway Address ADA issues at intersections	NA	Sharrows.	Sidepath, probably on south side of street adjacent to park. Segment a trail bridge over Tomahawk Creek, linking 119-Roe retail node to the regional trail system. Bridge should be generally aligned with south mall entrance, and provide clear pedestrian crossing.
3	TC Parkway, 119th to 117th	0.30	4-lane divided parkway, office/ commercial environment, 2 24 foot channels with 50-75 foot median, no curbs	No sidewalks	13,600	Use of adjacent Tomahawk Creek Trail.	Bike lanes with buffer where possible.

BICYCLE BOULEVARD

G 132ND STREET

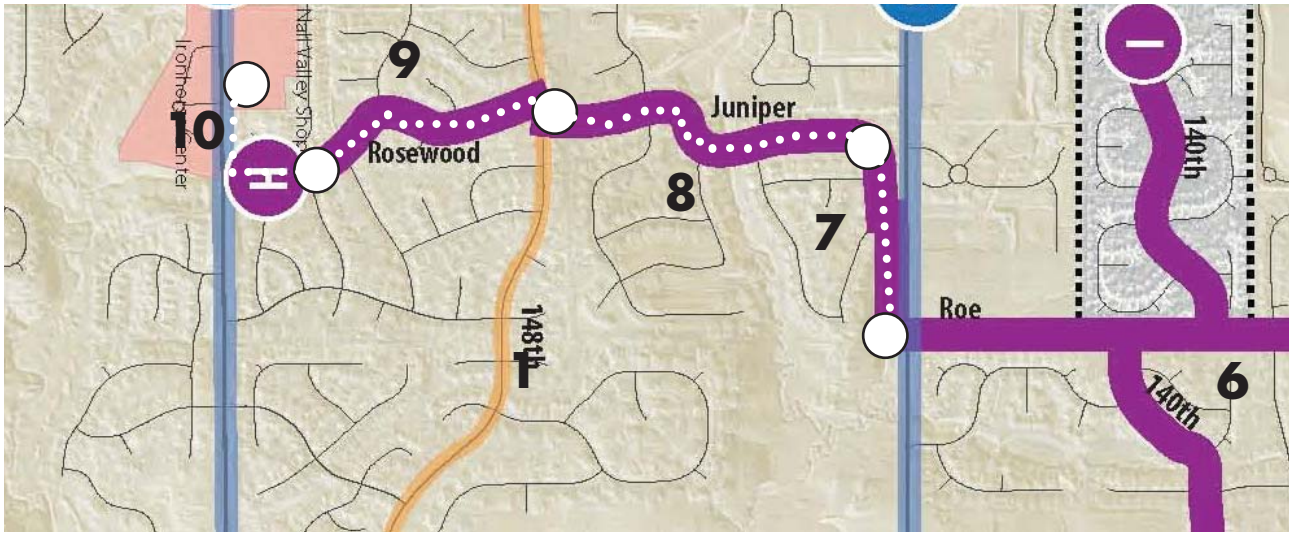
North

SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	132nd Street, Roe to High	1.10	2-lane neighborhood collector, 36 feet with some sections of divided parkway	Existing sidewalks need improvement Address ADA issues	NA	Sharrows.	Same. Striped parking lanes may be useful if traffic calming is necessary.
2	High Drive, 132nd to Sagamore	0.20	2-lane local residential, 28 feet	No sidewalks	NA	Sharrows. High south of 132nd is a neighborhood connector to 133rd Street.	Same as Short Term
3	Sagamore, High Drive south to High Drive north	0.10	2-lane residential collector, 31 feet	No sidewalks	NA	Sharrows	Same as Short Term
4	High Drive, Sagamore to Overbrook	0.40	2-lane local residential collector, 25 feet	No sidewalks	NA	Sharrows	Same as Short Term

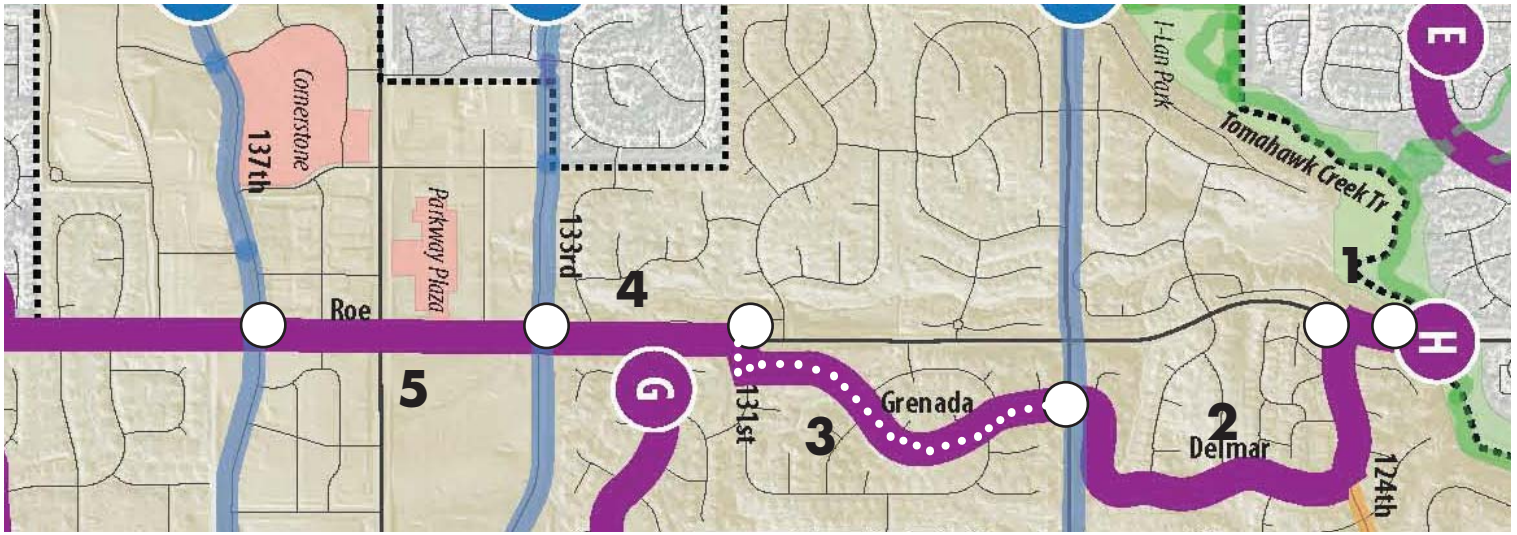
BICYCLE BOULEVARD

H WESTSIDE

North



SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	Roe, Tomahawk Creek Trail to 124th	0.20	4-lane arterial, 48 to 60 feet	Good condition, continued maintenance	15-20,000	Walking connection on east side sidewalk to south approach of creek bridge. Widening of sidewalk to back of curb for maximum clearance.	Redesign or reallocation of street width to narrow roadway slightly, providing enough space for a standard sidepath or cycle track on east side.
2	124th/ Delmar/126th Terrace/Grenada, Roe to 127th	0.69	2-lane local residential streets, varying from 26 to 34 feet	Existing sidewalks need improvement Address ADA issues	NA	Sharrows.	Same as Short Term
3	Grenada/131st, 127th to Roe	0.55	2-lane local residential streets, 24 feet	Existing sidewalks need improvement Address ADA issues Gaps in sidewalk network	NA	Sharrows	Same as Short Term
4	Roe, 131st to 133rd	0.30	4-lane arterial, widening to a divided section near 133rd Street; 52 feet in undivided segment.	Good condition, continued maintenance	8,280	Widening of east side sidewalk to sidepath width if possible, with crossing at 133rd Street signal.	Pedestrian crossing at midblock, with enhanced sidepath shifted to west side of the street. Preferred solution if resources are available.
5	Roe, 133rd to 137th	0.40	4-lane divided arterial with multiple turn lanes at 135th Street; 93 feet at 135th intersection. Sidepath on west side.	Good condition, continued maintenance	8,280	Existing sidepath with enhancements for clarity.	Redesign of 135th Street intersection to include crossing refuge medians, dividing right turn traffic from other movements.

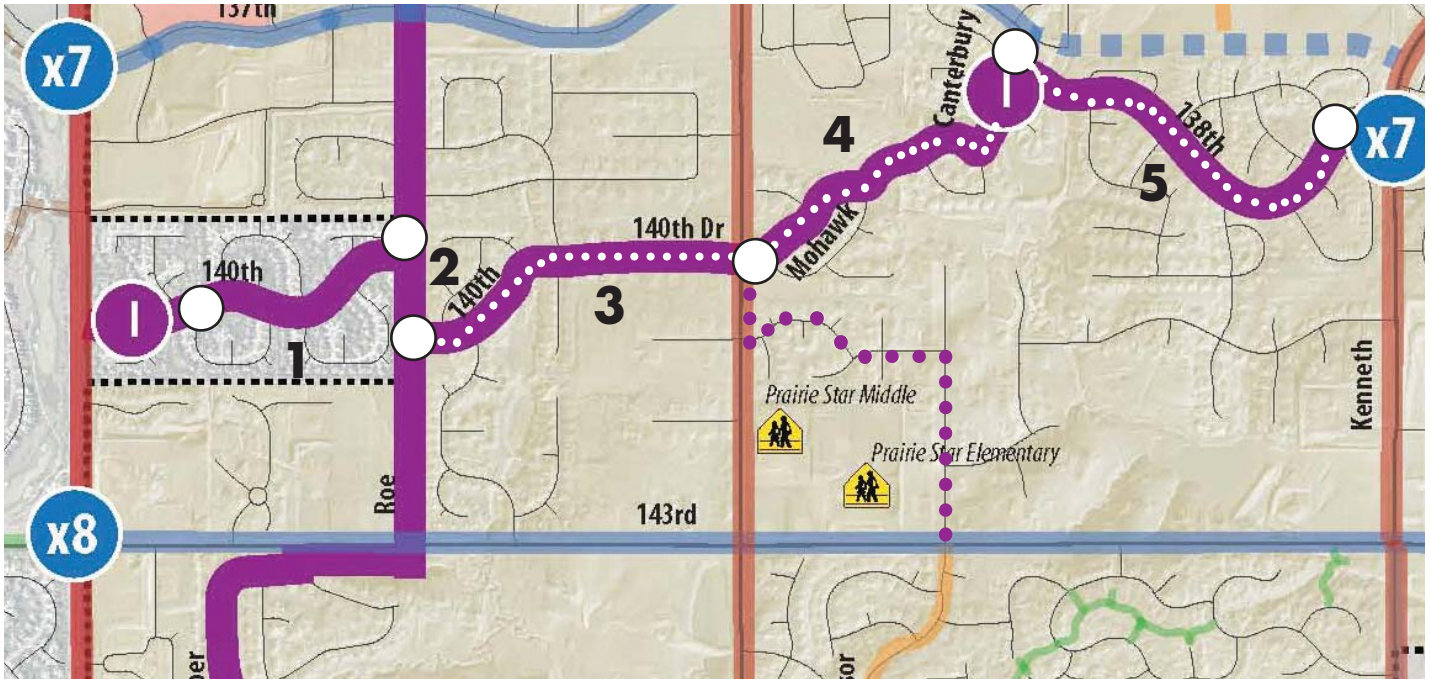


SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
6	Roe, 137th to 143rd streets	0.80	4-lane minor arterial, tapering to two lane south of 138th Terrace, 53 feet narrowing to 36 feet.	Good condition, continued maintenance	NA	On-road option by continuing sidepath to 138th Terrace,, and bike lanes with 12 foot travel lanes south to 143rd.	Retention of bike lanes, continuation of sidepath to 143rd. Ultimate reconstruction of Roe to complete street standards.
7	143rd Street, Roe to Juniper	0.34	3-lane complete street with bike lanes after reconstruction project.	Existing sidewalks need improvement Address ADA issues Gaps in sidewalk network	7,000-13,000	Bike lanes and sidepath included in current project.	Same as Short Term
8	Cedar/Juniper, 143rd to 148th	0.50	2-lane local residential streets, 25 feet	Existing sidewalks need improvement Gaps in sidewalk network	NA	Sharrows	Same as Short Term
9	Rosewood, 148th to 151st	0.52	2-lane local residential streets, 25 feet	Existing sidewalks need improvement Gaps in sidewalk network	NA	Sharrows	Same as Short Term
10	151st, Rosewood to shopping center entrances	0.10	2-lane widening to 3-lane at Nall intersection, 24 feet to 50 feet	No sidewalks	NA	Interim path connecting Rosewood to shopping centers.	Reconstruction of 151st as a complete street with pedestrian and bicycle infrastructure incorporated into design.

BICYCLE BOULEVARD

1 140TH STREET

North



SEGMENT KEY	SEGMENT	LENGTH (MILES)	STREET TYPE AND WIDTH	SIDEWALK CONDITION	2013 ADT	SHORT TERM OPTIONS	ULTIMATE DESIGN
1	140th, Nall to Roe (Overland Park)	0.50	2-lane residential collector, 32 feet	Unknown	NA	Sharrows, but depends on recommendations of OP bicycle Master Plan	Same as Short Term
2	Roe, 140th to 140th jog	0.10	2-lane minor arterial, 36 feet	Good condition, continued maintenance	under 8,000	12-foot travel lanes with bike lanes	Retention of bike lanes with sidepath on west side of street and improved 140th Street crossing into Leawood
3	140th/140th Drive, Roe to Mission	0.60	2-lane local residential streets, 22 to 27 feet, with break in the middle to discourage through traffic. Walkway links two cul-de-sacs.	Gaps in sidewalk network Connection to schools	NA	Sharrows	Same, with widening of sidewalk to pathway standards
4	140th/Mohawk/ Canterbury, Mission to 138th	0.55	2-lane local residential street system, 25 feet typical	Gaps in sidewalk network	NA	Sharrows for wayfinding	Same as Short Term
5	138th, Canterbury to Kenneth	0.70	2-lane residential collector, 34 feet	Gaps in sidewalk network	NA	Sharrows	Bike lanes or striped parking lane with sharrows in travel lane.

TRAIL PROJECTS RECAP

Edge of Corinth School campus, between 83rd Street and Mission Road

x1 A

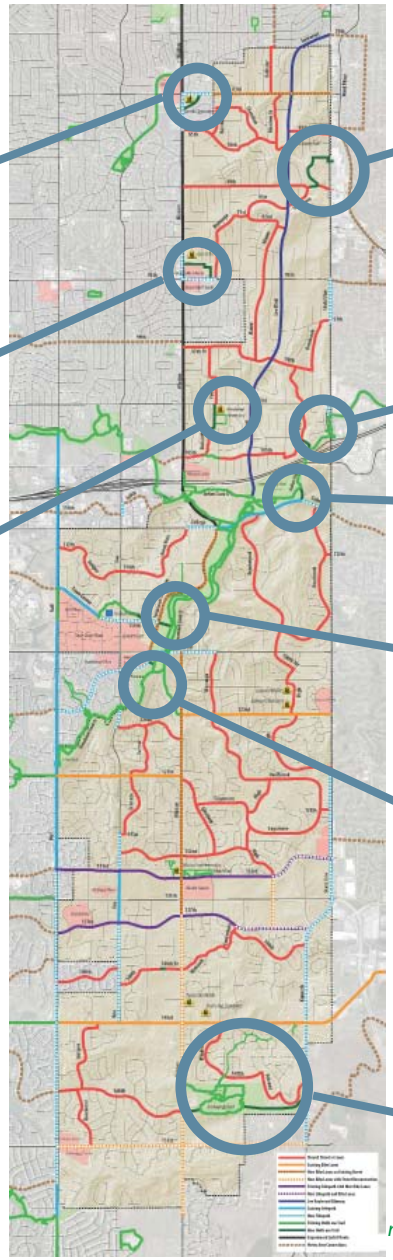
Perimeter of Ranch Mart North lot, linking 95th and Mission Road

2

New connection from 105th and Mohawk Street to Brookwood Elementary School

B

Most of the trail projects on exclusive right-of-way (as opposed to sidepaths along streets) are short projects associated with and extending connections from the system's individual routes. This recap summarizes these trail projects and identifies the routes that they are either part of or extend. The Ironwoods Trail concepts extends the current park trails to Mission Road (Route 4) and Kenneth Road (Route 5).



Link from Ward Parkway Center, under tunnel, around parking lot perimeter to pedestrian bridge and 89th Street

2

Bridge between 105th and Sagamore and Indian Creek Trail and 103rd and State Line. Trail using unpaved road between College Boulevard and Indian Creek Trail

x4 C

City Hall Park Trail to 117th Street, and 117th Street connection to Tomahawk Creek Trail

D

Bridge from Tomahawk Creek Trail to Town Center Crossing

E

Extension of Ironwoods Park Trails to Mission Road and Kenneth Road

4 5

Priorities and Implementation

The proposed Leawood bikeways network will be implemented in phases, and will almost certainly evolve over time. However, this plan establishes both an initial phase that guides activity during the next five years, and a concept for how the network emerges incrementally from that foundation. The sequencing of phases and specific routes proposed here follows these criteria and principles:

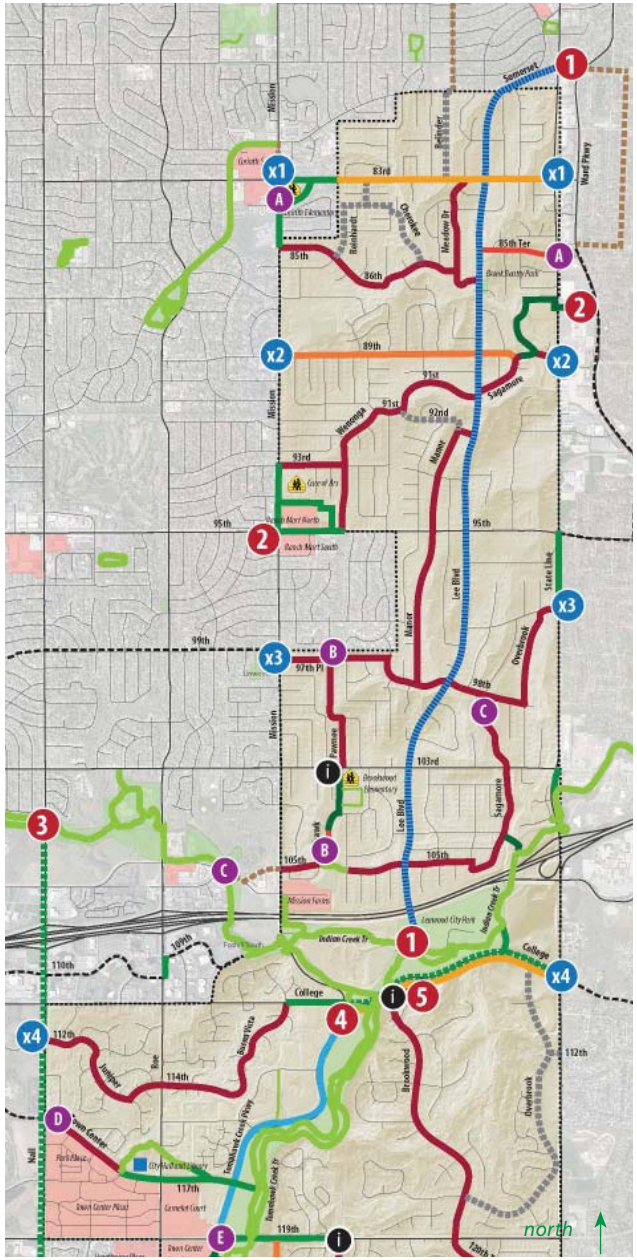
- **Response to demands.** In every phase, high priority routes should address existing demand patterns, and serve destinations that are valuable to users and appropriate endpoints for bicycle transportation. The survey results summarized in Chapter 2 provide valuable information on the importance of various destinations.
- **Route integrity.** High priority routes and projects should provide continuity between valid endpoints such as destinations and trails. When developed incrementally, routes should not leave users at loose ends.
- **Extensions of existing facilities.** Projects that make use of and extend the reach of key existing facilities that need attention,.
- **Gaps.** Small projects that fill gaps in current facilities or tie relatively remote neighborhoods to the overall system can be especially useful at early stages n the system's development.
- **Opportunities.** The implementation sequence should take advantage of street projects, resurfacing and street rehabilitation projects, and other infrastructure projects.
- **Relative ease of development.** It is important that the a useful system be established relatively quickly and at comparatively low cost. Routes that require major capital cost or lead to neighborhood controversy should be deferred to later phases, when precedents are established and the network becomes part of Leawood's urban landscape.

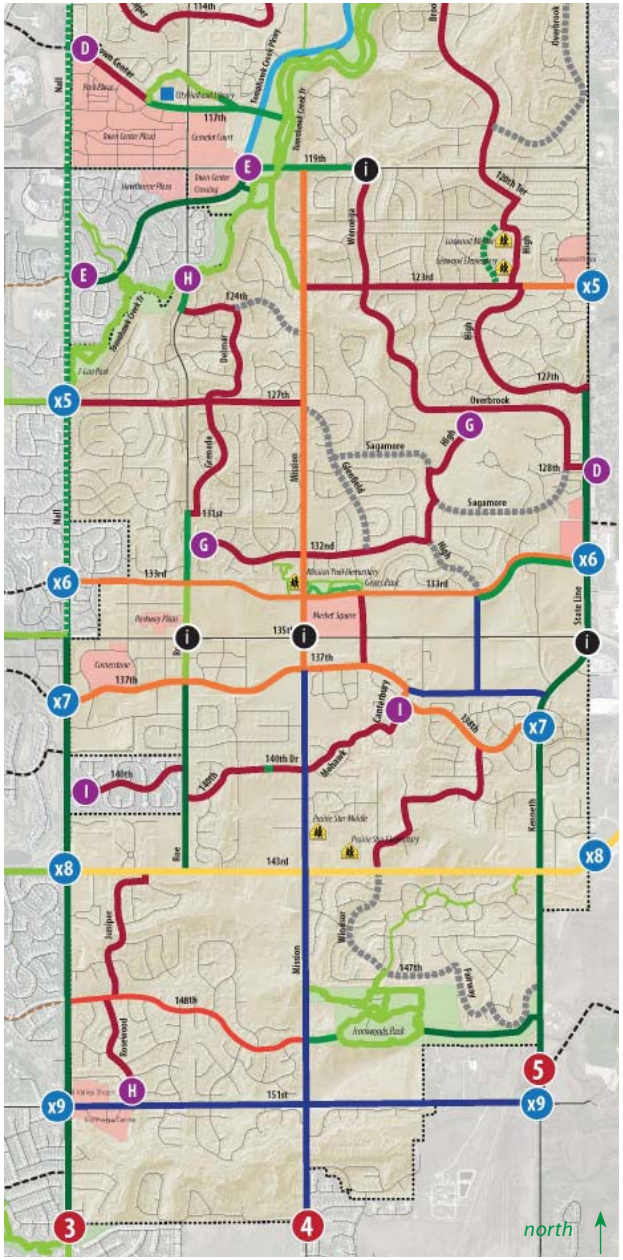
While ease of development should not supersede other key factors, it is nevertheless a key strategic factor as Leawood begins to put its system on the ground. Projects or routes that perform well on other criteria and are relatively easy and inexpensive to achieve can provide early, substantive accomplishments that build future momentum.

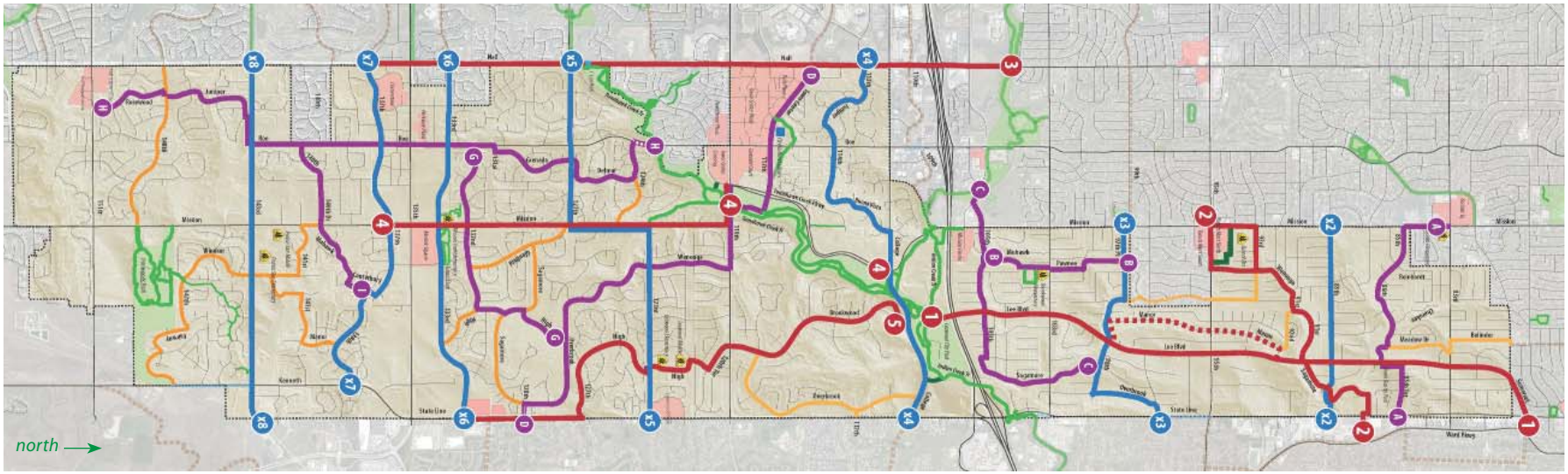
Developability helps determine priorities. The initial system should serve major destinations and provide good connectivity while minimizing large scale projects. Thus, the conceptual overall system was evaluated according to developability categories, which include:

- **Implementation without change.** These segments can be put in place with minimum change, primarily pavement markings and supporting graphics. They involve the lowest cost and least impact. Typical examples are streets with sharrows or enough width for bicycle lanes without other lane modifications.
- **Implementation with minor changes.** These segments and routes typically involve lane reconfigurations, such as narrower lanes, or parking change, such as possible limitation of parking to one side of the street. However, they do not require changes in the number of available travel lanes.
- **Major lane modifications.** These segments use existing street channels, but require major lane modifications such as road diets that reduce the number of available lanes while still remaining fully capable of accommodating current traffic volumes.
- **Minor roadway widening.** These road segments widen existing streets to provide shoulders or bicycle lanes.
- **Major roadway construction.** These projects include new streets or major reconstructions of existing streets, designed as complete streets to include bicycle and pedestrian accommodations.

- **Connecting links.** These on-street links connect major routes in the system. Typically, they fall within the "implementation without change" category, requiring only pavement markings and information and identification graphics.
- **Projects under development.** These segments are opportunities that take advantage of projects either under construction or in the short-term pipeline.
- **Existing trails.** These facilities are in place and are incorporated into the bicycle transportation system in their current form.
- **Minor path development and gap filling.** These separated segments include short pathways that fill gaps in the system or relatively short stretches of new sidepaths or cycle tracks within existing right-of-way.
- **Intersection Projects.** These projects involve intersections of a bikeway route with a major arterial street. These projects generally include refuge medians or short cycle tracks that resolve offset intersections.







Initial system: 2015-2020

SEQUENCING

The Sequencing Map combines the developability categories with the other priority criteria to stage the network in two time periods. Complete system development may occur within ten years, suggesting two five-year development phases. Actual implementation depends on the amount of available funding. However, early program phases include the most immediately developable routes or route segments, with later stages involving major regional trails, and street reconstructions.

Initial System: The Starting Point

While the City and the user community will help to determine the order of projects within each phase, the system must start to emerge with some specific routes and route segments. This pilot system establishes the foundation of the ultimate network, and should provide maximum impact for minimum initial investment, link all parts of the city, and serve proven destinations and traffic patterns. Because many of the Leawood routes largely involve adaptation and wayfinding on existing street with minimum change, much of the proposed system can be implemented within a five year period.

The Phase One System

Phase One, encompassing development between 2015 and 2020, includes the following components:

Principal Lines

- **Route 1**: Improvements to Lee Boulevard with minor widenings and lane realignment to provide climbing shoulders between Somerset and 103rd. Wayfinding directions for the "quiet" route along parallel Manor Road.
- **Route 2**: Completion of route including pathway access from Ward Parkway Center to 89th Street.
- **Route 3**: Upgrade of sidepath with intersection enhancements and wayfinding from Indian Creek Trail to 137th Street.
- **Route 4**: Lane modifications of Mission Road between 119th and 137th to provide bike lanes. Connection of Mission Road lanes to Tomahawk Creek Trail
- **Route 5**: Completion of route from College to 133rd Street, including State Line sidepath between 127th and 133rd.

Crosstown Routes

- **Route x2**: Completion of route.
- **Route x3**: Completion of route.
- **Route x4**: Completion of route with short-term improvements to College Blvd., primarily adapting existing sidewalk between Tomahawk Creek and State Line. Trail connection between College and Indian Creek Trail using unpaved park road.
- **Route x5**: Completion of route.
- **Route x6**: Completion of route with sidepath on south side of 133rd from High to State Line.
- **Route x7**: Completion of route on 137th from Nall to Canterbury, with interim use of 138th to State Line.
- **Route x8**: Completion of route with 143rd Street reconstruction.

Bicycle Boulevards

- **Route A**: Completion of route, including sidepaths at Corinth School.
- **Route B**: Completion of route, with short trail segment from Mohawk through Brookwood School site.
- **Route C**: Completion of route.
- **Route D**: Completion of route, includes sidepath extension along 117th Street and 119th links specified in Route 4.
- **Route G**: Completion of route.
- **Route H**: Completion of route. Major investments in sidepath extensions along Roe.
- **Route I**: Completion of route.

Trails

- Mohawk to Brookwood School Trail. (Route B)
- Ranch Mart/Cure of Ars Perimeter Path (Route 2)
- College to Indian Creek Trail Link (Route x4): Completion of route.
- Town Center/City Hall Park to Tomahawk Creek Trail Link (Route D)
- Tomahawk Creek Trail bridge to Tomahawk Creek Parkway/ Town Center Crossing
- Ironwoods Trail link to Mission Road via Fire Station site

Connecting Links

- Belinder/Meadow, city line to 86th
- 92nd, 91st to Manor
- Chadwick/Aberdeen/Ensley, 93rd to 97th Pl.
- Overbrook, College to Brookwood
- 124th, Delmar to Mission
- Glenfield, Mission to 132nd
- Sagamore, Glenfield to 128th
- High, 132nd to 133rd
- Pawnee, 133rd to 137th
- Manor/141st/Canterbury/142nd, 138th to Windsor
- 141st/Windsor, Mission to 143rd
- Windsor/147th/Fairway, 143rd to Kenneth
- 148th, Nall to Mission

Circle Route: Phase One elements will complete the circle route.

Opinion of Probable Cost for Ten-Year Network*

ROUTES	OPINION OF PROBABLE COST
PRINCIPAL LINES	
1 Lee Boulevard Bikeway	$597,000
2 Ward Parkway to Ranch Mart	$192,280
3 Nall	$1,255,000
4 Mission	$639,600
5 Eastside	$500,800
Subtotal	$3,184,680
CROSSTOWN ROUTES	
x1 83rd	$39,600
x2 89th	$28,300
x3 98th	$21,450
x4 College	$135,130
x5 123rd/127th Street	$15,000
x6 133rd Street	$69,000
x7 137th Street	$54,500
x8 143rd Street	$0
x9 151st Street	$16,000
Subtotal	$378,980
BICYCLE BOULEVARDS	
A 85th Street	$136,850
B Brookwood	$108,550
C 105th/Sagamore	$25,220
D Town Center	$342,580
E Tomahawk Creek Parkway	$16,770
G 132nd Street	$23,400
H Westside	$233,580
I 140th Street	$33,550
Subtotal	$920,500
TOTAL	$4,484,160

Phase Two

Phase Two expands and enhances the basic system established during the first five years, and features significant new multi-modal development along major street corridors.

Principal Lines

- **Route 3**: Completion of route with extension of enhanced sidepath to city line at 155th.
- **Route 4**: Completion of route with Tomahawk Creek Parkway bike lanes and reconstruction/widening of Mission Road between 137th and city line at 155th.
- **Route 5**: Completion of route with enhanced sidepath to 151st.

Crosstown Routes

- **Route x1**: Completion of route.
- **Route x7**: Completion of route with construction of 137th to State Line
- **Route x9**: Completion of route with reconstruction of 151st to complete street standards.

Bicycle Boulevards

- **Route E**: Completion of route with Overland Park.
- **Route I**: Completion of route with Overland Park.

Trails

- Sagamore/105th link to Indian Creek Trail via pathway and bridge. (Route C)
- Ironwoods Trail extension to Kenneth Road

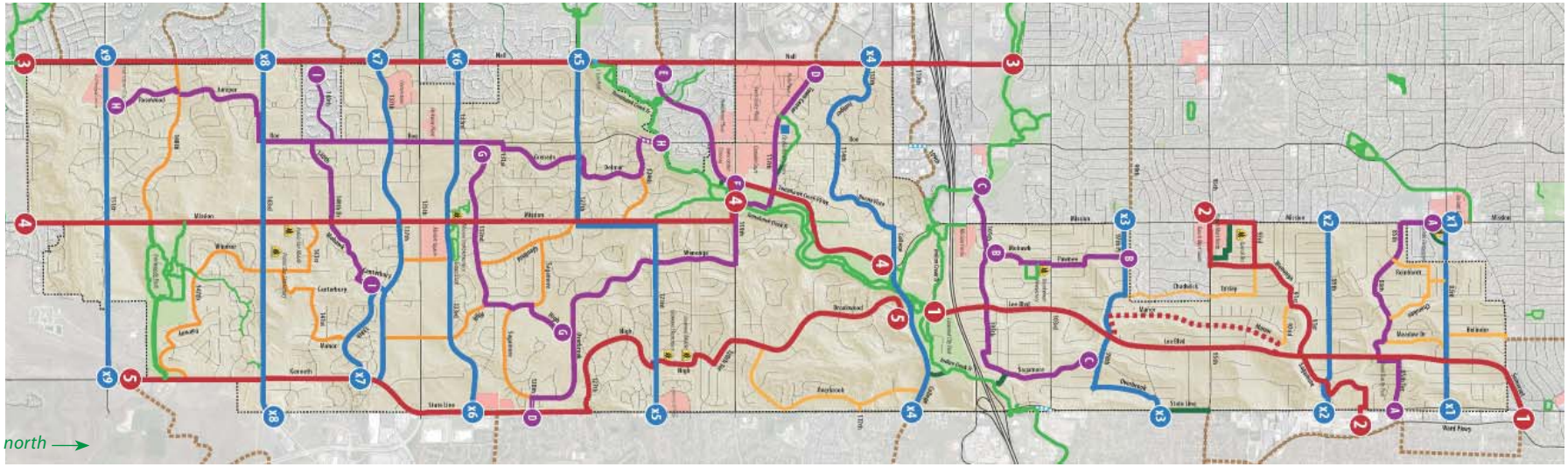
Connecting Links

- Belinder/Cherokee, 83rd to 86th
- High Drive extension with development, 133rd to 137th

*** Based on Short Term Options**

Costs do not include projects involving major street reconstruction

Phase Two: 2020-2025



Ultimate System: Completion by 2025

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
1 Lee Boulevard*	1	Somerset to 89th Street	1.2	Restriping to provide 10.5-foot travel lanes, with minor realignment on climbs to provide minimum 4-foot climbing shoulder in uphill direction.	$30,000	$36,000
	2	89th to 103rd Street	1.8	Continuation of Somerset to 89th concept with minor widening where necessary to meet minimum standards. Provide quiet street option between 92nd and 98th Streets via Manor Road.	$300,000	$540,000
	3	103rd Street to Indian Creek Trail/City Park	0.7	Sharrows on residential segment between I-435 and 103rd Street. Bike lanes on bridge. Bike lanes on 30-foot section south of I-435, with 10.5-foot travel lanes	$30,000	$21,000
Total Cost						$597,000*

**Cost for Lee Boulevard is expected to be part of existing planned roadway improvements.*

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
2 Ward Parkway to Ranch Mart	1	Ward Parkway Tunnel	0.2	Sharrows on roadway with consent of mall	$13,000	$2,600
	2	Ward Parkway Center overflow lot	0.2	Cycle track using surplus pavement around periphery of lot. Alternative is to develop new path on open space around the lot.	$34,000	$6,800
	3	Indian Creek Tributary/2020 Building parking lot	0.16	Multi-use path between parking lot edge and creek	$325,000	$52,000
	4	Trail bridge and path to 89th Street	0.15	Utilize existing bridge; new multi-use path with ADA compliant grades to 89th Street cul-de-sac	$325,000	$48,750
	5	89th Street cul-de-sac and Sagamore Road, 89th to Lee Boulevard	0.26	Sharrows; Lee Boulevard Bikeway treatment (Route 1) between Sagamore and 91st with marked pedestrian/bike crossing	$13,000	$3,380
	6	91st, Lee Boulevard to Wenonga Road	0.52	Sharrows	$13,000	$6,760
	7	Wenonga Road 91st to 95th	0.6	Sharrows	$13,000	$7,800
	8	95th, Wenonga to edge of Ranch Mart parking lot	0.04	Widen sidewalk to sidepath standards	$200,000	$8,000
	9	Ranch Mart parking lot	0.16	Terminate path at parking lot, sharrows in drive aisles to define bike route. Improved pedestrian crossing of 95th Street using median as refuge.	$13,000	$10,080
	10	Ranch Mart parking lot	0.17	Sharrows in drive aisle of rear bay of parking lot	$13,000	$2,210
	11	Mission Road, Shopping center parking lot to 93rd Street	0.2	Widen east side sidewalk to sidepath standards	$200,000	$40,000
	12	93rd, Mission to Wenonga	0.3	Sharrows	$13,000	$3,900
Total Cost						$192,280

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
x1 83rd	1	83rd, Mission to Prairie Village /Leawood City Line	0.2	Sharrows. Cemetery restriction and necessity for a left-turn lane complicate adequate solution for less capable cyclists.	$13,000	$12,600
	2	83rd, City Line to State Line Road	0.9	11-foot travel lanes with bike lanes. Shared through lane where left-turn lane is provided.	$30,000	$27,000
x2 89th	3	89th, Mission to Lee Boulevard	0.9	10-foot travel lanes with 4-foot shoulder/bike lane; or sharrows with supporting share the road signage	$30,000	$27,000
	4	89th, Lee to cul-de-sac	0.1	Sharrows, merges with Principal Line 2 at cul-de-sac	$13,000	$1,300
x3 98th	1	98th, Mission to Ensley Lane	0.5	Sharrows	$13,000	$6,500
	2	Ensley/98th Street to Overbrook	0.68	Sharrows	$13,000	$8,840
	3	Overbrook, 98th to 97th	0.4	Sharrows	$13,000	$5,200
	4	97th, Overbrook to State Line	0.07	Sharrows	$13,000	$910
Total Cost						$89,350

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
A 85th Street	1	Corinth School site, 83rd to Mission	0.25	Path along south edge of school site, following Howe Drive	$325,000	$81,250
	2	Mission Road, Corinth site to 85th	0.2	Widen sidewalk to enhanced sidepath standards	$200,000	$40,000
	3	85th/Ensley/86th/Meadow Drive, Mission to Lee Boulevard	0.9	Sharrows	$13,000	$11,700
	4	Lee Boulevard, Meadow to 85th Terrace	0.1	See Principal Route 1		$-
	5	85th Terrace, Lee to State Line	0.3	Sharrows	$13,000	$3,900
Total Cost						$136,850

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
B Brookwood	1	105th/Mohawk, Mission to end of cul-de-sac	0.4	Sharrows	$13,000	$5,200
	2	Mohawk, cul-de-sac to 103rd Terrace	0.1	Convert to paved, multi-use path	$325,000	$32,500
	3	Brookwood School site, 103rd Terrace to 103rd Street	0.2	New multi-use path through school site, probably on west side; connection to paths within school land.	$325,000	$65,000
	4	Pawnee Lane, 103rd to 101st	0.2	Sharrows	$13,000	$2,600
	5	101st, 101st Pawnee to 101st Mohawk	0.05	Sharrows	$13,000	$650
	6	Mohawk, 101st to 97th Pl	0.2	Sharrows	$13,000	$2,600
Total Cost						$108,550

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
C 105th / Sagamore	1	105th, Indian Creek Pkwy to Mission Farms access drive/Mohawk	0.4	Sharrows	$13,000	$5,200
	2	Trail, Mohawk Street to 105-Mohawk Lane	0.09	Same as existing	$-	$-
	3	105th, Mohawk Lane to High Drive	0.6	Sharrows	$13,000	$7,800
	4	High Drive/Sagamore Road, 105th to 98th	0.94	Sharrows	$13,000	$12,220
	5	Trail link and bridge, Sagamore to Indian Creek Trail	0.08	None	$-	$-
Total Cost						$25,220

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
3 Nall*	1	Indian Creek Trail to Tomahawk Creek Trail (Common boundary between Leawood and Overland Park)	2.6	Enhanced sidepath with clearly demarcated crossings, advisory signage to motor vehicles at intersections and driveways of path presence. Improve wayfinding with directions to destinations and routes in both Leawood and Overland Park.	$100,000	$260,000
	2	119th to 135th	1.2	Enhanced sidepath with clearly demarcated crossings, advisory signage to motor vehicles at intersections and driveways of path presence. Improve wayfinding with directions to destinations and routes in both Leawood and Overland Park.	$100,000	$120,000
	3	135th to City Line	2.5	Extend enhanced sidepath to city limit.	$350,000	$875,000
Total Cost						$1,255,000*

**Cost for Nall Avenue is expected to be shared with Overland Park. Leawood's share is $627,500 of the total $1,255,000.*

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
4 Mission*	1	Tomahawk Creek Parkway, College to 119th	1.2	Use of adjacent Tomahawk Creek Trail from College to 119th Street	$8,000	$9,600
	2	119th, Tomahawk Creek to Mission	0.2	Path connection adjacent to park from TC Pkwy to Tomahawk Creek Trail. Existing bridge under 119th Street, with access to south side of street. Widen south side sidewalk to enhanced sidepath standard to Mission Road.	$350,000	$70,000
	3	Mission Road, 119th to 135th	2	2 11-foot travel lanes with 4-5 foot bike lanes	$30,000	$60,000
	4	Mission Road, 135th to City Line	2.5	Possible widening of west side sidewalk to sidepath standard.	$200,000	$500,000
Total Cost						$639,600*

**Costs for segment 4 of Mission Road is expected to be part of existing planned roadway improvements. The total cost, without segment 4, is $139,600.*

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
5 Eastside	1	Brookwood, College to 119th	1.25	Shared, striped parking/bike lane, eight feet on each roadway. Sharrows on segment with no median. Improved pedestrian crossing to College Boulevard, using median west of intersection as refuge area	$30,000	$57,500
	2	Belinder Road/High Drive, 119th to Leawood Middle School campus	0.3	Improve pedestrian/bicycle crossing of 119th. Sharrows on streets.	$13,000	$23,900
	3	School campus, High Drive to 123rd	0.35	Widen to standard ten foot path. Mark transition to 123rd Street bike lanes.	$30,000	$10,500
	4	High Drive/127th, 123rd to State Line Road	1	Sharrows	$13,000	$13,000
	5	State Line Road, 127th to 135th	1.1	Enhanced sidepath, with improved crossing definition at 135th Street intersection.	$350,000	$385,000
	6	State Line/Kenneth Road, 135th to 143rd	1.1	Sidewalk use	$8,000	$8,800
	7	Kenneth Road, 143rd to city line	0.7	None	$3,000	$2,100
Total Cost						$500,800

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
x4 College	1	112th/Juniper/114th, Nall to Roe	0.68	Sharrows	$13,000	$8,840
	2	114th/Buena Vista, Roe to College	0.83	Sharrows	$13,000	$10,790
	3	College, Buena Vista to Mission/Tomahawk Creek Pkwy	0.2	Expand sidewalk on south side to enhanced sidepath standard. Clarify trail access at Mission Road intersection.	$200,000	$40,000
	4	College Boulevard, Mission to State Line	1	Use north side sidewalk as combination walkway/bikeway with advisory signage.	$15,000	$19,000
	5		0.15	Improve park road west of Overbrook intersection to link path to Indian Creek Trail	$350,000	$56,500
Total Cost						$135,130

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
x5 123rd / 127th Street	1	127th, Nall to Mission	1	Existing bike lanes	$-	$-
	2	Mission, 123rd to 127th	0.5	Installation of bike lanes.	$30,000	$15,000
	3	123rd Street, Mission to State Line	1.2	Existing bike lanes	$-	$-
Total Cost	$15,000					

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
x6 133rd Street	1	Nall to Mission	1	Install bike lanes, converting to sharrows at intersections with left turn lanes.	$30,000	$30,000
	2	Mission to High Drive	0.7	Install bike lanes, converting to sharrows at intersections with left turn lanes.	$30,000	$21,000
	3	High Drive to State Line	0.6	Install bike lanes, converting to sharrows at intersections with left turn lanes.	$30,000	$18,000
Total Cost	$69,000					

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
X7 137th Street	1	Nall to Mission	1	Install bike lanes, converting to sharrows at intersections with left turn lanes.	$30,000	$30,000
	2	Mission to Chadwick	0.6	Install bike lanes, converting to sharrows at intersections with left turn lanes.	$30,000	$18,000
	3	Chadwick to Kenneth Road	0.5	Use Canterbury/138th Street route as shared right of way to Kenneth Road.	$13,000	$6,500
Total Cost						$54,500

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
X8 143rd	1	143rd, Nall to Kenneth	2	In process of reconstruction with bike lanes.	$-	$-
Total Cost						$-

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
X9 151st Street	1	151st, Nall to Kenneth	2	Direct bicycle use to 148th Street between Nall and Mission and through Ironwoods Park.	$8,000	$16,000
Total Cost						$16,000

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
D Town Center	1	Town Center Drive/117th Street, Nall to Roe	0.6	Fill sidepath gap between 117th and Roe, probably on north side, Establish a well-defined crossing at trail access paralleling City Hall parking lot.	$300,000	$180,000
	2	117th, Roe to Tomahawk Creek Parkway	0.4	Sidepath on north side, with junction to City Hall Park Trail. Continue route with defined crossing of Tomahawk Creek Parkway. Use existing drive for access to Tomahawk Creek Trail.	$300,000	$120,000
	3	Tomahawk Creek Trail, 117th to 119-Mission	0.46	Existing trail with crossing under 119th Street and sidepath on south side of 119th to Mission.	$8,000	$3,680
	4	119th, Mission to Wenonga	0.25	Sidewalk use for connection	$8,000	$2,000
	5	Wenonga Lane, 119th to 123rd	0.5	Striped combination parking lane 8 feet from curb. Sharrows in travel lane Lane also serves as pedestrian area when sidewalks are not present.	$30,000	$15,000
	6	Overbrook Road, 123rd to 128th	1.5	Sharrows	$13,000	$19,500
	7	128th, Overbrook to State Line	0.08	Bike Lanes to announce bicycle boulevard	$30,000	$2,400
Total Cost						$342,580

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
E Tomahawk Creek Parkway	1	TC Parkway, Nall to Roe (Overland Park)	0.7	Sharrows	$13,000	$9,100
	2	TC Parkway, Roe to 119th	0.29	Sharrows.	$13,000	$3,770
	3	TC Parkway, 119th to 117th	0.3	Use of adjacent Tomahawk Creek Trail.	$13,000	$3,900
Total Cost						$16,770

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
G 132nd Street	1	132nd Street, Roe to High	1.1	Sharrows.	$13,000	$14,300
	2	High Drive, 132nd to Sagamore	0.2	Sharrows. High south of 132nd is a neighborhood connector to 133rd Street.	$13,000	$2,600
	3	Sagamore, High Drive south to High Drive north	0.1	Sharrows	$13,000	$1,300
	4	High Drive, Sagamore to Overbrook	0.4	Sharrows	$13,000	$5,200
Total Cost						$23,400

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
H Westside	1	Roe, Tomahawk Creek Trail to 124th	0.2	Walking connection on east side sidewalk to south approach of creek bridge. Widening of sidewalk to back of curb for maximum clearance.	$300,000	$60,000
	2	124th/Delmar/126th Terrace/Grenada, Roe to 127th	0.69	Sharrows.	$13,000	$8,970
	3	Grenada/131st, 127th to Roe	0.55	Sharrows	$13,000	$7,150
	4	Roe, 131st to 133rd	0.3	Widening of east side sidewalk to sidepath width if possible, with crossing at 133rd Street signal.	$200,000	$60,000
	5	Roe, 133rd to 137th	0.4	Existing sidepath with enhancements for clarity.	$4,000	$1,600
	6	Roe, 137th to 143rd streets	0.8	On-road option by continuing sidepath to 138th Terrace,, and bike lanes with 12 foot travel lanes south to 143rd.	$30,000	$24,000
	7	143rd Street, Roe to Juniper	0.34	Bike lanes and sidepath included in current project.	$30,000	$10,200
	8	Cedar/Juniper, 143rd to 148th	0.5	Sharrows	$13,000	$6,500
	9	Rosewood, 148th to 151st	0.52	Sharrows	$13,000	$6,760
	10	151st, Rosewood to shopping center entrances	0.1	Interim path connecting Rosewood to shopping centers.	$300,000	$30,000
Total Cost						$215,180

INITIAL BIKEWAYS NETWORK: OPINION OF PROBABLE COST

ROUTE	SEGMENT		LENGTH (MILES)	INFRASTRUCTURE TYPE	UNIT COST	COST
I 140th Street	1	140th, Nall to Roe (Overland Park)	0.5	Sharrows, but depends on recommendations of OP bicycle Master Plan	$13,000	$6,500
	2	Roe, 140th to 140th jog	0.1	12-foot travel lanes with bike lanes	$30,000	$3,000
	3	140th/140th Drive, Roe to Mission	0.6	Sharrows	$13,000	$7,800
	4	140th/Mohawk/Canterbury, Mission to 138th	0.55	Sharrows for wayfinding	$13,000	$7,150
	5	138th, Canterbury to Kenneth	0.7	Sharrows	$13,000	$9,100
Total Cost						$33,550

CHAPTER 7

SUPPORT SYSTEMS

WHILE PREVIOUS CHAPTERS HAVE FOCUSED ON THE DESIGN AND CHARACTER OF A BIKEWAYS NETWORK, INFRASTRUCTURE BY ITSELF DOES NOT CREATE AN EXCELLENT BICYCLE TRANSPORTATION PROGRAM. To guide communities, the League of American Bicyclists (LAB), through its Bicycle Friendly Communities (BFC) program, establishes five components of design that are used to determine whether a city should be awarded BFC status – the 5 E's of Engineering, Education, Encouragement, Enforcement, and Evaluation.

According to the League, the evaluative elements of the 5 E's are:

- **ENGINEERING**: Evaluating what is on the ground and has been built to promote cycling in the community. Areas of evaluation include:
  - Existence and content of a bicycle master plan.
  - Accommodation of cyclists on public roads.
  - Presence of both well-designed bike lanes and multi-use paths in the community.
  - Availability of secure bike parking.
  - Condition and connectivity of both the off-road and on-road network.
- **EDUCATION**: Determining the amount of education available for both cyclists and motorists. Education includes:
  - Community programs teaching cyclists of all ages how to ride safely in any area from multi-use paths to congested city streets.
  - Education for motorists on how to share the road safely with cyclists.
  - Availability of cycling education for adults and children.
  - Number of League Cycling Instructors in the community.
  - Distribution of safety information to both cyclists and motorists in the community, such as bike maps, tip sheets, and as a part of driver's education manuals and courses.
- **ENCOURAGEMENT**: Concentrating on promotion and encouragement of bicycling. Areas of evaluation include:
  - Programming, such as Bike Month and Bike to Work Week events.
  - Community bike maps and route finding signage.
  - Community bike rides and commuter incentive programs.
  - Safe Routes to School programs.
  - Promotion of cycling or a cycling culture through off-road facilities, BMX parks, velodromes, and road and mountain bicycling clubs.
- **ENFORCEMENT**: Addressing connections between the cycling and law enforcement communities, addressing:
  - Liaisons between the law enforcement and cycling communities.
  - Presence of bicycle divisions of the law enforcement or public safety communities.
  - Targeted enforcement to encourage cyclists and motorists to share the road safely.
  - Existence of bicycling related laws, such as those requiring helmet or the use of sidepaths.
- **EVALUATION & PLANNING**: Considering programs in place to evaluate current programs and plan for the future, including:
  - Measuring the amount of cycling taking place in the community.
  - Tabulation of crash and fatality rates, and ways that the community works to improve these numbers.
  - Presence, updating, and implementation of a bicycle plan, and next steps for improvement.

Most of this plan addresses the Engineering aspect of bicycle programming. But the "soft" systems, namely the other four E's, are critical to taking full advantage of infrastructure investments, improving the effectiveness and safety of bicyclist, and making Leawood a truly bicycle friendly community. The following discussion provides recommendations for the support systems for bicycling in the city, organized around the LAB's five categories of bicycle friendliness.

ORGANIZATIONAL INFRASTRUCTURE

A truly successful bicycle transportation program will require an organizational infrastructure that will grow over time. This framework must do several things, including advise decision makers in and out of city government, organize programs, advocate for pedestrian and bicycle interests, market educational efforts, and serve as a central point of communication for the bicycling community.

An active transportation advisory committee (ATAC). This committee will initially act as a link between the active transportation community and city and county governments, with a scope that includes review of city, school and other public projects that affect or address bicycle/pedestrian access, identifying and addressing problems, advising city staff on specific issues, and assisting with public and private implementation of this plan. Leawood's Bicycle Friendly Committee could be folded into this group, while involving representatives for pedestrians. Other responsibilities are likely to emerge over time, potentially including such areas as legislation, technical planning, and educational programs.

An ATAC should be formally established in city government by executive order or city council resolution to give it somewhat permanent status, and should meet on a regular basis. Formal status sends the message that the committee is taken seriously and its interests are a recognized part of Leawood's transportation picture. It might also be logical to consider the ATAC to be a regional body that also advises the Mid-American Regional Council.

A bicycle/pedestrian coordinator. This position provides a consistent presence within city government for bicycle and pedestrian initiatives. Typically, the coordinator staffs the advisory committee, is critically involved in implementation and technical design of components of this plan, initiates and prepares grant applications, works with civic and private sector groups on programs, reviews development applications and projects, and generally becomes the public face for active transportation in the city. In Leawood, this responsibility may be assigned to an existing staff member with a particular interest in active transportation, or new part-time staff member, or staff in an allied organization such as the regional planning agency. This will reduce cost while still providing functional partnerships with departments and agencies that touch this vital area. These departments include Engineering, Operations and Maintenance, Parks and Recreation, Development Services, the regional planning agency, county government, the Kansas Department of Transportation, and private organizations. In many cases, funding for a bicycle/pedestrian coordinator comes in whole or in part from outside city government, such as health organizations or corporations.

An active transportation advocacy group. Leawood is fortunate to have high quality bicycle retailers (Elite Cycling, BikeSource, and Leawood Bicycles), an organization like the Kansas City Metro Bicycle Club, and an active and highly knowledgeable community of bicyclists. Clubs or other community organizations are extremely important in coordinating specific programs such as education efforts, institutions such as bicycle cooperatives, special events, communications, and other actions in behalf of active transportation. Logical partners in advocacy include health providers, safety organizations and councils, and similar groups. In some cities, groups develop under the leadership of active living organizations.

Biking Rules. Excerpts from a street code to promote responsible urban cycling, developed by New York City's Transportation Alternatives advocacy organization.

EDUCATION

Increase the number of League Certified Instructors (LCI's) in Leawood. The League of American Bicyclists BikeEd program is recognized as the standard for bicycle safety education, and includes a variety of courses that serve young cyclists, recreational riders, and everyone up to road-hardened commuters. Successful operation of the program is dependent on one critical factor, however: the presence of local instructors. Therefore, a critical part of the program is training of instructors through the League Certification process. In this process, cyclists complete both prerequisite courses and a three-day course conducted by a specially trained instructor. Successful completion and passing written and on-road evaluations qualifies individuals as League Certified Instructors (LCI), who are then authorized to provide training to other cyclists. In addition to a cadre of instructors, a successful training program requires marketing and placement to match instructors with demand from schools, corporations, and other organizations. This can most appropriately be done through an advocacy or active living organization with staff to organize the education effort.

Integrate bicycle rules of the road into drivers education programs. Most drivers are unaware of the rights and responsibilities of vulnerable users such as bicyclists (as well as motorcyclists and pedestrians). These factors should be included in drivers education programs for new motorists and certification testing. In addition, a significant unit on bicycle, pedestrian, and motorcycle laws and behaviors should be included in defensive driving classes for drivers who have received citations for moving traffic violations. This often reaches motorists who may be most likely to drive inattentively or aggressively, and may be most likely to endanger cyclists.

Work with major employers to conduct on-site education programs. As part of efforts to encourage better employee health through greater active transportation, major employers often are willing to host BikeEd programs. Outreach and partnerships with companies to offer programs on-site can increase participation in bicycling, and assist employers with establishing an ethos based on healthy living.

Develop and implement bicycle education programs for kids. Young bicyclists perceive the riding environment differently from adults, and obviously have neither the visual perspective nor experiences of older riders. Schools and safety groups often offer "bike rodeos" which may or may not address the skills of riding even on local streets. The LAB's BikeEd program has a specific track that addresses these issues and skills, and they should be incorporated into these more frequently offered safety events.

Publish and post on-line an engaging and brief guide to safe bicycling. Information on safe urban cycling should be both ubiquitous and appealing to different audiences, including both motorists and bicyclists. Poor safety practices are both dangerous and bad for public relations, creating the possibility of backlash against cyclists. New York's Biking Rules program, an on-line guide to practice and law developed by the advocacy organization Transportation Alternatives, and a brief New York City DOT publication on safe riding are excellent examples. Chicago has published a safety booklet specifically targeted toward young cyclists. Leawood should develop similar guides, which also successfully avoid portraying bicycling as a hazardous activity.

Case Study

Comprehensive School-Age Pedestrian Safety Program. In response to a number of crashes involving school-aged children the Orange County, Florida's safety team initiated a curriculum for children K-12. The safety team was made up of volunteers from the Sheriff's Office, Police and Fire departments, engineers, the school board, and various other community groups; this strong conglomeration of people ensured that the group was heard and their call to action met. The curriculum was developed largely by the school board and launched with the help of the Sheriff's Office, spreading the message of safety in age appropriate ways. Elementary school children were guided by safety specialists through various situations that they would encounter on their walks to school. Older children in the middle schools and high schools were presented the material via posters, videos, books, presentations, and in-class assignments. The development and implementation of the program took roughly a year and a half. The program is a comprehensive approach given the background and disciplines of all those involved and its inclusion of safety procedures and the laws governing pedestrian activity in its creation.

ENCOURAGEMENT

Develop a bike share system. People may not always have access to a bicycle, and yet would still like to ride; a bike share system can help get would be cyclists on the road and riding. Locating stations around the city in strategic areas based on demographics and amenities can encourage people to ride instead of driving. Bike share systems are especially popular in downtown and urban districts, on and around college or university campuses, and at major trail head locations. Bike share systems allow the rider to use a bike for a flat fee or in many cases free use during a set window of time with charges being applied incrementally after the initial allotment. Washington DC has a bike share system with locations all across the National Mall, downtown, Arlington, and surrounding areas; the network hosts over 2,500 bikes across 300 plus stations. Riders receive the first 30 minutes of each trip free of charge.

Expand participation in active transportation through programs that engage corporations in competitions and fun, such as corporate commuter challenges. These programs track participation by number of trips and miles traveled during a multiple-month period, and give awards to winners at an event at the end of the period. Companies may be classified by size, so that competition is among similarly sized organizations. These challenge programs are successful by encouraging bicycle transportation within companies and in many cases produce a bicycle culture as companies compete against each other.

Institute a bike month celebration. Bike month events typically occur during May, and can involve a variety of activities, including short rides led by the mayor or other public officials, clinics on subjects such as riding technique and bicycle repair, special tour events, screenings of bicycle-related movies, and other programs.

Organize special rides that are within the capabilities of a broad range of riders and encourage family participation. On Memorial Day weekend, the Active Transportation Alliance's Bike the Drive closes Chicago's Lake Shore Drive for exclusive bicycle use for three hours on Sunday morning for cyclists to enjoy. During 2013, Omaha closed several streets in neighborhood business districts to celebrate bicycling and healthy living. In Madison, seven miles of downtown streets are closed to motor traffic for exclusive use by bicycles and pedestrians in a free event that attracts thousands. Many community rides and benefits have different lengths and routes to appeal to all ages. These events build interest, and make cycling comfortable and attractive to more people.

Implement a bicycle ambassador program in middle and high schools. Ambassadors are students with a special interest in bicycling who share that interest with their peers. Students

Encouragement through events large and small. From top: a community street festival celebrating bicycling and healthy living (South Omaha, NE); a group event for the opening of a new bike lane project in Bellevue, NE; the world's largest group ride, Bike New York's Five Boroughs Bike Ride, with 32,000 participants.

Bike parking as art. Top to bottom: inverted U's at the University of Nebraska at Omaha, enhanced with the school's mascot; Edsel bike parking lot; bicycle-shaped parking sculptures.

can work together with a common goal to provide safety education and market the many positive aspects of bicycling in the city.

Implement a city-wide bicycle ambassador program. Ambassadors are citizens with a special interest in bicycling who wish to share that interest with their community. Like the student ambassadors there would be a focus on the positive impacts of cycling and safety education. Linking this ambassador program with the tourism board can help bolster Leawood's ability to attract new residents and visitors alike.

Publish and maintain a Leawood Bicycle Map. The initial bicycle map can illustrate the bicycle network proposed by this plan, along with trails. It categorizes streets based primarily on the quality of their bicycling environment, using such criteria as continuity, traffic volume, width, and service to destinations. It also illustrates existing trails and their interaction with the street system. This map should be published and distributed through bike stores, educational programs, employers, and community agencies and facilities. The map should also be posted on-line and paired with a blog or interactive website that invites comments and suggestions. The map should be updated periodically (typically every two years) as the system evolves.

Encourage Leawood businesses to participate in the League of American Bicyclists Bicycle Friendly Business (BFB) program. The program recognizes businesses that encourage their employees to use bicycles for transportation through efforts such as providing secure bicycle parking, sponsoring company rides, offering economic incentives, establishing internal bicycling events and bicycle interest groups, and supporting community bicycle initiatives.

Achieve Bicycle Friendly Community status within three years. In addition to recognition as a good bicycling environment, many observers also consider Bicycle Friendly Community status to be an indicator of overall community quality. As such, it is a significant community marketing tool, and reinforces substantial efforts in balanced transportation development.

Case Study

Overcoming Opposition to Sidewalk Construction. The PTA committee at Sherwood Forest Elementary School in Winston-Salem, NC and school staff and principal worked with the city to develop a Safe Routes to School (SRTS) grant that was met with opposition. Residents on a neighborhood street were opposed to SRTS due to its inclusion of almost one mile of new sidewalk along Kirklees Road. Misinterpretation and misrepresentation of the plan to add a sidewalk led to increased opposition, the solution was to distribute a flyer explaining the SRTS door-to-door to residents along Kirklees Road. The small, yet dedicated group of volunteers was able to reverse the situation and ultimately gain a majority vote from residents along Kirklees Road in favor of the new sidewalk. Beyond creating a safe walking environment for children to school, the new sidewalk links the surrounding neighborhood to a prominent park and trail network and remedies an area prone to pedestrian and vehicle conflicts.

Walk Oakland: Map and Guide. The residents of Oakland, CA did not have a complete guide to the walking and biking facilities across the city so the Oakland Heritage Alliance and volunteers created a map to highlight walking and biking routes. Many other projects were considered to help various advocacy groups promote active transportation, but the Oakland Pedestrian Safety Project decided that a map would reach the largest audience and be most effective in promoting walking across the city. The project was funded by a grant from the State of California Office of Traffic Safety and took six months from start to finish. The end product was a map of walkways, bike routes, landmarks, civic destinations, neighborhoods and districts, historic trails, and transit routes to be distributed around the city via coffee shops, recreational centers, schools, bike shops, and community organizations. Additional features included on the map were street grades, to help residents determine not only a safe route, but also one that would be comfortable to walk or ride, information on design improvements, recommended routes, walking tour information and safety information for walkers and cyclists.

Sunday Ciclovia: "Bike, Walk, Dance, Breathe." The city of Clearwater, Florida's East Gateway District, now part of the downtown redevelopment area, is multicultural area and populated with low-cost rentals, nearby jobs, and public transportation making it the first stop for new residents relocating from Mexico. The city's goal was to get these new residents involved and heard within the city by hosting annual events, Sunday Ciclovia grew out of this effort. Originally the Ciclovia was intended to support East Gateway businesses and spark interest in the community, but publicity for the event spread to businesses in the downtown core who wanted to take part in the event. The Ciclovia closed two miles of roadways from East Gateway to the downtown core and was open for six hours for residents to walk and cycle free of motor-vehicle traffic. The idea of Ciclovia is spreading across the country as a means of promoting walking and biking, increase support for local businesses, and boost community input and pride.

ENGINEERING (FACILITIES)

Institute a bicycle parking program, installing facilities at strategic locations across the city. Bicycle parking is a low cost but significant physical improvement that both encourages cycling, provides greater security, and keeps bikes from damaging trees or street furniture, or obstructing pedestrians. The parking program includes several elements:

Identifying key locations for facilities. Examples of priority locations include:

- Major public facilities such as government buildings, the public library, community centers, parks and recreational destinations.
- Locations near trails that offer support services such as restrooms, food, and water.
- Neighborhood commercial centers and districts.
- Museums and attractions.
- Employment concentrations.

Bikeways System Graphics. Top: Bike Omaha destination and route intersection signs; above:, trail entrance identifier in Bismarck

Sign concepts for Leawood. Top: Destination confirmation signs. Above: Destination "blades" Right: System brand and directional signs.

- Bike corrals. In business districts, one on-street parking space can be converted to bike parking, and can accommodate up to 20 bikes.
- Diagonal stalls in business districts. In areas with heavy demand, one stall can also accommodate up to 24 bicycles in a "bike corral."

Standardized bike parking equipment that is durable, relatively inexpensive, and unobtrusive. Many of the bike racks in use today, including the so-called "schoolyard" rack and "waves" are inefficient, take up a great deal of space, and, in the case of the former, can actually damage bikes. Better in most cases are less obtrusive designs such as the inverted U, hitching post, or the new "theta" design that recently won a bicycle parking design competition for New York City.

Develop a funding mechanism and incentive program for bicycle parking installations. Leawood may provide a small allocation for installing facilities at public destinations. Bike parking on private property may be funded with the assistance of special events. For example, Omaha's Eastern Nebraska Trails Network holds an annual Corporate Challenge ride, which in 2011 attracted a record 4,200 cyclists. A portion of the proceeds are used to purchase inverted U's, some of which are offered to targeted private businesses at reduced cost.

Amend zoning ordinances to require a specific amount of bicycle parking for high demand business types.

Develop and install a unified bikeway network graphic system. While signs and sign clutter should always be minimized, a carefully designed identification and directional graphics system can greatly increase users' comfort and ease of navigating the street system. The graphic system may have individual features, but should generally follow the guidelines of the Manual of Uniform Traffic Control Devices (MUTCD). Types of signs in the system include:

- Route identifier, including a system logo and the number and name of the route. These signs reassure users that they are on the right path and is keyed to numbered routes.
- Intersection signs, indicating the intersection of two or more routes.
- Destination way finders, indicating the direction, distance, and time (using a standard speed, typically 9 miles per hour), to destinations along the route.
- Directional changes, signaling turns along a route.

The graphic system should be modular to provide maximum flexibility and efficiency in fabrication. Signs should also use reflective material for night visibility. The Clearview font is recommended as a standard for text.

Case Study

City of Boulder Crosswalk Compliance Studies and Treatment Implementation. The city of Boulder, CO was struggling with drivers not yielding to pedestrians in crosswalks, creating an unsafe environment and thereby discouraging many residents from walking. The solution was to develop a Pedestrian Crossing Treatment Warrants document and a year later hire a consultant to conduct a study to determine the effectiveness of the treatments. The treatments included in the study were rumble strips, raised pedestrian crossings, "State Law" signage, sign-mounted lights, and in-pavement lighting. The study was conducted during peak times and noted the number of yields to pedestrians with the legal right-of-way verses non-yields. Studies were completed before the treatments to create a basis to determine the level of effectiveness and six months after the treatments were installed. A variety of street widths, traffic volumes, pedestrian traffic volumes and intersection conditions were studied to provide comparisons. The study showed an overall increase in the level of compliance from 34 percent to 77 percent for all locations in which a treatment was implemented. The multi-lane roadways with higher traffic volumes had the largest jump from 21 percent to 63 percent, but yet still had the lowest compliance percentage of the other conditions studied. The treatment with the largest impact were pedestrian activated sign-mounted lights and the treatment with the lowest impact was the advance rumble strips. The results of the study have been included in the Pedestrian Crossing Treatment Warrants.

ENFORCEMENT

Involve a Police Department representative on the advisory committee, bike education efforts, and other aspects of the bicycle transportation program. Police participation adds a critical perspective to facility and safety program planning and implementation.

Enforce bicycle laws for both motorists and bicyclists. All users of the road have responsibilities to each other. Effective enforcement begins with police officers being completely familiar with legal rights and responsibilities of cyclists. But bicyclists must not have free passes to disobey traffic laws, and irresponsible riders often create backlash against all. Enforcement for all users leads to better, safer behavior and greater predictability and cooperation by all.

Integrate a traffic law enforcement and cyclist diversion program. Just as motorists are required to uphold traffic laws and regulations or risk being ticketed and in many cases fined, so too must bicyclists and pedestrians uphold traffic laws governing their responsibilities. The first step to ensuring that cyclists and pedestrians are obeying to traffic laws is too enforce them, often this includes educating not only the general public but law enforcement agencies as well so that they can appropriately and effectively issue citations. Step two is to develop a diversion program, similar to those available to motorists, that will not only help keep violators out of court but also educate offenders on safe cycling and pedestrian behavior. The diversion program is designed more to educate with an emphasis on safety rather than to punish and can often be coordinated with various groups; schools, workplaces, scout troops, and other community groups. Tempe, AZ and Huntington Beach, CA are two examples of cities with bicyclist diversion programs.

Bike theft prevention. When discussing bicycle safety, often protecting ones property, in this case a bike, is overlooked. Mitigating and preventing bicycle theft starts with the rider; ensuring that cyclists routinely and properly lock their bikes at designated facilities. Requiring new development to include bicycle parking ensures that rider will have a designated location to properly park their bikes. Law enforcement is the next point of protection, police departments must develop an understanding and a willingness to solve bike theft issues. If problems exist bait bike programs may be implemented to help thwart repeat offenders or opportunistic criminals. The University of Minnesota began their bait bike program in 2010 after discussions and guidance from the University of Wisconsin-Madison.

EVALUATION AND PLANNING

Institute an evaluation system that compiles bicycle traffic counts and crash information, and monitors mode split data through the American Community Survey and user surveys. Good evaluation information measures the effectiveness of the program and informs adjustments and improvements. The bicycle/pedestrian coordinator is ultimately responsible for developing and implementing this evaluative program. An evaluation system can help determine where an area or route of high priority is within the city, potentially adjusting future planning and reorganizing the unmet needs of the community.

Complete periodic surveys of system users, monitoring customer satisfaction and recommendations. The very high response to the survey in Chapter 2 indicates a large and committed constituency that is a great source of information and input. In addition to being an excellent measure of user satisfaction and recommendations for improvement, surveys keep the bicycle community actively engaged in the process of improving bicycle transportation in Leawood.

Surveying or studying the economic impact of an active transportation network. Understanding how biking and walking in a community is effecting the economics of the place is a valuable piece of any active transportation plan. Economic studies can help bike advocates find support from area businesses large and small and be a catalyst for future development and system expansion.

Surveying or studying the health impact of an active transportation network. Understanding how biking and walking in a community is effecting the overall health of city can often be just as important as the economics of the situation. The goal of any active transportation system is to keep people healthy and happy, and out of the doctor's office.

Update Complete Streets Policy.

Case Study

Pedestrian Safety Planning Group. The residents of Bethlehem, NY formed the Bethlehem Citizens for Pedestrian Safety to meet and discuss issues related to the pedestrian environment. Members of the group included the Town Supervisor, Town Board members, planners, highway superintendent and staff, the Traffic Safety unit supervisor of the Police Department, the NYSDOT bike and pedestrian coordinator, and the Capital District Transportation Committee. Several other community organizations supported the efforts of the group. The group developed several projects: education programs, structural improvements, data collection and planning, new sidewalks to complete segments, and improved crosswalks timed with routine maintenance. The group also spearheaded improved signage around town, the "WALK LEFT/RIDE RIGHT" campaign being the most prominent and moving off the streets and into businesses and homes via refrigerator magnets and flyers. The group still meets and provides recommendations and input on transportation projects in the Capital District.

Pedestrian and Bicycle Travel Policy. Kentucky formed the Pedestrian and Bicycle Deign Guidance Task Force to address the USDOT's "Design Guidance Accommodating Bicycle and Pedestrian Travel: A Recommended Approach" and the typical state design of roadways which generally included automobile travel and little, if any consideration for active transportation. The groups goal was to help guide the design and implementation of pedestrian and bicycle facilities across the state. The guidelines give planners and engineers specific requirements to accommodate non-motorized means of travel; factoring in aspects such as adjacent land use, current and projected non-motorized traffic, transit stops and routes, and local bike routes and trail systems. Through the formation of the task force and subsequent design guidelines the state looks to reduce vehicle miles traveled per day and improve air quality.