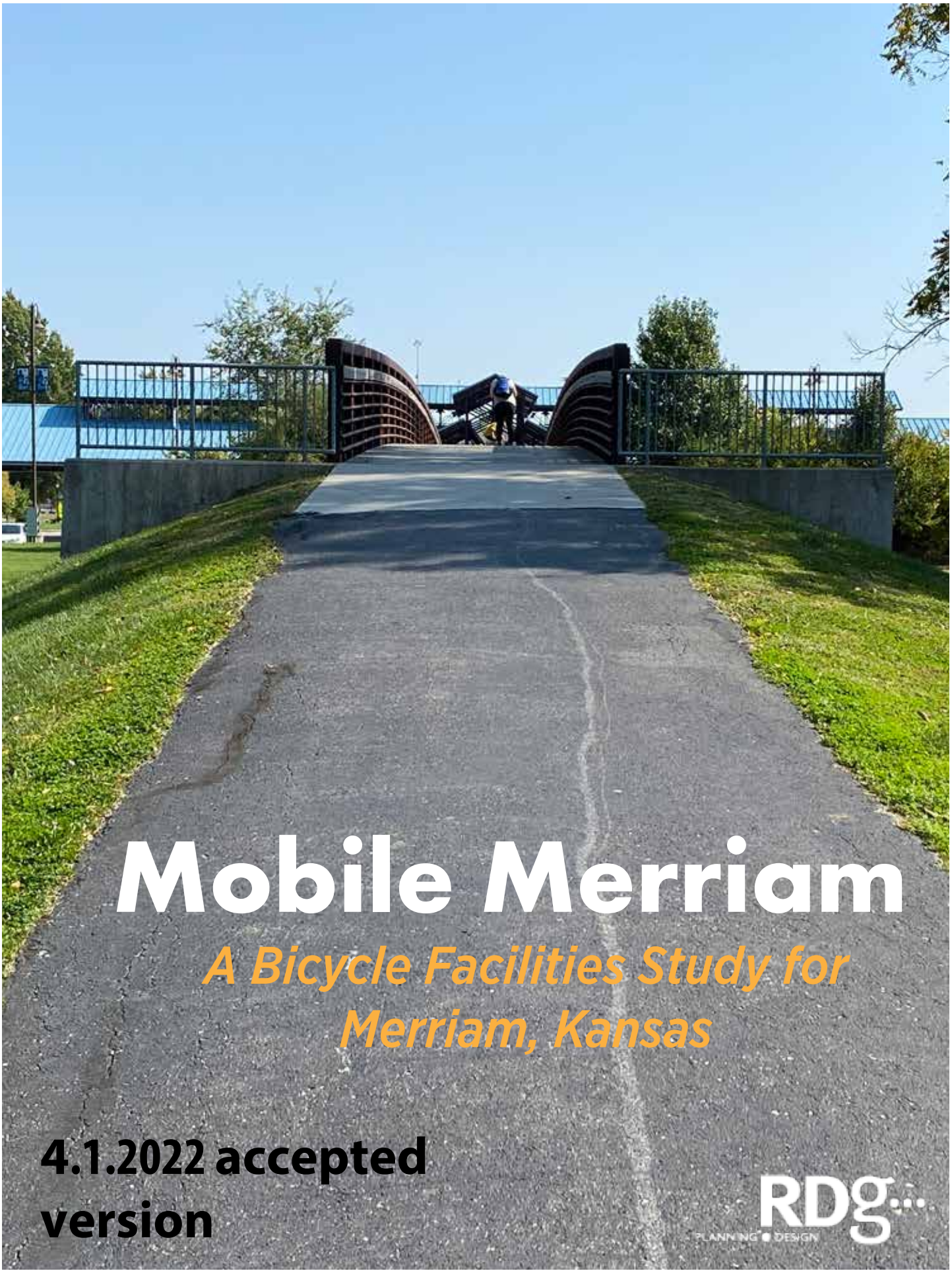


Mobile Merriam

A Bicycle Facilities Study for Merriam, Kansas

4.1.2022 accepted version

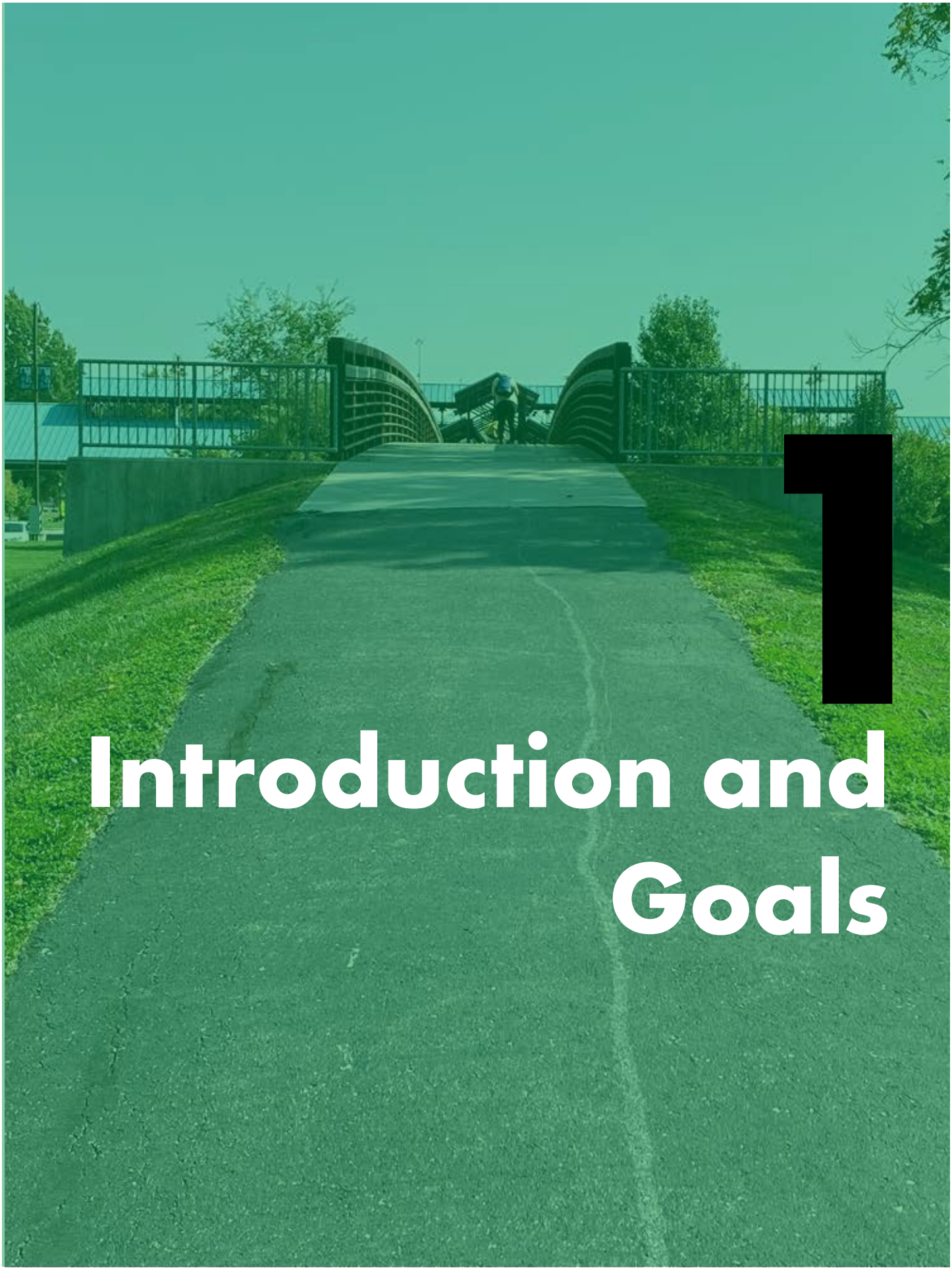
RDg PLANNING • DESIGN

Acknowledgements

Table of Contents

1 Introduction and Goals 3
2 The Network 9
3 Route Details 19
4 Guidelines 43

Appendix: Knox Avenue 61



1 Introduction and Goals

Mobile Merriam:
A Bicycle Facility Study

Introduction

We spend a large amount of our lives in motion – commuting to work or school, traveling to the destinations that mark our lives in cities, and generally going about our lives. How we move can affect many things, including our own health and that of our communities.

As humans, we have been blessed with the ability to travel effectively under our own power. Most of us walk or run everyday, sometimes accumulating surprising numbers of steps and even miles. We can travel even farther by bicycle, a remarkable vehicle that we can easily lift, travels at half the speed of a contemporary car in city traffic, does not use fossil fuels, produces no 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. The introduction of new technologies, like the e-bike with small electric motors that provide pedal assists, can bring bicycling as an efficient form of transportation, within the capability of even more number of people. Our ability and efficiency to transport ourselves is indeed a gift.

The Kansas City metropolitan area , with its extensive network of trails, a growing number of streets adapted for bicycle transportation, a strong advocacy organization, and municipal governments and a regional planning agency committed to active transportation, clearly recognizes that active mobility is an important part of a balanced regional transportation system. During the two years of the COVID pandemic, this awareness has increased, as walking and bicycling have emerged as safe and healthy environments for individual and group recreation and overall mobility.

Merriam is well positioned to be a larger part of the regional active transportation network. The popular Turkey Creek Streamway Trail runs the length of the city, and serves such important destinations as the Merriam Marketplace, Downtown Merriam, and Waterfall, Werner, and Campbell Parks. Local trails in Antioch and Brown Parks also serve park users and connect residential areas. The emerging bikeway along Merriam Drive and Southwest Boulevard also connects this close-in suburban city to Downtown Kansas City and potential connections to other Johnson County trails and communities are readily available.

Despite this positioning, Merriam has been somewhat late to the game in developing the on-street facilities necessary to achieve full connectivity. There are several reasons for this. Merriam is a linear community bisected by Interstate 35. Streets that cross I-35 all have interchanges, introducing traffic conflicts that are difficult for bicyclists to negotiate. East-west Shawnee Mission Parkway is also a significant barrier to north-south access. Continuous crosstown streets with light to moderate traffic are scarce. And Merrriam's difficult topography outside of the Turkey Creek corridor create other challenges for bicyclists.

Despite these barriers, the city is committed to developing bicycle facilities that serve both internal needs within Merriam and external connections to other parts of the region. Much of this network will be implemented over time and coordinated with other improvement projects such as street resurfacing. This plan is designed to guide this process, showing the type of infrastructure that should be installed when streets on the network are improved. It also goes farther by identifying potential projects that include new off-street trail segments, intersection upgrades for greater safety and user comfort, and facility segments that connect to other regional routes. These projects may be funded from a variety of other sources, discussed later in this document.

This *Mobile Merriam* plan is dedicated to helping Merriam's citizens make healthy, low-impact, and intrinsically pleasant transportation a greater part of their routine lives. While we know that most trips will continue to be made by car, the 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 human-powered transportation offers.

Goals of the Plan

Increase the number of people who use walking and biking for transportation as well as recreation. Merriam's primary trail, the Turkey Creek Streamway Trail, is popular and has a significant transportation function, providing access to parks, between Antioch Road and 75th Street, Merriam Marketplace, and the traditional center of town. 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.

Improve bicycle and pedestrian access to key community destinations. An active transportation network should get people comfortably and safely to where they want to go. Therefore, Merriam's system should serve destinations, providing clear and direct connections to key features both in the city and in surrounding areas.

Removing or improving barriers that discourage people from walking or biking for transportation. Merriam's topography creates physical challenges for some people. I-35 and Shawnee Mission Parkway are also discouraging because of their width, speed, geometrics, and high traffic volume. Difficult intersections and intersection offsets also create conditions that people find difficult to cross safely. Creating more comfortable routes and barrier crossings is an important objective of this plan.

Guiding city policy and programming of street improvements. Incorporating bicycle infrastructure into street improvement projects is good public policy, allowing a network to emerge at low marginal cost. In January, 2022, the first such project was released for bids.

Use walking and bicycling as part of an effort to make Merriam healthier for the community, and for the individual. Trips made by active transportation promote health at two levels:

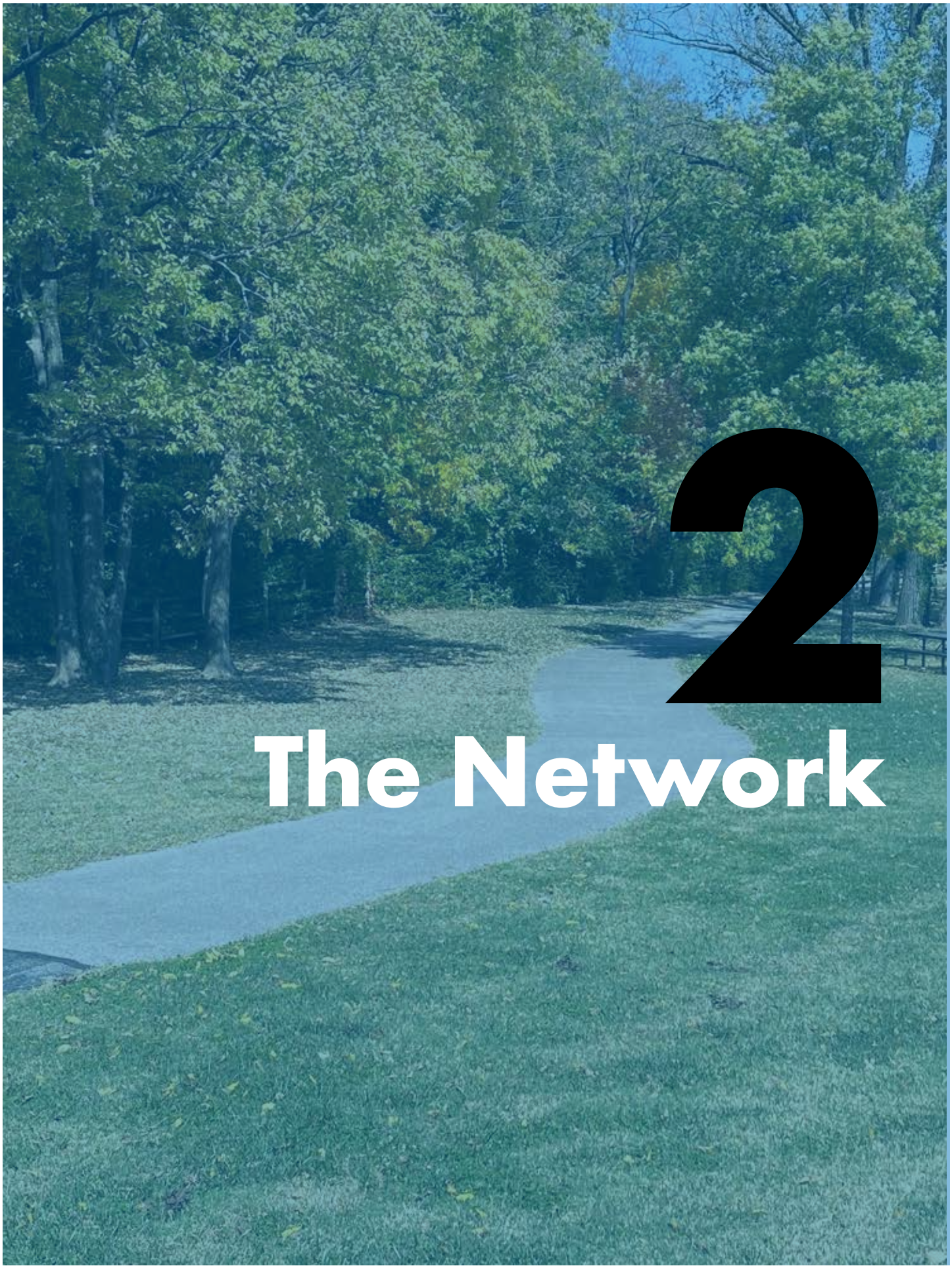
- **Community health.** Reducing emissions also helps ensure that Merriam will maintain its status as a healthy environment for its citizens. On a social level, bicycling builds community by enhancing the quality of civic life, helping us interact with each other as people. Places that lead in bicycle transportation also tend to attract people because of their community quality.
- **Individual health.** 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 and lowers overall health care costs.

- **Health and Access Equity.** We often assume that everyone has access to transportation on demand through their car, but this is not always the case. An effective active transportation network provides affordable mobility to people who do not have access to cars for economic and other reasons. In Merriam, it can provide access to major recreation and wellness facilities such as the community center and water park, schools, shopping, and other destinations using the least expensive of modes to operate. It also provides connections to defined or potential routes in the Kansas City metropolitan area that lead to other key necessities and amenities. Creating transportation alternatives is a regional enterprise, and Merriam fulfills its role by providing routes and making connections within its boundaries and to other parts of the region.
- ***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 region. Physical safety improvements must also be supported by education, enforcement, and encouragement programs, and its effectiveness measured by evaluation.

Capitalize on the development benefits of a destination-based active transportation system. Better active transportation facilities can have a significant and desirable effect on urban design and development patterns. Walkable and bikeable neighborhoods and projects are highly valued by a new generation of homeowners and investors.


BUMP



2 The Network

Criteria for Potential Routes

Other than Turkey Creek and some local drainageways, Merriam has few of the linear features (such as abandoned or lightly used railroads, power line easements, campus development) that commonly provide opportunities for off-street trails and shared use paths. In addition, the city is largely built out, with highly developed street and development patterns. As a result, a Merriam bicycle network will depend heavily on existing streets along with a few short greenway connectors.

In designing a network, we must also understand that an effective bicycle network is a transportation system. A good network is not composed of disconnected segments of streets and trails. Rather, its components should fit together to get people where they want to go and to do so in ways that are reasonably direct, safe, comfortable; within the capabilities of a variety of users serve all parts of the community; and offer a positive overall experience.

Candidate streets for the network should display at least some of the following attributes:

- ***Good continuity.*** Street components of the network should ideally continue for at least 1/2 mile to provide direct access and avoid frequent turns. This is not always possible, especially in a long and relatively narrow city like Merriam. However, continuity can be achieved by street segments that can be joined to form a continuous route.

- ***Service to desirable or important community destinations.*** These include trails, parks and recreational facilities, schools, major shopping areas, smaller commercial destinations like neighborhood centers, and the community center.

- ***Safe conditions,*** notably low traffic volume and speeds.

- ***Relative lack of significant barriers.*** This poses a substantial challenge in Merriam, bisected as it is by the I-35/BNSF corridor. At arterial street intersections that create barriers, pedestrian signals or other techniques such as grade separations or refuge medians can help pedestrians and bicyclists cross safely.

- ***Ability to accommodate future bike facilities.*** This can be accomplished when streets are wide enough to include bike lanes or can provide bicycle facilities by re-purposing excess travel lanes.

- ***Positive experience.*** Tree cover, traffic calming, gentle curves, and attractive adjacent buildings can add up to providing a good cycling environment.

Barriers. I-35 poses a formidable barrier to east-west travel in Merriam. Sidewalks designed in a different era do not accommodate bicyclists and are barely passable for pedestrians. Since most streets that cross I-35 have heavy traffic and interchange ramps, using the roadway is not an option for most riders.

Continuity. While it is somewhat hilly, Knox Avenue's good north-south continuity combined with relatively low traffic makes it an excellent candidate for inclusion in the network.

Experience. Grandview Lane lives up to its name by providing access to Quail Creek Park, with curves and tree cover that create an attractive rider experience.

Crossing barriers. Signalized crossings of major arterials can help determine suitability of streets for bicycle access. This image illustrates such a crossing of Shawnee Mission Parkway at Craig Avenue. (Google Earth streetview photograph)

Ability to accommodate facilities. Mastin Street's width is sufficient to provide room for bike lanes in both directions. On a wide two-lane street, bike lanes also help reduce traffic speeds.

Destinations. The Walker School building, now the home of Philadelphia Missionary Baptist Church, was the center of the fight against racial segregation in Merriam's South Park neighborhood. This site with adjacent Brown Park are important determinants of a network that moves people in both senses of the word.

Functional Categories

Functional categories describe the overall role that individual components play in a potential bicycle network. These categories are tailored to the needs and context of individual communities. Thus, the following categories are relevant for Merriam and its layout of streets and trail opportunities.

Regional Commuter Route. This route is part of a combination of facilities that leads to a major metropolitan center or employment concentration. In the case of Merriam, this destination is Downtown Kansas City, Missouri, and the facility is the combination of the Turkey Creek Trail and Merriam Drive. Northeast of the city boundary, the route continues on Merriam Lane and Southwest Boulevard, with bike lanes provided most of the way between I-635 and 18th and Main. Current studies for the Merriam Drive and Merriam Lane corridors are likely to propose upgrades to existing infrastructure.

Principal Bikeway or Bike Route. These are major destination based routes that have good continuity (for Merriam, over 1/2 mile) and access to important activity centers or the Turkey Creek Trail. West of I-35, many of these routes connect to and depend on the Turkey Creek Trail for continuous north-south access. East of I-35, they most often connect residential areas to the community center, pool, and commercial centers. Bike lanes are the preferred infrastructure on these routes, but in many cases street width is not adequate for two-sided parking and separated bike facilities.

Secondary Bike Routes and Connectors. These are shorter on-street routes, largely intended to link residential areas to the principal routes. Typical infrastructure for these routes are wayfinding signage and in some cases shared lane markings.

Bicycle Boulevards. Bicycle boulevards, variously also referred to neighborhood greenways and calm streets, are principal routes characterized by low traffic and excellent continuity. They are naturally suited to bike travel for a wide variety of users. Bicycle boulevards can have a variety of treatments, including special signage, traffic calming devices such as mini-roundabouts, curb extensions, neck downs, speed tables, and others. They may also have features designed to make arterial street crossings safer, including cautionary signage, pavement markings, induction loops sensitive to bicycles, and signal protection. Knox Avenue and the Goodman/Hardy/Craig combination are examples of bicycle boulevards in the potential Merriam network.

Shared Use Paths. Shared use paths in Merriam refer to relatively long facilities separated from motor vehicle traffic and accommodating a variety of active modes that include walkers, runners, in-line skaters, and bicyclists (including e-bikes). Shared use paths can include off-road routes such as the Turkey Creek Streamway Trail and separated paths along streets and roads, customarily referred to as "sidepaths" or incorrectly as "widened sidewalks." Sidepaths may be used along principal routes as an upgrade or complement for on-street infrastructure, recognizing that many riders with less

experience are uncomfortable sharing streets with motorists.

In several situations, relatively short segments of shared use paths are incorporated into principal on-street routes to maintain continuous crosstown access. Examples are the trails within Brown Park and Antioch Park.

Shared use sidewalks. In several situations in Merriam, high-traffic streets and physical constraints may require bicyclists to share a sidewalk to maintain continuity. The most common of these conditions are sidewalks at crossings and interchanges of I-35. Other situations include major streets where traffic is too heavy for comfortable on-street riding or for the credible use of shared lane markings, but right-of-way is too limited for normal width sidepaths. Shared use sidewalks are sometimes used in Merriam to negotiate jogs in a route at a major street crossing to take advantage of a protected pedestrian crossing.

It is advisable for bicyclists to walk their bikes through segments where they are likely to encounter pedestrian traffic. Special caution is required whenever bicycles are forced by conditions onto sidewalks.

Principal route. This segment of Mastin Street forms a principal north-south route in combination with Switzer Street and Perry Lane between W. 47th and W. 62nd Streets, and connecting to Nieman Road in Shawnee.

Connector. This local connector (W. 65th Street) uses residential streets to link the Craig Street bicycle boulevard with Antioch Road. Completion of this route will require a short segment of path where 65th Street was closed by an earlier action to prevent through automobile traffic around the north side of Antioch Park.

Regional commuter route. From top, Merriam Drive in Downtown Merriam and Merriam Lane with bike lane north of Merriam's municipal limits at the I-635 interchange. Together with the Turkey Creek Trail and Southwest Boulevard, Merriam Drive forms part of a developing commuter route to Downtown Kansas City, Missouri.

Bicycle boulevard. This segment of Goodman Street is a recent example of traffic calming design. This design, together with protected crossings of Johnson Road near Hardy Street and Shawnee Mission Parkway at Craig Street create a good continuous north-south bicycle boulevard route east of I-35.

Shared use paths. Shared use paths fall into two overall categories. Off-road paths (top) use alignments in most cases away from roads, although they may parallel roads for some distance). Examples are the Turkey Creek Trail and park trails in Brown and Antioch Parks. Sidepaths follow streets but within public right-of-way but usually separated from traffic by curbs or the edge of pavement. From top: Turkey Creek Streamway Trail, Brown Park Trail, and a sidepath segment of the Turkey Creek Trail along Merriam Drive

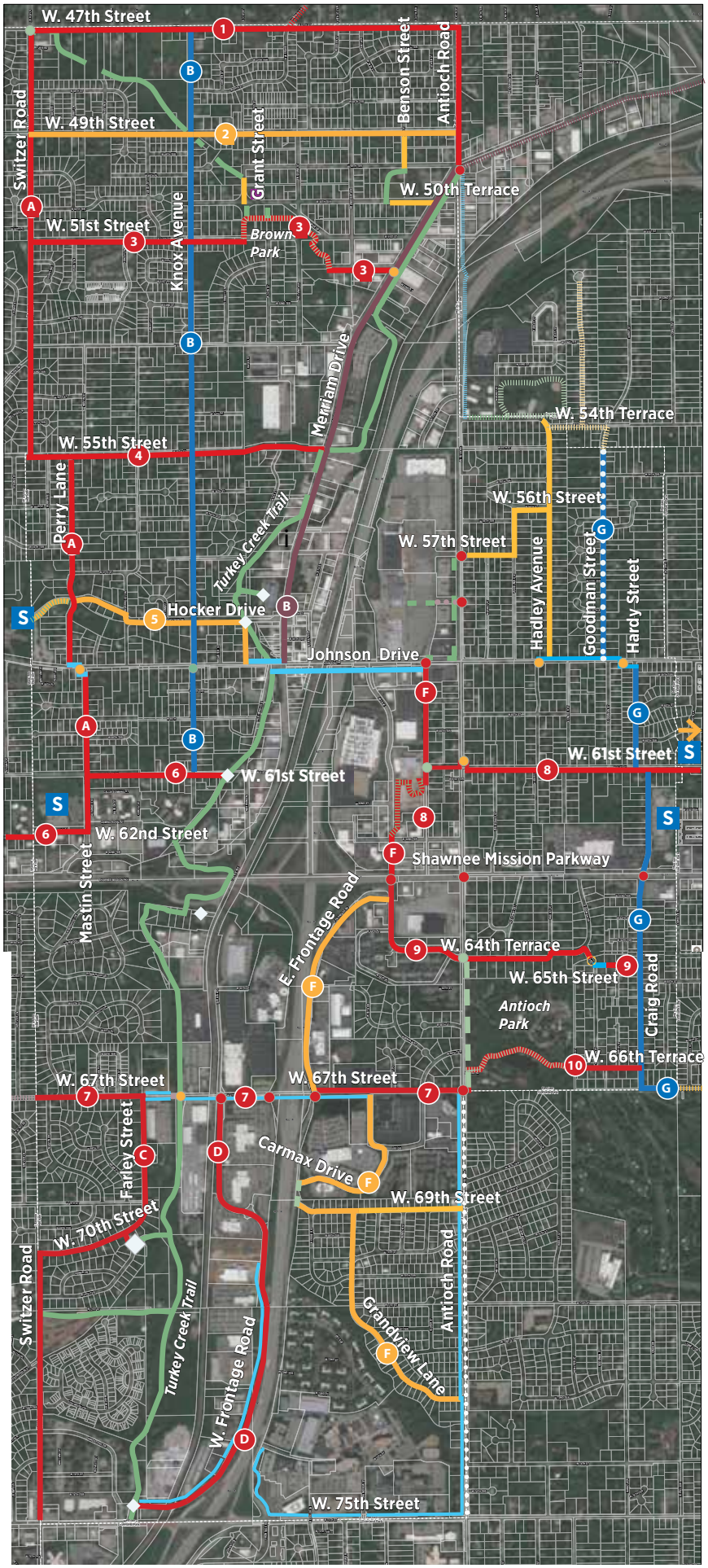
Shared use sidewalk. Top: Antioch Road is a key north-south but its limited right-of way beyond the four-lane street section makes sidepath development very difficult without right-of-way acquisition. In this case, the sidewalk is used by bicyclists for at least a short distance, Future study of lane reconfiguration is recommended. Above: Sidewalk segment along Johnson Drive, linking Goodman and Hardy Streets with a HAWK pedestrian signal across the arterial street.

The Proposed Merriam Network

The diagram to the right displays the Merriam bicycle network proposed by this plan, identified by the functional categories described above. Most of this system uses existing facilities without major capital development other than street resurfacing and maintenance. Pavement markings and other enhancements would be incorporated into the city's regular street improvement and rehabilitation programs. However, the network does propose several important initiatives or policies. These include:

- **A new trail along a potential greenway corridor between W. 47th Street and Switzer Road and W. 49th Terrace and Grant Street.** This is identified as a potential corridor in the regional MetroGreens program and connects the northwest part of the city with Brown Park and the Turkey Creek Streamway. Its access to the Walker School site gives it additional historical significance.

- **A sidepath along Antioch Road from W. 57th Street to Johnson Drive; and Johnson**



- Regional Commuter Route
- Principal Bikeway or Bike Route
- Principal Bikeway with Trail
- Secondary Bike Route
- Connectors
- Bicycle Boulevard
- Bicycle Boulevard with Existing Calming
- Existing Shared Use Path
- Proposed Shared Use Path
- Joint Use Sidewalk
- New Sidewalk
- Full Traffic Signal
- HAWK or other pedestrian signal
- Other Enhanced Crosswalk
- School
- Trailhead
- Historic Site
- Antioch Road Study Corridor

Numbers correspond to route numbers detailed later in this section.

Drive from Antioch Road to Slater Street. This serves Merriam Town Center and connects residential areas in the northeast of the city with the community center and water park. Efforts should also be made with Merriam Town Center management to provide better pedestrian and bicycle access from this path into the center itself. This could be achieved by widening the existing sidewalk on the north side of the W. 57th Street entrance from Antioch Road to the outer drive of the shopping center, and converting one row of parking to bicycle and pedestrian use.

- **Merriam Drive complete street upgrades**. Separate studies are considering options for the Merriam Drive corridor. Within Merriam, the Turkey Creek Streamway Trail becomes a relatively narrow sidepath between the north side of the creek and W. 55th Street and north of Waterfall Park to Antioch Road. The street lacks bicycle facilities through Downtown Merriam between its two connections with the trail on the north side of the creek and Johnson Drive. This plan suggests concepts for the Downtown segment. But any improvement or modification of Merriam Drive north of Johnson Drive should include specific bicycle accommodations.

- **I-35 underpasses.** The proposed network has principal crossings under I-35 at Johnson Drive and W. 67th Street. The current structure of these interchanges does not permit adaptation to bicycle or even good pedestrian accommodation. Any reconstruction or redesign of these interchanges, which are under the jurisdiction of the Kansas Department of Transportation, should provide standard accommodations for all modes of travel, including active modes.

- **Wayfinding System.** Installation of wayfinding signage is a short-term and relatively inexpensive way to implement an effective network, even as other projects like pavement markings are phased in over time. On-street signage should use the standard bicycle system established by the Manual on Uniform Traffic Control Devices (MUTCD). A sample signage plan for the Knox Avenue bicycle boulevard and Hocker Drive connector is presented in the Appendix to this document. Chapter 3 presents general standards for signage in the Merriam network.

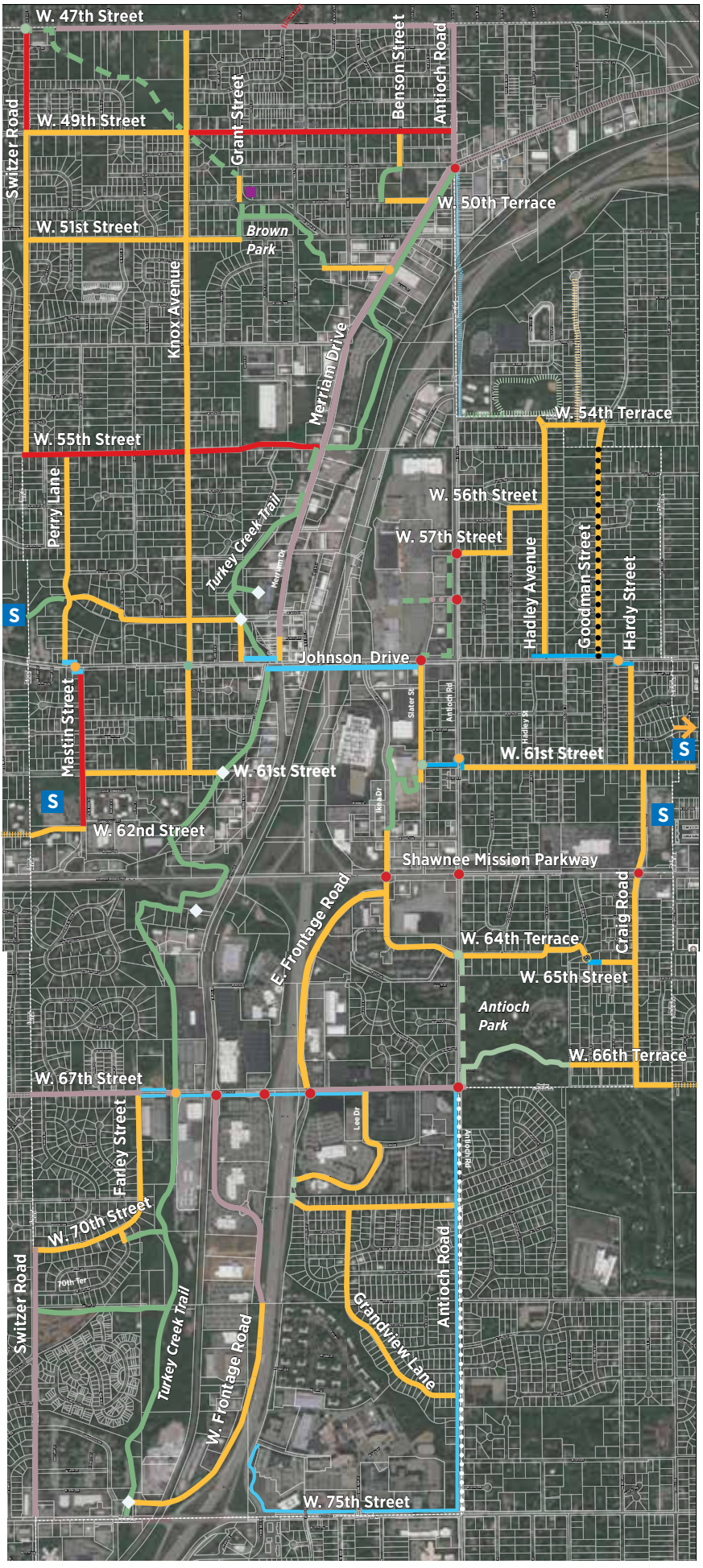
- **Antioch Special Study.** Antioch Road is the most direct and continuous north-south complete street opportunity on the east side of I-35, especially south of Shawnee Mission Parkway. However, the street, a currently a four-lane section, does not provide room for a sidepath. Average daily traffic on this segment appears to be at a level that can be served by a three lane facility, providing space for bike lanes. A study should be done to model operation of a three-lane section here, to test the possibility of a lane reallocation.

Major initiatives. From top: Potential greenway and trail corridor between W. 47th Street and Switzer Road to Brown Park; Merriam Drive in Downtown Merriam; and Antioch Road at W. 67th Street

Infrastructure Treatments

The map at right applies infrastructure types to the proposed network. Different infrastructure types are generally related to street widths and traffic volumes:

- Shared lane markings are most appropriate on streets with low volumes and width under 30 feet. The most significant purposes of sharrows are wayfinding for bicyclists and awareness building for motorists.
- Combined sharrows and bike lanes are applied to streets with widths between 32 and 36 feet and moderate traffic volumes. Bike lanes should be used in the uphill direction.
- Bike lanes are applied to streets with moderate to higher volumes, depending on parking conditions and street width.



- Bicycle Route or Bicycle Boulevard
- Bicycle Route with Traffic Calming
- Single Direction Bike Lane
- Bi-Directional Bike Lane
- Existing Shared Use Path
- Proposed Shared Use Path
- Joint Use Sidewalk
- Full Traffic Signal
- Pedestrian Actuated Signal
- Other High Visibility Crosswalks
- School
- Trailhead
- Historic Resource
- Route Continuation in Adjoining City
- Antioch Road Study Corridor

Shared lane marking. Shared lane markings or sharrows are a pavement marking used to indicate the presence of bicycles on a street and to aid wayfinding. Some cities have used a green background to enhance visibility, This practice is not included in the 2009 MUTCD but is indicated as an optional features in the 2014 NACTO *Urban Bikeway Design Guide*

Buffered bike lane. This application uses a narrow cross-hatched buffer to provide a greater level of separation between travel and bike lanes. Sometimes delineators (including planters, bollards, or bumpers) are used, but these are not proposed for the Merriam applications.

Standard bike lane with MUTCD-compliant wayfinding.

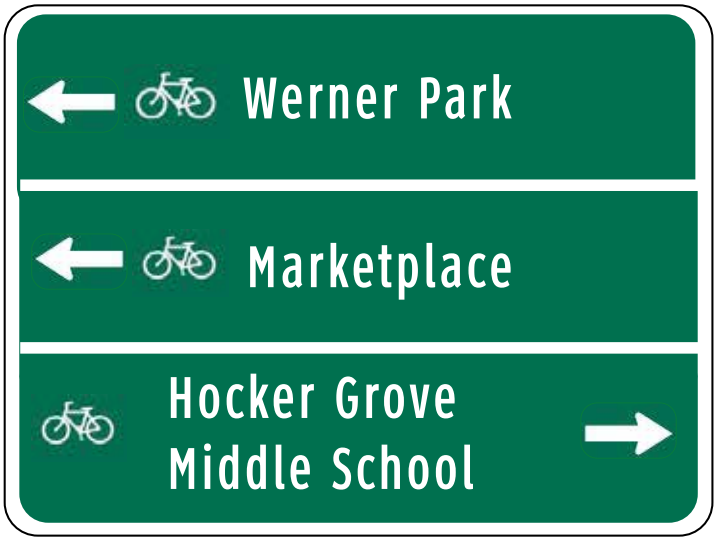
Standard bike lane with green background enhancement. The background is used at the beginning of each block to enhance visibility.

Crossing treatments. Top: "Continental" crosswalk and sharrows are used together with a HAWK pedestrian actuated signal. Above: High visibility yellow crosswalks, increasingly used in California.

Recommended Signage Conventions

D11-1c **Bicycle Route Designation**
Used at key points along a route and always following intersection with another route.

R4-11 **Full Lane**
Used on streets with shared lane markings

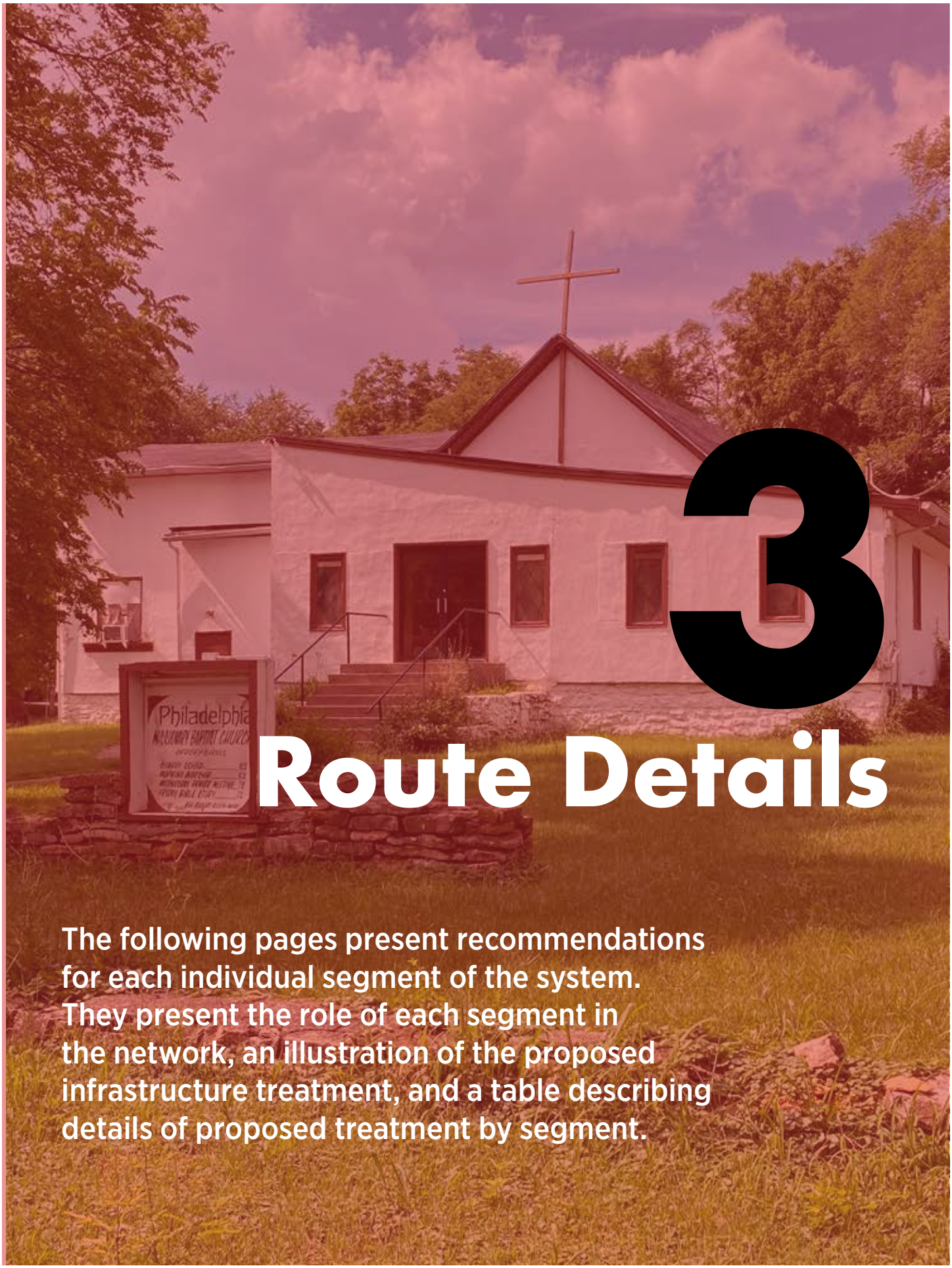


D1-1c, 2C, 3C **Bicycle Destination**
Used at intersecting routes leading to destinations served by that route

W11-1 **Bicycles Warning**
Used facing major streets that intersect with bicycle boulevards or principal routes, alerting motorists to the presence of bicyclists in the area

R3-17 **Bike Lane Advisory**
Optional use on streets with bike lanes

W11-15 **Trail Crossing Warning**
Used facing streets that intersect with sidepaths and off-road trails



3 Route Details

The following pages present recommendations for each individual segment of the system. They present the role of each segment in the network, an illustration of the proposed infrastructure treatment, and a table describing details of proposed treatment by segment.

Details

The following pages describe each of the components of the proposed Merriam bikeway and trail network in detail. Each section includes the following information:

- An aerial photograph with a diagram of the specific segment, along with the surrounding area.
- A description of the role and function of the component in the overall community network. This includes significant destinations served by the route.
- A table that provides key facts and recommendations for route improvements, including:
  - A summary of the type of treatment for the facility;
  - For on-street segments, the typical width of the street, parking condition, and grades.
  - Other comments or special factors that relate to the specific segment.
- A diagram that displays the existing section and the proposed treatment of the street. These diagrams are not included where the street section or pavement markings will not change or where the only proposed change is the use of shared lane markings.

Routes with a prevailing east-west direction are indicated by numbers, while north-south routes are designated with letters. The color background on the route designator indicates the distinguishing infrastructure type, following the designations shown summarized on the table below.

Color	Facility Type	Typical Pavement Width	Treatment
	Bicycle Route/ Bicycle Boulevard	24-30’	Signage shared lane marking, traffic calming, right-of-way preference
	Traffic Calming Installations	24-30’	Signage shared lane marking, traffic calming, right-of-way preference
	Single Direction Bike Lane	32-36’	One sided parking, bike lane on one side (uphill) shared lane marking on opposite side
	Bi-directional bike lane	30’-48’	No parking on 2-lane streets under streets under 40’; one-sided parking on 2-lane streets 40-48’; 4-to 3-lane diet on 4-lane, 48’ streets; no restriction above 48’
	Existing shared use path	8-10’	10’ recommended minimum, 8’ in constrained areas
	Proposed shared use path	8-10’	10’ recommended minimum, 8’ in constrained areas
	Joint use sidewalk	6’	May require “walk bike” signage
	Full traffic signal		Full vehicle traffic signalization
	HAWK or RRFB signal		Pedestrian actuated signals with high visibility crosswalks.
	Other enhanced crosswalk		
S	School		
	Trailhead		Trail access with parking, signage, other support facilities
	Historic Resource		

Route continuation in adjoining city

7 Route includes bi-directional bike lanes

2 Route includes single direction bike lane with shared lane marking in opposite direction

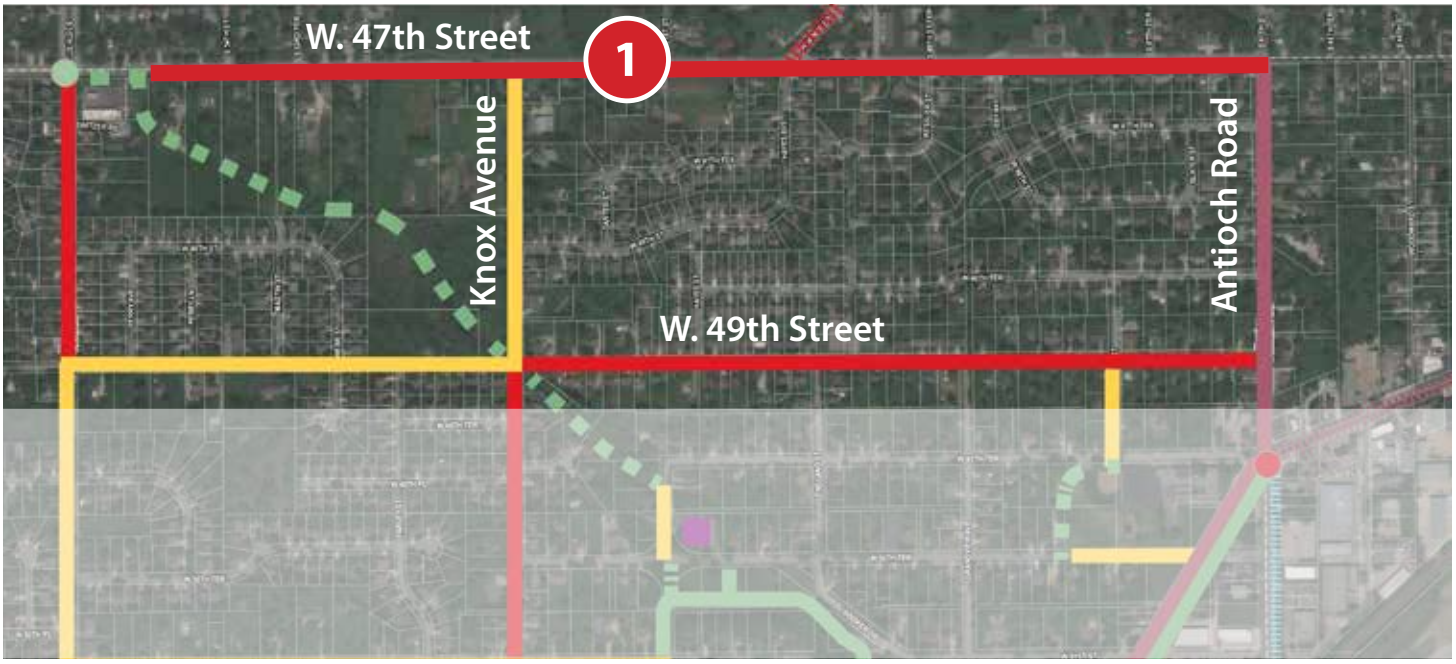
5 Route uses shared lane markings or no pavement markings

3 Route uses includes shared use path

Numbers indicate east-west routes

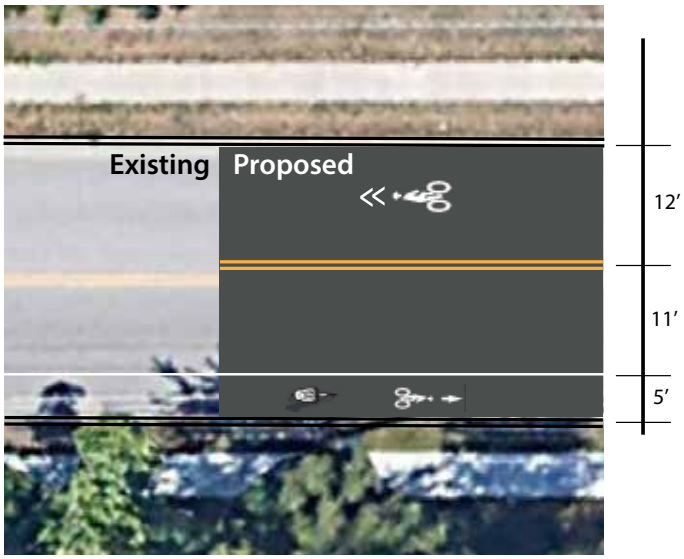
Letters indicate north-south routes

1 W. 47th Street



Role in the Network

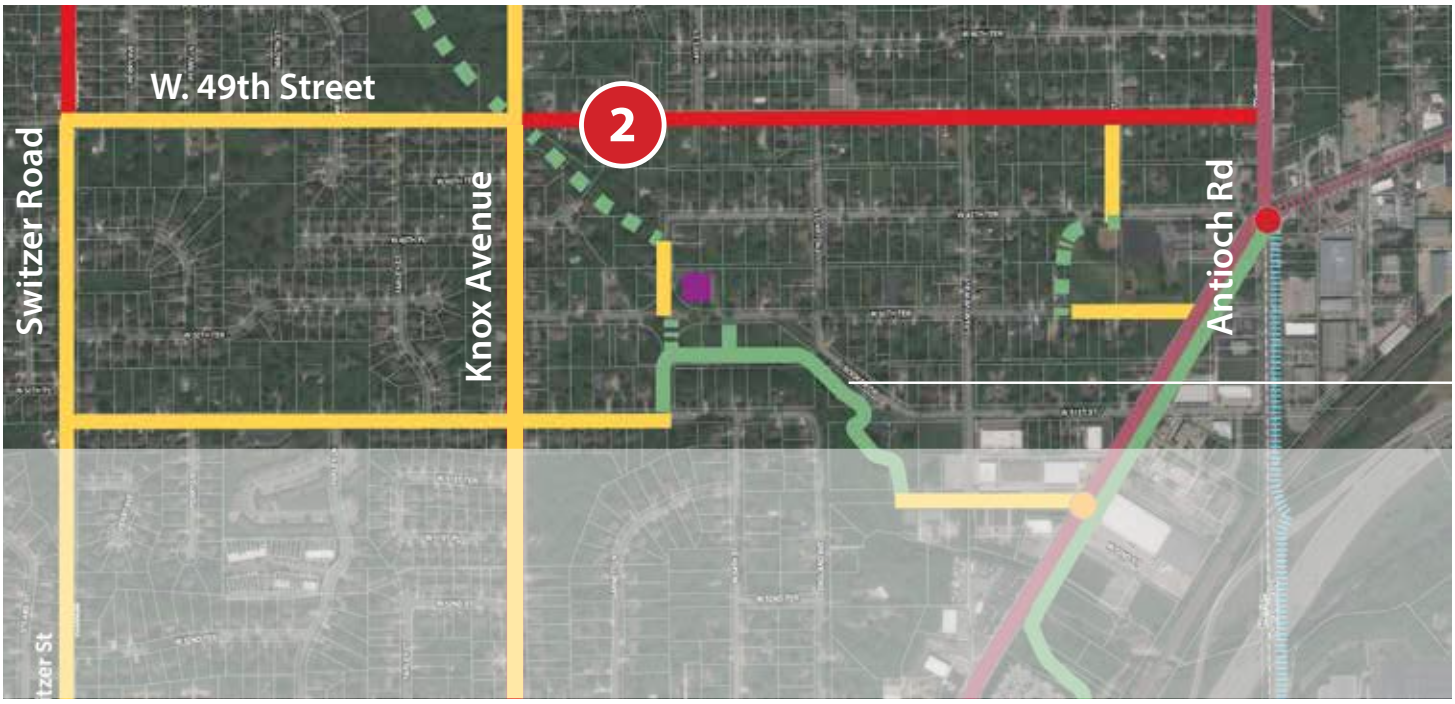
- Significant east-west corridor for Merriam and Kansas City, Kansas
- Serves Turner and Highland Parks and Midland Trail Elementary School
- Accommodates directional uphill bike lanes with no on-street parking
- Serves neighborhood commercial node at Switzer Road
- Requires coordination with Unified Government



Typical Section

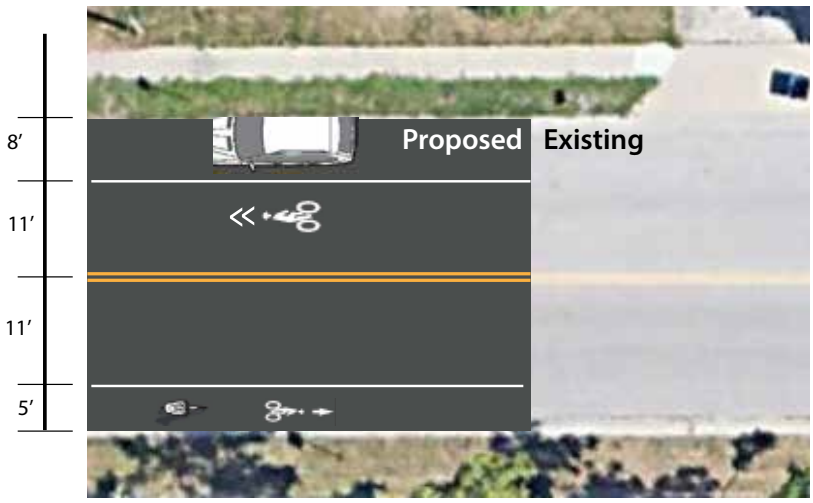
Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
W. 47th Street, Switzer Road to S. 51st Street (KCK)	0.50	Bike lanes	28 feet curb to curb	No parking	1.6% ruling grade EB	-Standard bike lanes on EB uphill grade, shared lane marking on WB
W. 47th Street, S. 51st Street (KCK) to Antioch Road	0.50	Bike lanes	28 feet curb to curb	No parking	1.8% ruling grade WB from Antioch Road to S. 51st Street	-Standard bike lane on WB uphill grade, shared lane marking on EB. Markings to be coordinated with Kansas City, KS

2 W. 49th Street



Role in the Network

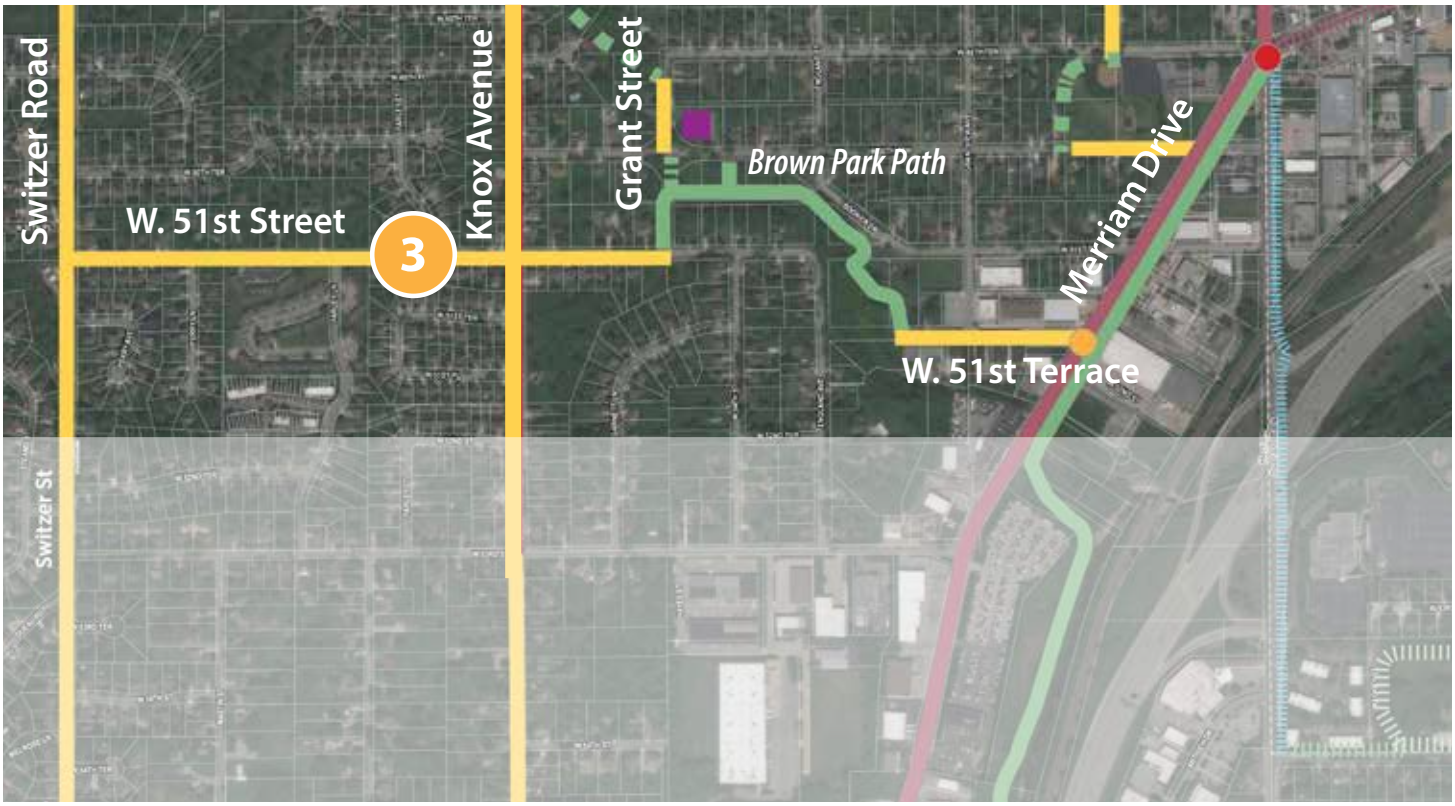
- East-west route with direct northside access to Merriam Drive.
- Location is completely within Merriam, making it readily attainable.
- Access to future greenway corridor.



Typical Section

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
W. 49th Street, Switzer to Knox Avenue	0.40	Bike route;	25 feet	2 side	2.8% ruling grade WB from Knox Avenue	Bike route and wayfinding signage; shared lane markings
W. 49th Street, Knox Avenue to Antioch Road	0.60	Single direction bike lane with 1-side parking	35 feet	Current: 2 side; Proposed: 1-side	Rolling topography east of Knox to Antioch. Maximum short grade of 5.3%	- Standard bike lane EB from Knox to Antioch with shared lane marking and striped parking lane on north side - Shared lane markings if 2-sides parking is retained

3 W. 51st Street/Brown Park



Role in the Network

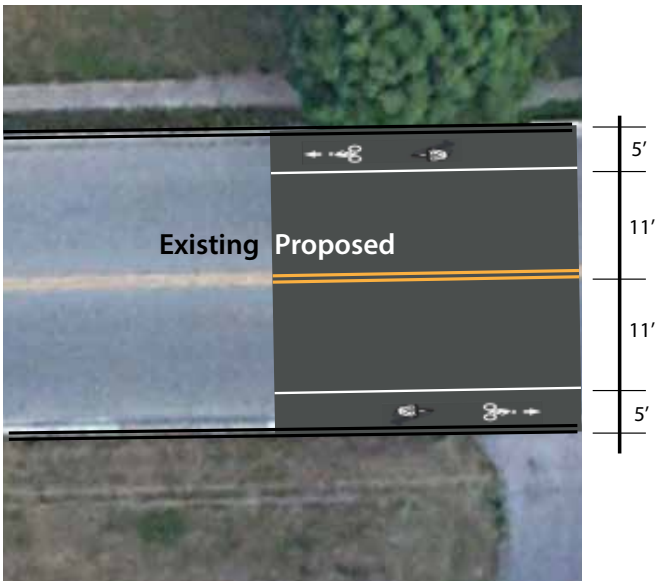
- Connects west side of the city to Brown and Waterfall Park
- Link to Merriam Drive and Turkey Creek Trail
- Access to Walker School site with opportunity for historic interpretation
- Integrates Brown Park Trail into the overall citywide system

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
W. 51st Street, Switzer to Brown Park	0.51	Bike route	25 feet	2 side	2.4% ruling grade WB from Brown Park to Switzer	Bike route and wayfinding signage
Brown Park Trail	0.31	Shared use path. Upgrade to 10 foot standard width.	7-8' existing trail width	NA	Essentially flat	- Widen where possible to 10 foot standard width - Connection to future greenway from 47th Street
W. 51st Terrace	0,14	Bike route	25 feet	1 side	Flat	- Bike route and wayfinding signage - Shared lane markings fot connection to park - Crossing enhancement at Merriam Drive

4 W. 55th Street

Role in the Network

- Major east-west connection to Turkey Creek Streamway Trail and Waterfall Park
- Direct linkage to Shawnee and West Flanders Park
- Street section narrows in Shawnee. Bike lane would end at Merriam-Shawnee city boundary



Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
W. 55th Street, Switzer to Merriam Drive	0.70	Bike Lanes	Varies from 30-32 feet	None	3.4% ruling grade WB from Merriman Drive to Farley Street; essentially flat from Farley to Switzer Road	Standard bidirectional 5-foot bike lanes

5 Hocker Drive

Role in the Network

- Direct connection between Hocker Grove Middle School and Turkey Creek Streamway Trail
- Direct trail access at Hocker Drive and Grant Street
- Adjacent link to Werner Park and Marketplace
- Forms direct connection via Johnson Drive walkway under I-35

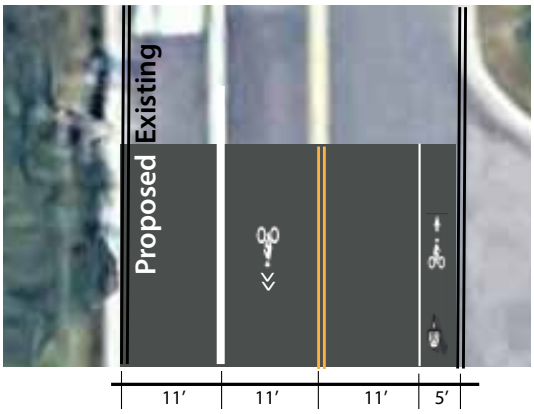
Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Hocker Grove Middle School to Perry Lane	0.15	Shared use path	NA	NA	3.7% WB from Perry Lane	10' shared use path on former interurban right of way. Completion of this will require city acquisition of the property or securing an easement for both path development and maintenance.
Hocker Drive, Perry Lane to Turkey Creek Streamway Trail access	0.42	Bike route	22 feet	1 side	3.6% ruling grade WB from trail access/Grant Street to Perry Lane	- Bike route and wayfinding signage - Shared lane markings to negotiate jog at Blackhoof Trail

6 W. 61st/62nd Street

Role in the Network

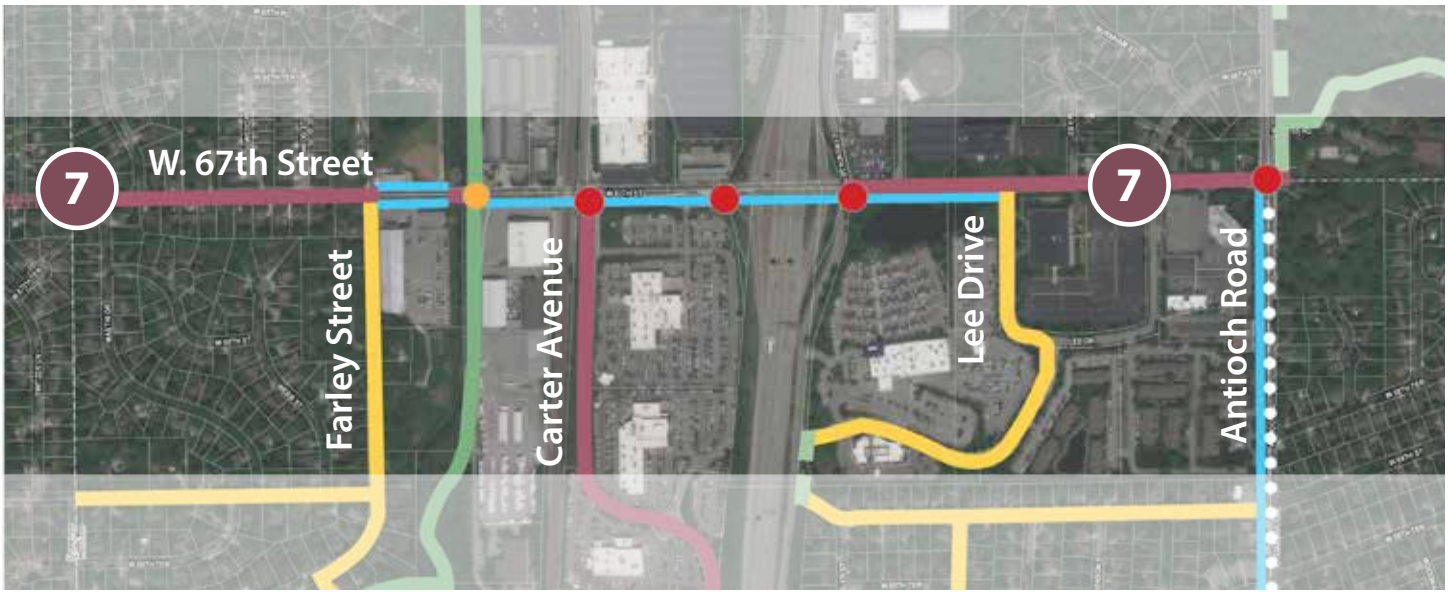
- Connection between Merriam and Shawnee, with access to the Nieman Road corridor
- Trail to trail link between Nieman Road and Turkey Creek Streamway Trail
- Terminates at Campbell Park Trailhead
- Serves Merriam Park Elementary School via Mastin Street
- Requires access agreement and right for pedestrian/bicycle passage on 62nd Street through Sunflower Apartments

Mastin Street Section at Merriam Park Elementary School



Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
W. 62nd Street (Sunflower Apts), city boundary to Mastin	0.12	Bike route	22 feet	NA	Flat	- Bike route and wayfinding signage - Shared lane markings for wayfinding - Street is on private property and requires easement for passage
Mastin Street	0.11	Bike lanes	34 feet	None	5.8% ruling grade NB from 62nd to 61st	- 6' standard bike lanes. SB shared lane marking in direct lane where turn lane is provided on Mastin Street into Merriam Park School.
W. 61st Street Mastin to Campbell Park Trailhead	0.31	Bicycle boulevard	25 feet	2 side	3.8% ruling grade WB from trailhead to Mastin; 9.5% maximum short grade	- Bike route and wayfinding signage - Shared lane markings for wayfinding

7 W. 67th Street



Role in the Network

- Major east-west component, connecting west side of Merriam to Antioch Park
- Continues through Antioch Park Trail and 66th Terrace to east city line
- Connection to Turkey Creek Trail
- Important I-35 crossing with improved sidewalk

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
W. 67th Street. west city line to Farley St	0.29	Bike Lanes	34 feet. Current section is 3 lanes from Farley to Mastin; 2 lanes west to city line	NA	5.3% WB from Farley Street. Gradual grade.	6' standard bike lanes
Farley Street to Turkey Creek Trail	0.10	Enhanced sidewalks	NA	None	Flat	Transition from bike lanes to sidewalks. Sidewalk use to trail intersection.

I-35 Crossing Concept

67th Street Section, Farley to City Line

67th Street Section, East Frontage to Antioch

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Turkey Creek Trail to East Frontage Road	0.31	Enhanced side-walks	NA	None	2.4% EB from trail	- Transition to south side-walk, using HAWK protect-ed crossing - 6′ sidewalk on south side as possible; probable walk bike zone at abutment - High visibility crosswalks at ramp crossings
East Frontage Road to Antioch Road	0.34	Bike lanes	45 feet, 4-lane section	None	2.6% continuous grade EB from frontage road	- Transition to bike lanes with high visibility cross-walk at frontage road - 4- to 3-lane reduction with 6′ standard bike lanes - High visibility crosswalk to Antioch Park

8 W. 61st Street

Role in the Network

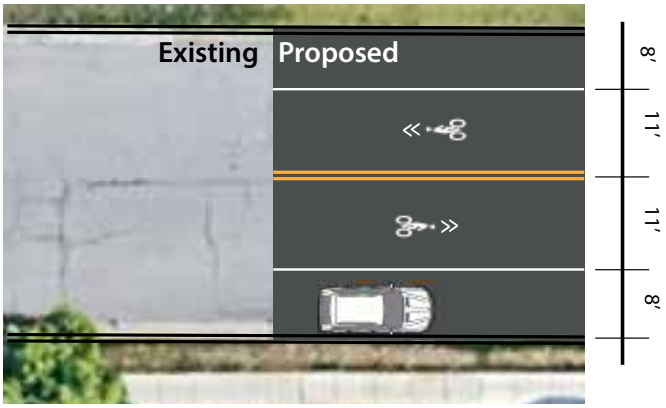
- East-West connection linking Community Center and Water Park to Crestview Elementary School and Shawnee Mission North High School
- Connection east to Rock Creek Trail and major retailing in Mission, including main street district along Johnson Drive
- Service to residential neighborhoods

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Path Connection, Slater to Antioch Road	0.10	Pathway	NA	NA	2.4% EB	Existing path and sidewalk to HAWK protected intersection of Antioch Road. Return to W. 61st Street along Antioch Road sidewalk
W. 61st Street, Antioch Road to city line	0.54	Bicycle boulevard	24 feet	1 side	2.5% EB from Antioch Road to Crestview School path	Shared lane markings with associated signage

9 W. 64th Terrace Crosstown

Role in the Network

- Connects Community Center/Water Park to Antioch Park
- Serves multifamily housing
- Close to Merriam Visitors Center
- Parallels Shawnee Mission corridor on south side, with adjacent neighborhood access



W. 64th Terrace 36' Section

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Eby Avenue/W. 64th Terrace, Shawnee Mission Parkway to Antioch Road	0.31	Bike route	36 feet, striped as 2 lane	2 side	4.2% WB Shawnee Mission to W. 64th Terrace and EB to Antioch Road	- Shared lane markings with associated signage - Striped parking lanes on both sides
W. 64th Terrace, Antioch Road to Goodman Street	0.30	Bike route	24 feet	2 side	1.6% EB	- Bike route and wayfinding signage,
GoodmanS treet, /W. 65th Street, W. 64th Terrace to Craig Road	0.15	Bike route	22 feet. Includes mini roundabout and short pathway segment	2 side	5.0% EB ruling grade	- Bike route and wayfinding signage,

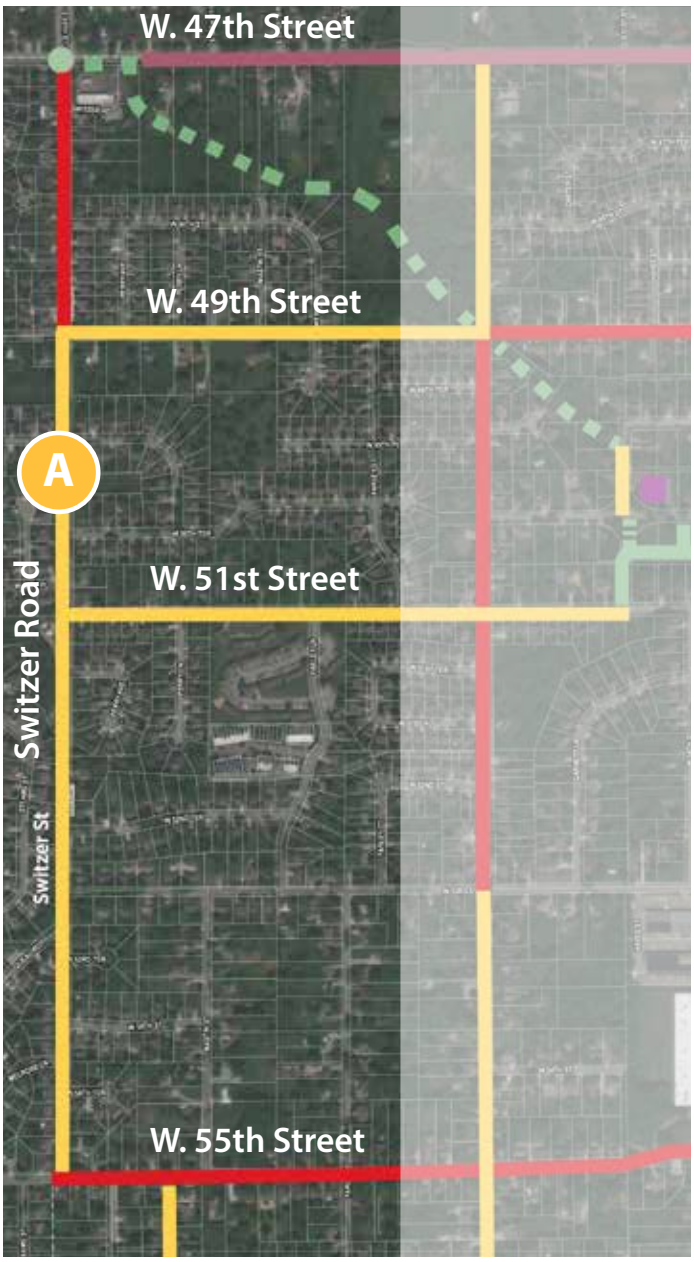
10 Antioch Park

Role in the Network

- Continues W. 67th Street main east-west route through Antioch Park and to the east city line.
- Major through bike route
- Route can continue through Overland Park to Prairie Village via W. 67th Street
- Continued potential connection east to Trolley Trail in Kansas City, Missouri

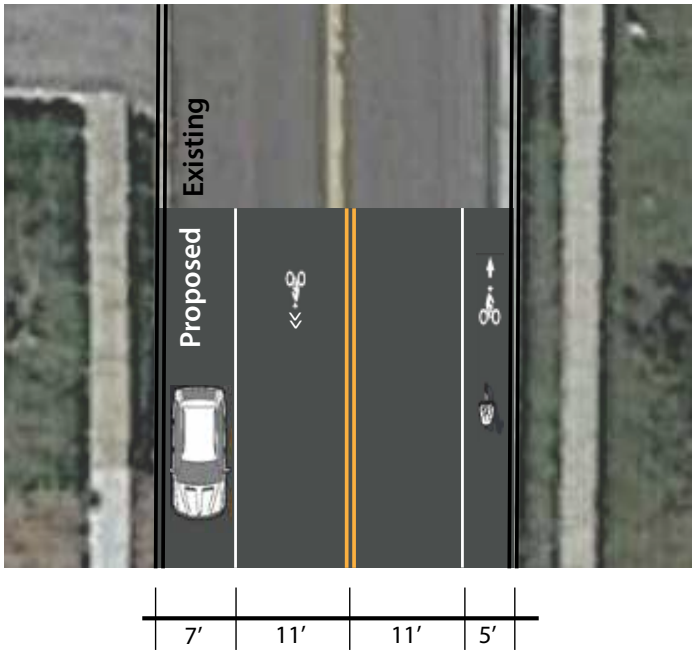
Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Antioch Park Trail, Antioch Road to W. 66th Terrace	0.29	Shared Use Path	NA	NA	Rolling park topography. Steepest grade in park is 6% EB	Existing trail
W. 66th Terrace, Park to Craig	0.16	Bike route	24 feet	2 side	2.8% EB	Bike route and wayfinding signage

A Westside Route: Switzer Road Segment



Role in the Network

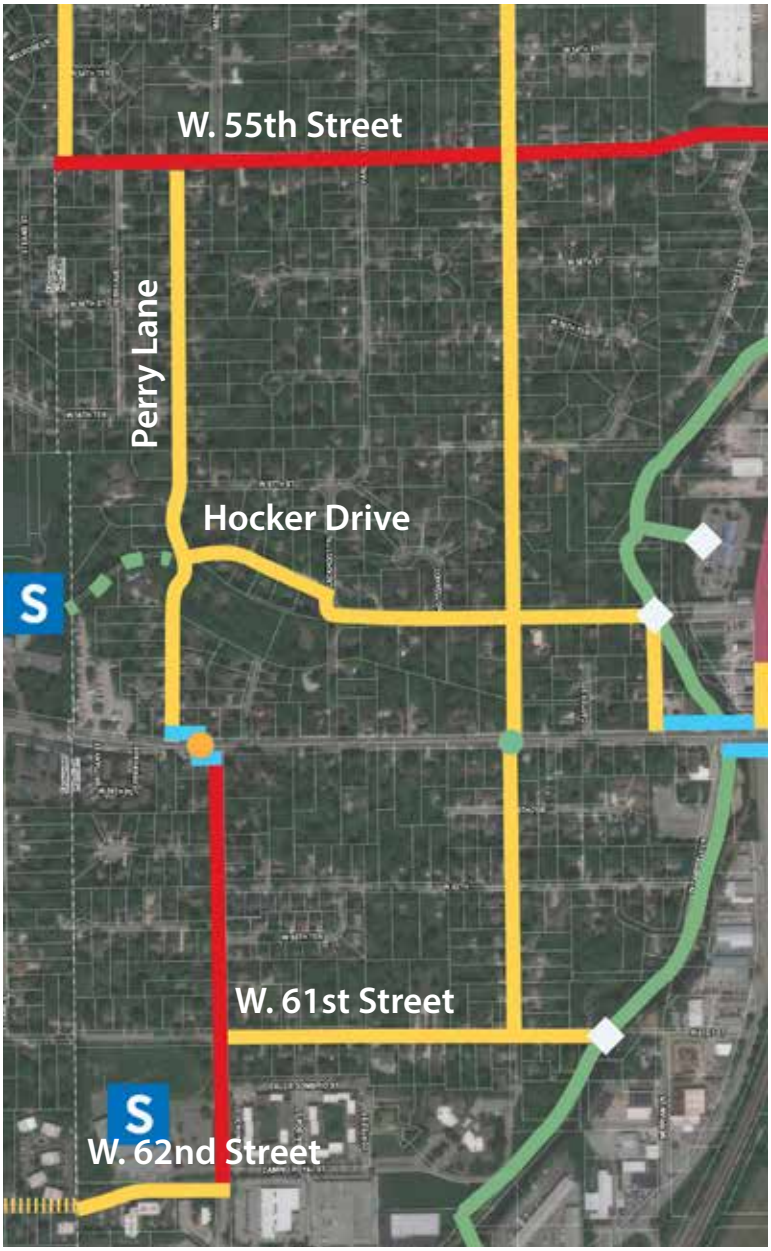
- North-south connector on western side of city
- Connects to school corridor along KCK S. 55th Street and riverfront industrial area for commuters
- Link along W. 55th Street Bikeway in Merriam, with to Nieman Road Corridor and West Flanders Park in Shawnee
- Component of a north-south bicycle boulevard composed of Switzer Road, Perry Lane, and Mastin Street



Switzer Road Section, 47th to 49th

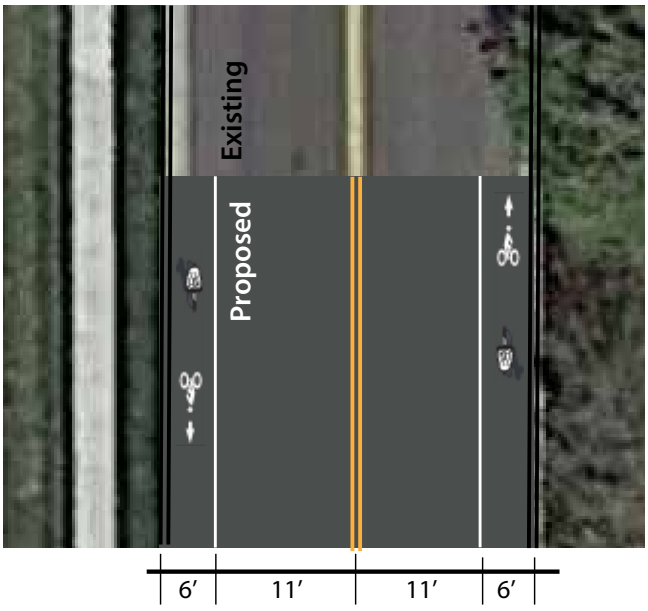
Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
W. 47th to W. 49th Street	0.24	Bicycle boulevard with one side bike lane	34 feet	1 side	4.8% SB from 47th to 48th; 3.6% NB from 49th to 48th	5' standard bike lane on east side; shared lane marking by City of Shawnee on west side
W. 49th to W. 55th Street	0.50	Bicycle boulevard combined with Perry Lane and Mastin Street	NA	None	7.1% NB uphill from just south of W. 51st to W. 47th Street; 5.6% SB from north of W. 53rd to W. 55th Street.	Transition from bike lanes to sidewalks. Sidewalk use to trail intersection.

A Westside Route: Perry Lane/Mastin Segment



Role in the Network

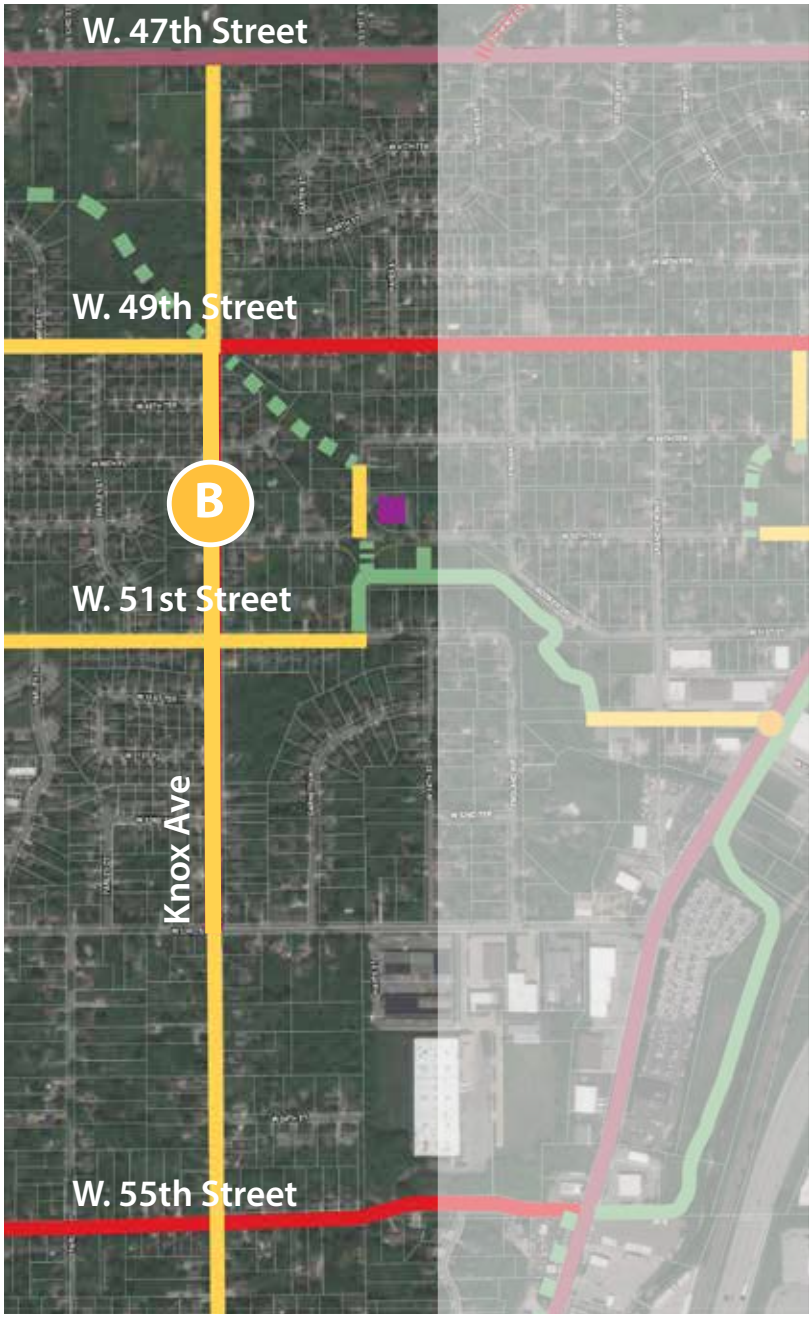
- North-south connector on western side of city
- Connects to school corridor along KCK S. 55th Street and riverfront industrial area for commuters
- Link along W. 55th Street Bikeway in Merriam, with to Nieman Road Corridor and West Flanders Park in Shawnee
- Component of a north-south bicycle boulevard composed of Switzer Road, Perry Lane, and Mastin Street



Mastin Street Section

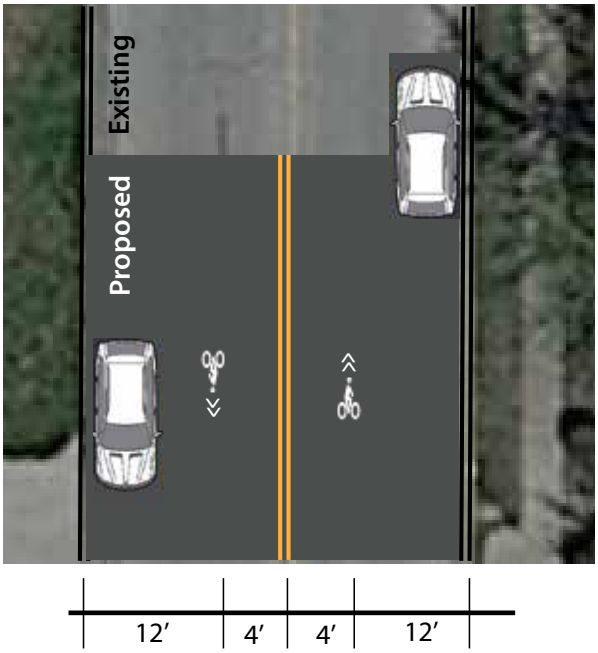
Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Perry Lane, W. 55th Street to Johnson Drive	0.50	Bicycle boulevard	25 feet	2 side	Rolling grades with limited net gain; maximum grade is 4.2% SB	- Shared lane markings and signage. Transition with sidewalks and existing HAWK protected crossing of Johnson Drive.
Mastin Street, Johnson Dr to W. 62nd Street	0.38	Bicycle boulevard with bike lanes	34 feet	None	6.7% NB from 62nd Street	- 6′ standard bike lanes - Convert to SB shared lane marking in the direct travel lane at turn lane into Merriam Park Elementary School;

B Knox Avenue Bicycle Boulevard (north)



Role in the Network

- North-south connector through center of city
- Direct access to Brown Park and Turkey Creek Trail at Campbell Park
- Major residential service corridor
- Ties together many of the east-west neighborhood corridors
- Connection to potential creek greenway



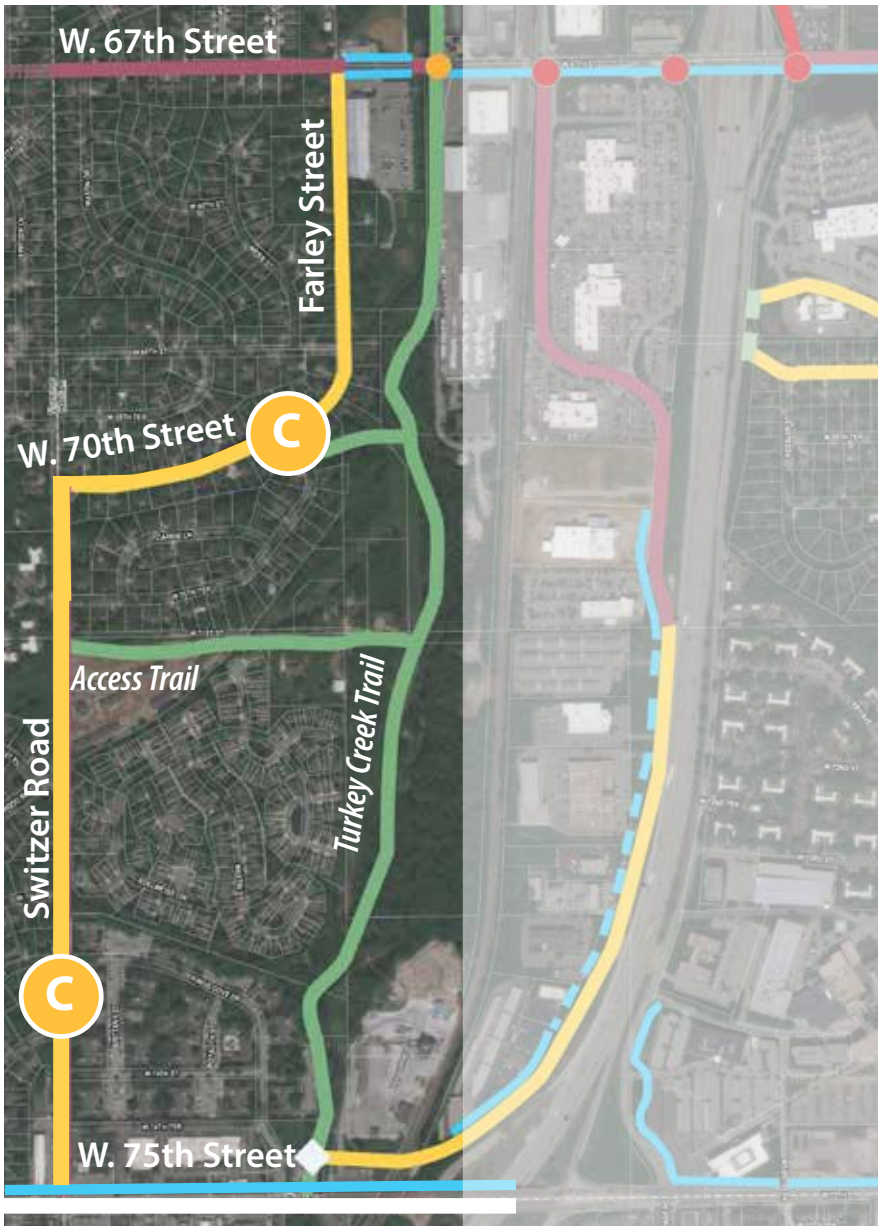
Note: This illustration displays sharrow placement on the 32′ section. On narrower sections, the centerline of the sharrow should typically be placed 10-11 feet from the curb line.

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
W. 47th to W. 49th Street	0.24	Bicycle boulevard	26 feet	2 side	4.4% continuous NB from 49th to 47th	Shared lane marking with associated signage
W. 49th to W. 53rd Street	0.50	Bicycle boulevard	32 feet	2 side	Rolling topography with typical 4.6 to 4.8% grades in both directions	Shared lane marking with associated signage

B Knox Avenue Bicycle Boulevard (south)

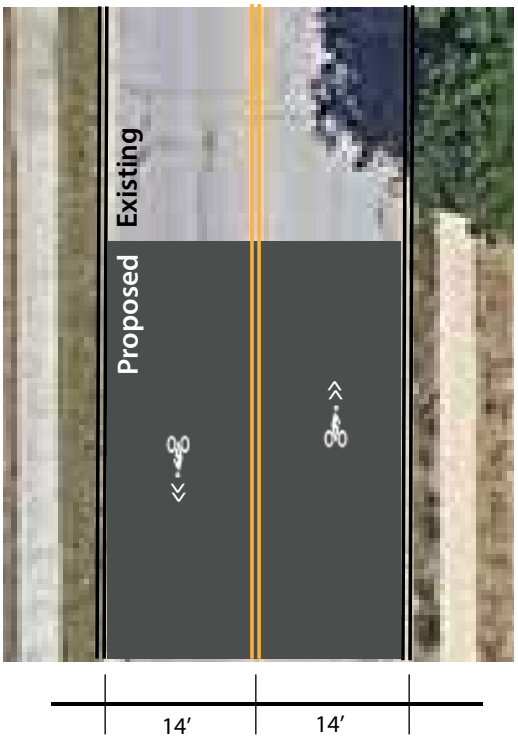
Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
W. 53rd to W. 55th Street	0.25	Bicycle boule-vard	25 feet	2 side	Rolling with maximum grades of about 4.5% in both directions.	Shared lane marking with associated signage
W. 55th Street to Johnson Drive	0.50	Bicycle boule-vard	27 feet	2 side	Rolling. Maximum grade 5.9% NB from Hocker Drive	Shared lane marking with associated signage
Johnson Drive to W. 61st Street	0.25	Bicycle boule-vard	25 feet	2 side	Rolling. Maximum grade 6.7% NB from 61st St	Shared lane marking with associated signage

C Farley/Switzer Route



Role in the Network

- Connector of neighborhoods west of Turkey Creek to the bikeway system and W. 67th Street
- Neighborhood route to W. 75th Street commercial corridor
- Potential service to Kings Cove
- Direct access to W. 75th Street and Nieman Road Center via Edgewood Boulevard in Shawnee



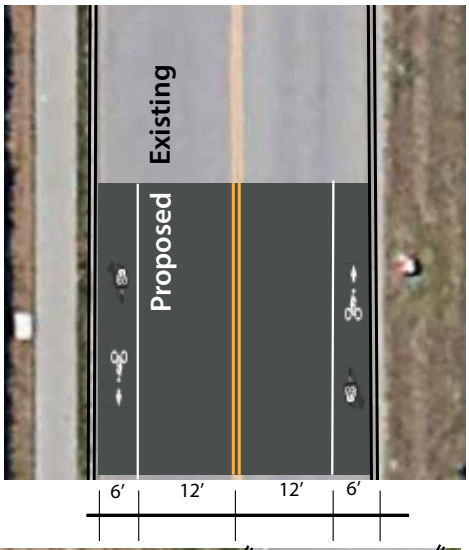
Switzer Road Section, 71st to 75th

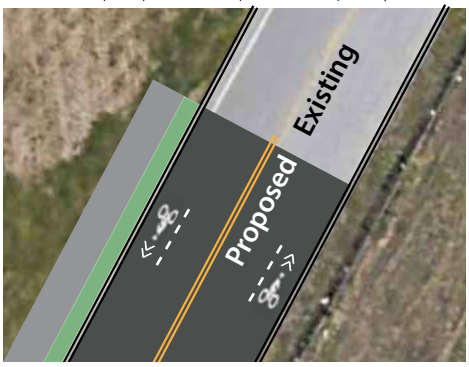
Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Farley Street, W. 67th to W. 70th Street	0.34	Bike route	26 feet	2 side	4.0% from W. 67th Street to W. 69th Street; and 3.7% NB from W. 70th Terrace to W. 69th Street	Bike route and wayfinding signage
W. 70th Street, Farley Street to Switzer Road	0.21	Bike route	24 feet	2 side	1.4% WB	Bike route and wayfinding signage
Switzer Road, W. 70th Terrace to W. 75th Street	0.64	Bike lanes	28 feet	None	Rolling. Maximum 4.1% SB from W. 70th Street to Edgewood Blvd	- Bike route and wayfinding signage, shared lane markings - Coordination with City of Shawnee

D West Frontage Road

Role in the Network

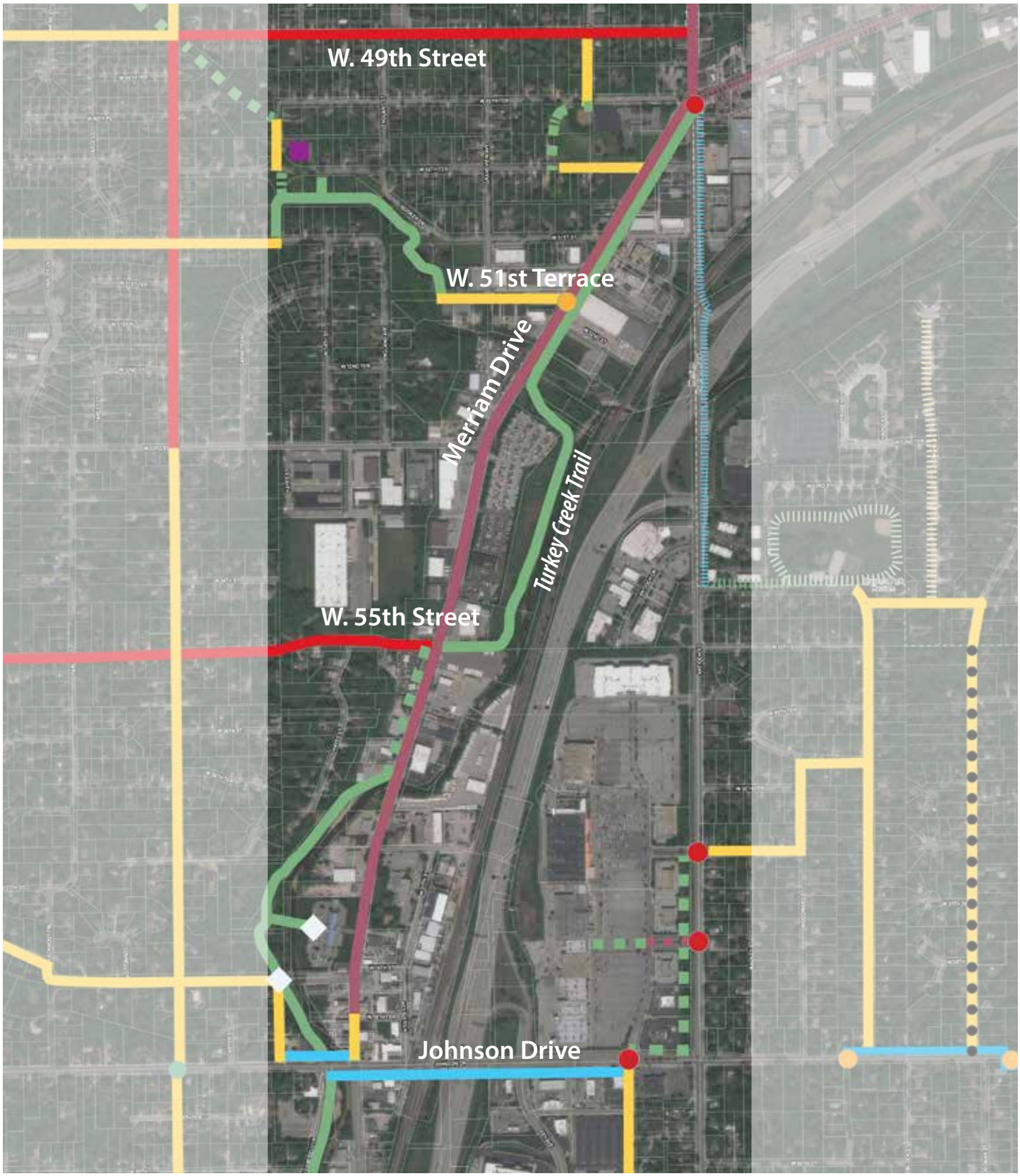
- Access to businesses along the I-35 corridor
- Complement to the Turkey Creek Trail on the east side of the railroad





Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Carter Ave/Frontage Rd, W. 67th to W. 71st Street alignment	0.54	Bike lanes/ shoulders	36 feet, 2 lane section	None	1.6% SB gradual grade	6 foot standard bike lanes. New
Frontage Road, W. 71st Street alignment to Wedd Street	0.68	Bike route	27 feet	None	3.7% NB to W. 71st Street	- Shared lane markings with associated signage - 5' sidewalk on west side from end of current sidewalk to driveway west of Turkey Creek - Gap with connection over Turkey Creek and connection to trail to be completed in 2022

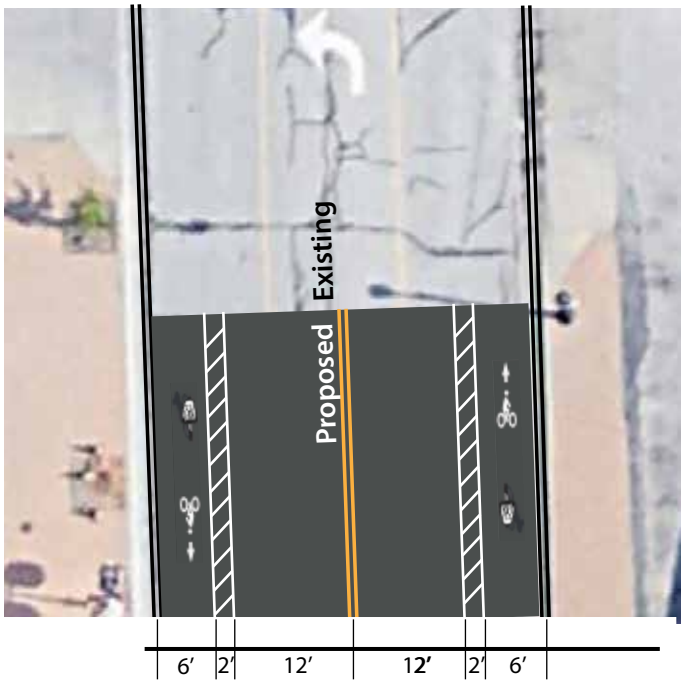
E Merriam Drive



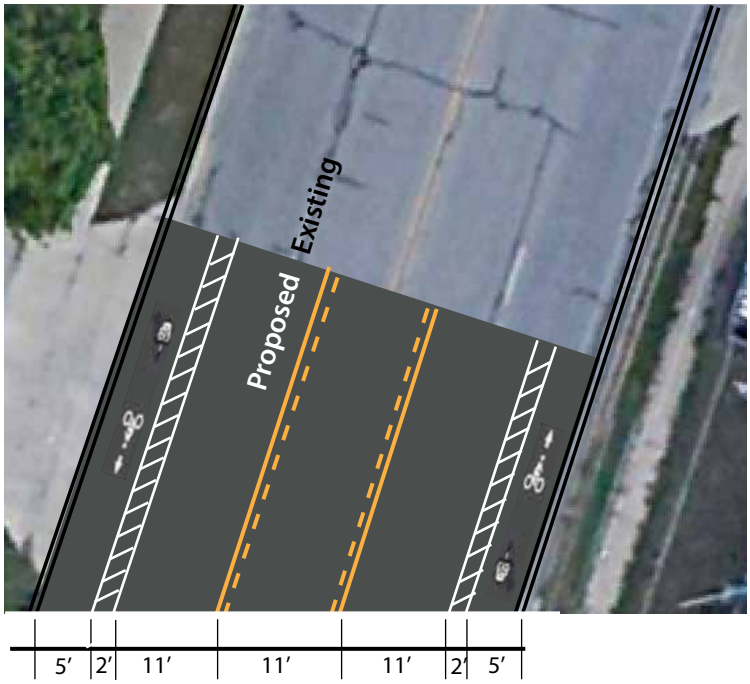
E Merriam Drive

Role in the Network

- Primary route through Downtown Merriam
- Access to Marketplace and Werner Park
- Parallels and in some places accommodates the Turkey Creek Trail as a sidepath
- Extends major commuter route to Downtown Kansas City, Missouri to Johnson Drive and south to the W. 75th Street Trailhead



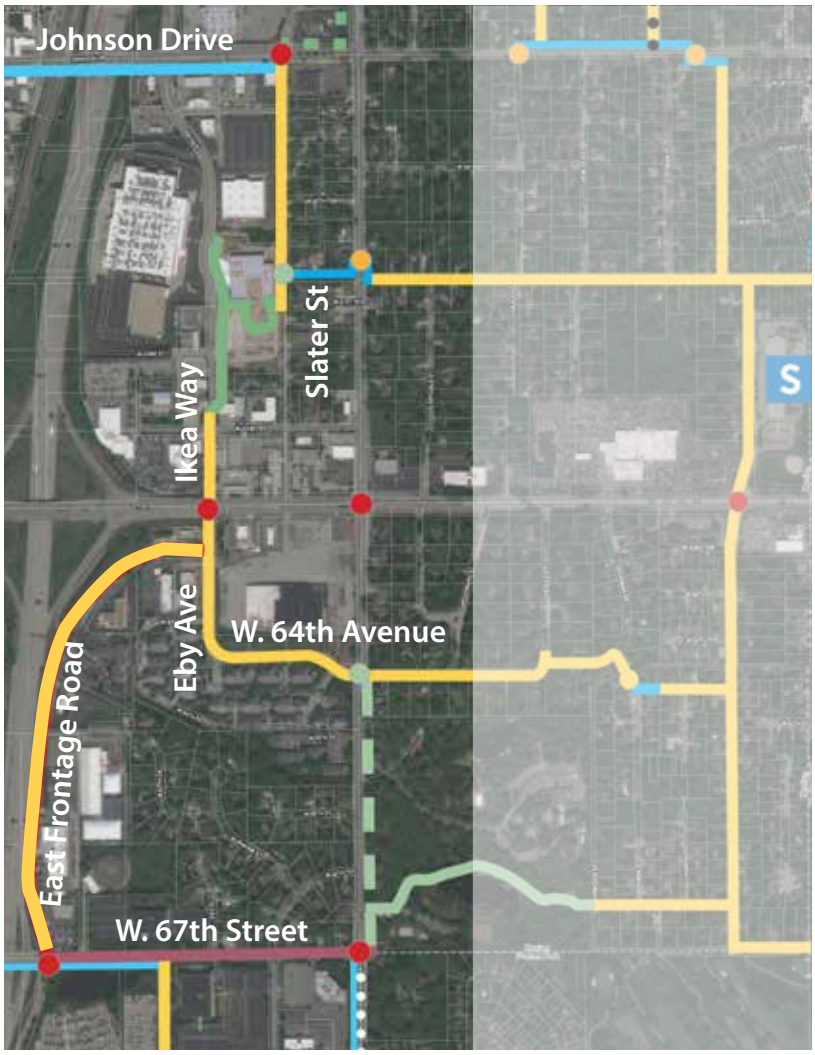
40-44 foot section, 58th to Turkey Creek



48 foot section, Turkey Creek to Antioch

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Merriam Drive, Johnson Drive to W. 58th Street	0.11	Bike route through downtown district	40 feet, 3-lane section	1-side south of 58th Ter	Flat	Enhanced shared lane marking with associated signage
Merriam Drive, W. 58th St to Turkey Creek bridge	0.22	Buffered bike lanes	40-44 feet, 3-lane section	None	Flat	- 3 to 2-lane reduction with buffered bike lanes - Width of buffer varies, increasing as street widens - 2-lane section matches Merriam Lane section north of I-635
Merriam Dr, W. 58th to Antioch Rd	0.93	Buffered bike lanes	48 feet	None	Maximum 1.9% NB	- 4 to 3 lane reduction with 11′ travel lanes

F East Frontage/Grandview Route (North)



Role in the Network

- Continuous north-south route serving features and businesses along the I-35 corridor.
- Serves Community Center, Water Park, and Visitors Center
- Links Johnson Drive and W. 67th Street corridors on north side
- Frontage under KDOT control. Concept shown is advisory

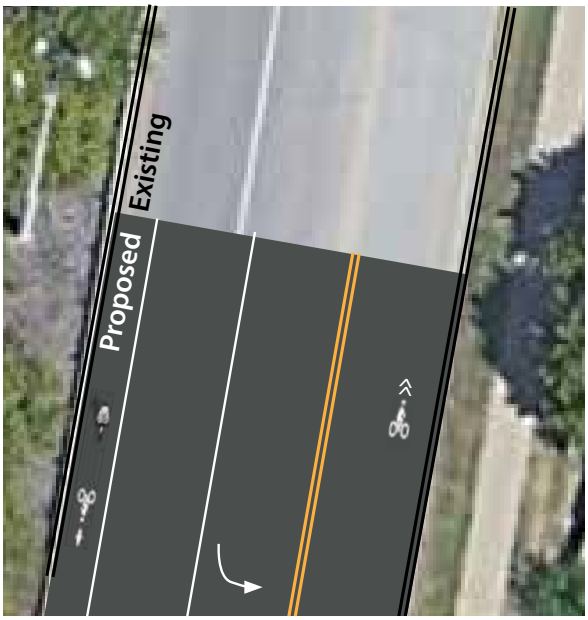
East Frontage Road, 27' section (including curbs)

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Slater Street, Johnson Drive to Community Center Path	0.26	Bike route	27 feet	None	5.6% maximum grade SB	- Shared lane markings with associated signage
Community Center Path, Slater Street to Ikea Way	0.16	Shared use path	8 feet	NA	4.7% continuous SB	Existing shared use path
Ikea Way/Eby Avenue to East Frontage Road	0.18	Bike route	25-32 feet	None	3.4% NB ruling grade	- Enhanced shared lane markings with associated signage
East Frontage Road, Eby to W. 67th Street	0.57	Bike route, 1 directional lane	27' including curbs	None	4.0% SB maximum grade, similar grade NB on north part of segment	Shared lane markings in opposing direction using dashed lines along the marking. KDOT has jurisdiction over the frontage road

F East Frontage/Grandview Route (South)

Role in the Network

- Connection for neighborhoods in south part of Merriam
- Serves Quail Creek Park
- Potential access to Shawnee Mission Medical Center



East Frontage, 42' section

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Lee/Carmax Drive	0.43	Bike route	26-32 feet	None	3.1% maximum grade SB; 2.3% NB	- Shared lane markings with associated signage
Sidepath, Carmax Drive to W. 69th Street	0.10	Shared use path	NA	NA	3.9% NB	Proposed short path connection
W. 69th Street, Frontage Road to Grandview Street	0.15	Bike route	25-32 feet	None	3.8% EB ruling grade	- Shared lane markings with associated signage
Grandview Street, W. 69th Street to Antioch Road	0.58	Bike boulevard	27-42'	None	5.0% NB maximum grade for first 1,000 ft. SB/EB grade is 1.5% beyond that point.	Bike lane in single direction, enhanced shared lane marking in opposing direction. KDOT has jurisdiction over the frontage road

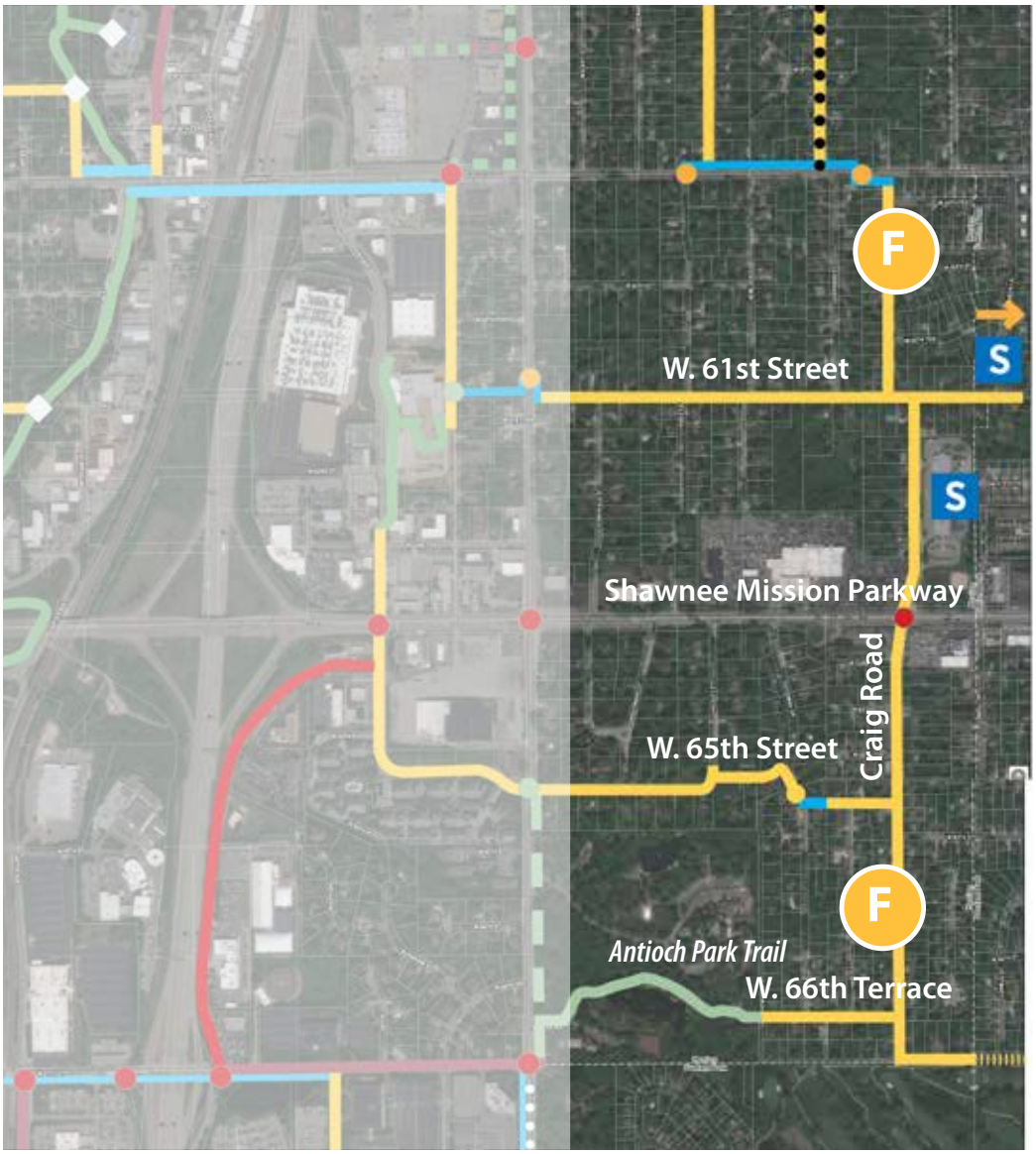
G Goodman/Craig Bicycle Boulevard (north)

Role in the Network

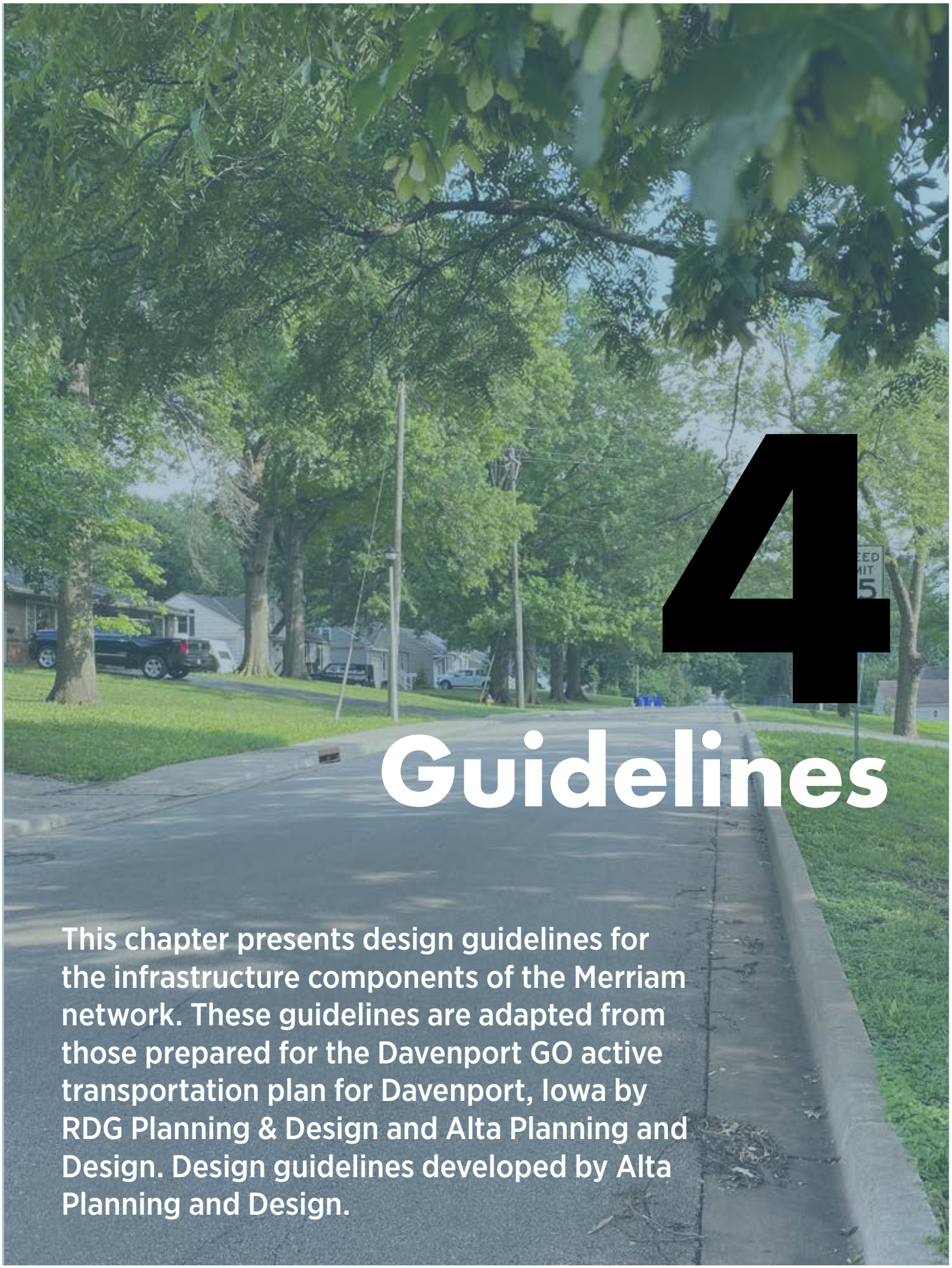
- Continuous east-side bicycle boulevard connecting residential areas in Merriam
- Connection of east-west routes, including potential connections in Overland Park, Mission, and Prairie Village
- Access to Antioch Park, Robinson Park, Hickory Hills Park (OP), Shawnee Mission North High School, Crestview Elementary School
- Takes advantage of Goodman St. traffic calming project

Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Goodman Street, W. 54th Terrace to Johnson Drive	0.55	Bicycle Boulevard	24 feet. Neckdown are used as a traffic calming technique	2 side	4.3% ruling grade SB to Johnson	- Shared lane markings with associated signage
Johnson Drive sidewalks, Goodman Street to Hardy Street	0.10	Sidewalk	48 foot, 4-lane section	None		- Use existing pedestrian crossing between Goodman and Hardy
Hardy Street, Johnson Drive to W. 61st Street	0.18	Bike route	26 feet	2 side	4.8% NB grade, 61st to Johnson	- Shared lane markings with asociated signage

G Goodman/Craig Bicycle Boulevard (south)



Segment	Length (mi)	Facility Type	Typical street width	Parking	Grades	Design Treatment
Craig Road, W. 61st Street to Shawnee Mission Parkway	0.24	Bicycle Boulevard	27-28 feet.	1 side	3.2% ruling grade SB; 5.7% maximum grade SB from Crestview School to Shawnee Mission Parkway	- Shared lane markings with associated signage
Craig Road, Shawnee Mission Parkway to 67th St	0.50	Bicycle Boulevard	26 feet; traffic calmers using speed humps	2 side	5% maximum grade NB and SB	- Shared lane markings with associated signage



4 Guidelines

This chapter presents design guidelines for the infrastructure components of the Merriam network. These guidelines are adapted from those prepared for the Davenport GO active transportation plan for Davenport, Iowa by RDG Planning & Design and Alta Planning and Design. Design guidelines developed by Alta Planning and Design.

DESIGN GUIDELINES

The Design Guidelines provide an inventory of bicycle and trail design treatments proposed in Merriam to provide a strong foundation for the development of the bicycle transportation network. These treatments and design guidelines represent the tools for creating a safe and accessible community. The guidelines are not, however, a substitute for a more thorough evaluation by a landscape architect or engineer upon implementation of facility improvements.

National Guidance

The following standards and guidelines are referred to in these guidelines:

- The Federal Highway Administration's (FHWA) ***Manual on Uniform Traffic Control Devices (MUTCD)*** defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public traffic The MUTCD is the primary source for guidance on lane striping requirements, signal warrants, and recommended signage and pavement markings.
- American Association of State Highway and Transportation Officials (AASHTO) ***Guide for the Development of Bicycle Facilities (2012)*** provides guidance on dimensions, use, and layout of specific bicycle facilities.
- The National Association of City Transportation Officials' (NACTO) ***Urban Bikeway Design Guide (2012)*** is the newest publication of nationally recognized bikeway design standards, and offers guidance on the current state of the practice designs.
- The AASHTO A Policy on ***Geometric Design of Highways and Streets (2011)*** commonly referred to as the "Green Book," contains the current design research and practices for highway and street geometric design.

State Guidance

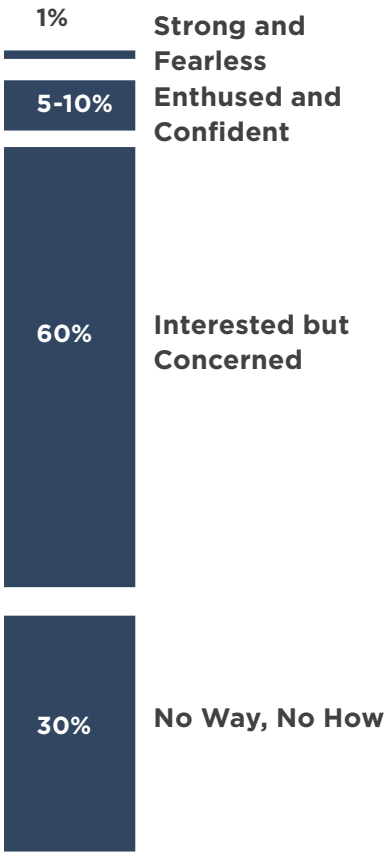
The Kansas Department of Transportation's (KDOT) Statewide Urban Design and Specifications (SUDAS) manual provides guidance for local agencies regarding bicycle and pedestrian facility design.

Impact on Safety and Crashes

Bicycle facilities can have a significant influence on user safety. The Federal Highway Administration Crash Modification Factor Clearinghouse (http://www.cmfclearinghouse.org/) is a web-based database of Crash Modification Factors (CMF) to help transportation engineers identify the most appropriate countermeasure for their safety needs. Where available and appropriate, CMFs or similar study results are included for each treatment.

BICYCLE USER TYPES

The current AASHTO Guide to the Development of Bicycle Facilities encourages designers to identify their rider type based on the trip purpose (Recreational vs Transportation) and on the level of comfort and skill of the rider (Causal vs Experienced). A user-type framework for understanding a potential rider's willingness to bike is illustrated in the figure below. Developed by planners in Portland, OR* and supported by research**, this classification identifies four distinct types of bicyclists.



Typical Distribution of Bicyclist Types

Strong and Fearless. Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections -- even if shared with vehicles -- over separate bicycle facilities such as shared-use paths.

Enthused and Confident. This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared-use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreationalists, racers and utilitarian bicyclists.

Interested but Concerned. This user type comprises the bulk of the cycling population and represents bicyclists who typically only ride a bicycle on low traffic streets or shared-use paths under favorable weather conditions. These bicyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become "Enthused & Confident" with encouragement, education and experience. This segment of users will help increase demand for bicycle facilities.

No Way, No How. Persons in this category are not bicyclists, and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will not ride a bicycle under any circumstances.

* Roger Geller, City of Portland Bureau of Transportation. Four Types of Cyclists. http://www.portlandonline.com/transportation/index.cfm?&a=237507. 2009.

** Dill, J., McNeil, N. Four Types of Cyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential. 2012.

SHARED ROADWAYS

On shared roadways, bicyclists and motor vehicles use the same roadway space. These facilities are typically used on roads with low speeds and traffic volumes, however they can be used on higher volume roads with wide outside lanes or shoulders. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

SIGNED & MARKED SHARED ROADWAYS

BICYCLE BOULEVARDS

SIGNED & MARKED SHARED ROADWAYS

Signed and marked shared roadways are facilities shared with motor vehicles. They are typically used on roads with low speeds and traffic volumes. These on-street bikeways incorporate shared lane markings in a general purpose travel lane and D11-1* bike route signs to identify the street as a bikeway and alert motorists to be aware of bicycle traffic. The shared lane markings (SLM) encourage bicycle travel and proper positioning within the lane. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

Typical Application

- Signed & Marked Shared Roadways serve either to provide continuity with other bicycle facilities (usually bike lanes) or to designate preferred routes through high-demand corridors.
- This configuration differs from a bike boulevard due to a lack of traffic calming and other enhancements designed to provide a higher level of comfort for a broad spectrum of users.
- In constrained conditions, the SLMs are placed in the middle of the lane. On a wide outside lane, the SLMs can be used to promote bicycle travel to the right of motor vehicles.
- In all conditions, SLMs should be placed outside of the door zone of parked cars.

* This and similar designations are the designations for specific signs in the *Manual on Uniform Traffic Control Devices* (MUTCD) of the Federal Highway Administration

Design Features

Route Signage

- Lane width varies depending on roadway configuration.

(A) Bike route signage (D11-1) should be applied at intervals frequent enough to keep bicyclists informed of changes in route direction and to remind motorists of the presence of bicyclists. Commonly, this includes placement at:

  › Beginning or end of Bicycle Route.

  › At major changes in direction or at intersections with other bicycle routes.

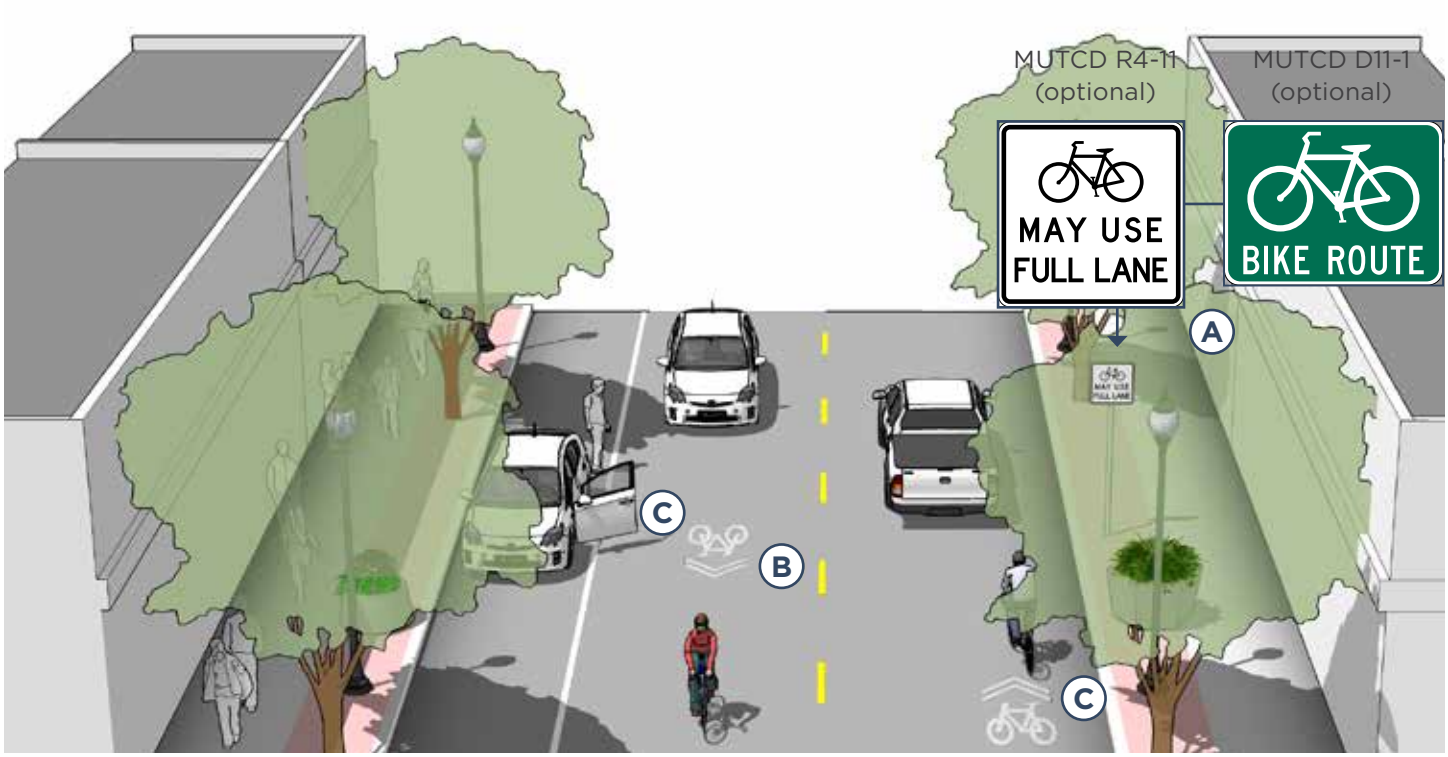
  › At intervals along bicycle routes not to exceed ½ mile.

Shared Lane Markings

- May be used on streets with a speed limit of 35 mph or under. Lower than 30 mph speed limit preferred.

(B) In constrained conditions, preferred placement is in the center of the travel lane to minimize wear and promote single file travel.

(C) Minimum placement of SLM marking centerline is 11 feet from edge of curb where on-street parking is present, 4 feet from edge of curb with no parking. If parking lane is wider than 7.5 feet, the SLM should be moved further out accordingly.



BICYCLE BOULEVARDS

Bicycle boulevards are low-volume, low-speed streets modified to enhance bicyclist comfort by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These treatments allow through movements of bicyclists while discouraging similar through-trips by non-local motorized traffic.

Typical Application

- Parallel with and in close proximity to major thoroughfares (1/4 mile or less).
- Follow a desire line for bicycle travel that is ideally long and relatively continuous (2-5 miles).
- Avoid alignments with excessive zigzag or circuitous routing. The bikeway should have less than 10 percent out of direction travel compared to shortest path of primary corridor.
- Streets with travel speeds at 25 mph or less and with traffic volumes of fewer than 3,000 vehicles per day.

Design Features

(A) Signs and pavement markings are the minimum treatments necessary to designate a street as a bicycle boulevard.

(B) Implement volume control treatments based on the context of the bicycle boulevard, using engineering judgment. Target motor vehicle volumes range from 1,000 to 3,000 vehicles per day.

(C) Intersection crossings should be designed to enhance safety and minimize delay for bicyclists.

Further Consideration

Bicycle boulevard retrofits to local streets are typically located on streets without existing signalized accommodation at crossings of collector and arterial roadways. Without treatments for bicyclists, these intersections can become major barriers along the bicycle boulevard and compromise safety.
Traffic calming can deter motorists from driving on a street. Anticipate and monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

Crash Reduction

In a comparison of vehicle/cyclist collision rates on traffic-calmed side streets signed and improved for cyclist use, compared to parallel and adjacent arterials with higher speeds and volumes, the bicycle boulevard as found to have a crash reduction factor of 63 percent, with rates two to eight times lower when controlling for volume Source: Minikel, E., *Cyclist Safety on Bicycle Boulevards and Parallel Arterial Routes in Berkeley, CA*, 2011, included in US Department of Transportation Crash Modification Clearinghouse.

Motor vehicle speeds affect the frequency at which automobiles pass bicyclists as well as the severity of crashes that can occur. Maintaining motor vehicle speeds closer to those of bicyclists' greatly improves bicyclists' comfort on a street. Slower vehicular speeds also improve motorists' ability to see and react to bicyclists and minimize conflicts at driveways and other turning locations.

Vertical Traffic Calming

Vertical speed control measures are composed of slight rises in the pavement, on which motorists and bicyclists must reduce speed to cross.

Guidance

- Bicycle boulevards should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.
- Speed humps are raised areas usually placed in a series across both travel lanes. A 14' long hump reduces impacts to emergency vehicles. Speed humps can be challenging for bicyclists, gaps can be provided in the center or by the curb for bicyclists and to improve drainage. Speed humps can also be offset to accommodate emergency vehicles.
- Speed lumps or cushions have gaps to accommodate the wheel tracks of emergency vehicles.
- Speed tables are longer than speed humps and flat-topped. Raised crosswalks are speed tables that are marked and signed for a pedestrian crossing.

Speed Hump

Offset Speed Hump

Temporary Speed Cushion

Raised Crosswalk

- For all vertical traffic calming, slopes should not exceed 1:10 or be less steep than 1:25. Tapers should be no greater than 1:6 to reduce the risk of bicyclists losing their balance. The vertical lip should be no more than a 1/4" high.

Intersections with Major Streets

The quality of treatments at major street crossings can significantly affect a bicyclist's choice to use a neighborhood greenway, as opposed to another road that provides a crossing treatment.

Guidance

- Bike boxes increase bicyclist visibility to motorists and reduce the danger of right "hooks" by providing a space for bicyclists to wait at signalized intersections.
- Median islands provided at uncontrolled intersections of neighborhood greenways and major streets allow bicyclists to cross one direction of traffic at a time as gaps in traffic occur.
- Hybrid beacons, active warning beacons and bicycle signals can facilitate bicyclists crossing a busy street on which cross-traffic does not stop.
- Select treatments based on engineering judgment; see National Cooperative Highway Research Program (NCHRP) Report # 562 Improving Pedestrian Safety at Unsignalized Crossings (2006) for guidance on appropriate use of crossing treatments. Treatments are designed to improve visibility and encourage motorists to stop for pedestrians; with engineering judgment many of the same treatments are appropriate for use along neighborhood greenways.

Shared lane markings continued across the intersection

Bike Box

Median Island

Hybrid Beacon (HAWK

Active Flashing Beacon

ADVISORY BIKE LANES (ABL)

While not proposed in the recommendations for Merriam, advisory bike lanes (ABL) may play a significant role as the network evolves. Advisory bike lanes are a type of shared roadway that clarify operating positions for bicyclists and motorists to minimize conflicts and increase comfort. Similar in appearance to bike lanes, advisory bike lanes are distinct in that they are temporarily shared with motor vehicles during turning, approaching, and passing.

Typical Application

- Most appropriate on streets where motor vehicle traffic volumes are low-moderate (500-4,500 ADT), and where there is insufficient room for conventional bicycle lanes. Traffic speeds of 30 KPH to 60 KPH are possible with advisory bike lanes but caution should be used at higher speed levels, e.g. traffic calming, lower vehicular volumes, etc.
- If on-street parking is present, parking lanes should be highly utilized or occupied with curb extensions to separate the parking lane from the advisory bike lane.

Design Features

A. No centerline on roadway.

B. Advisory bike lane width of 5 - 7 ft.

C. Minimum center travel lane width of 8 - 20 ft.. When center travel lane width allows 2 vehicles to pass without use of bike lanes, additional traffic calming should be considered. Center travel lane widths which make it unclear whether two vehicles can pass without use of the bike lane should be avoided – use obviously narrow or obviously wide center travel lanes.

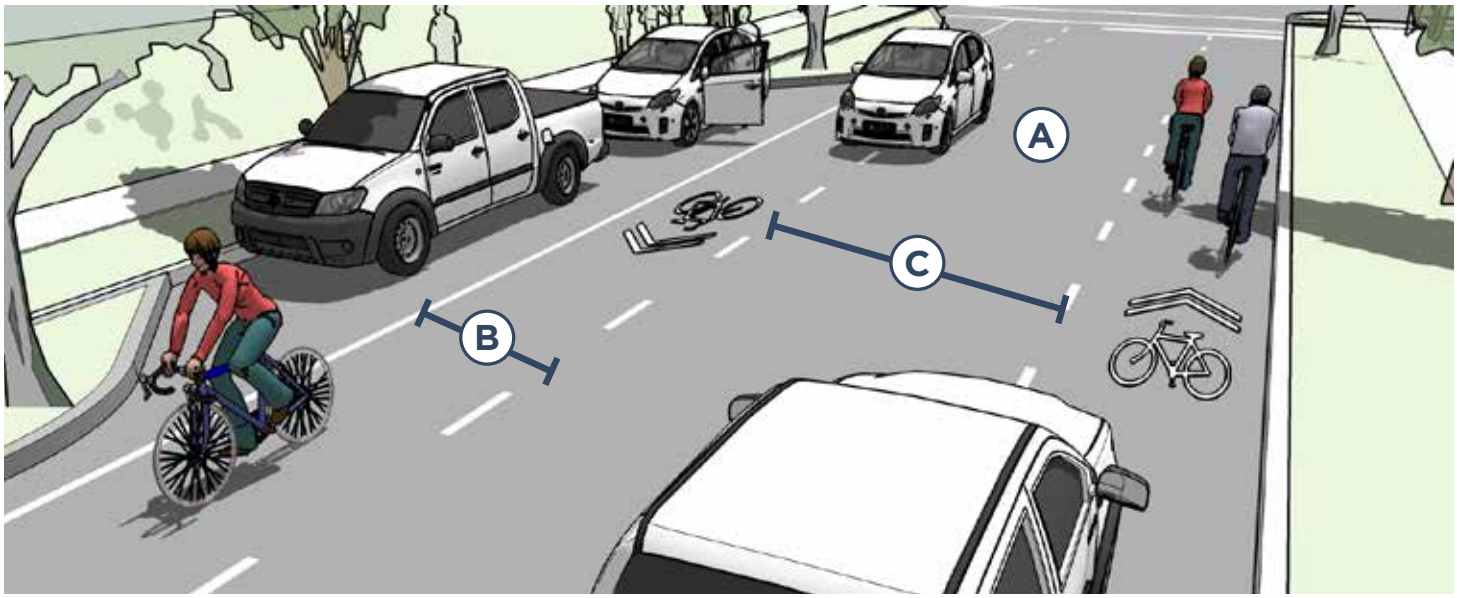
Advisory Bike Lane in Minnesota

Crash Reduction

Short-term engineering evaluation studies have been performed on five US ABL installations. All have found the facilities to be safe and operating as intended. One English study found a reduction in accidents from 17 injury accidents a year to 11 (a 35% reduction) after removal of a centerline from a road in Wiltshire County.

Further Consideration

- Consider the use of colored pavement within the bike lanes to discourage unnecessary encroachment by motorists or parked vehicles.
- It is important to consider the needs of various road users when implementing an advisory bike lane. Required passing widths for truck or emergency vehicles should be considered on routes where such vehicles are anticipated.
- This treatment can be used on both urban and rural roads with appropriate speeds and volumes. Curves, hills, and dips should be assessed for sufficient sight distance to ensure safe operation.
- Channelizing islands may be useful in areas where drivers need to be encouraged to return to the center travel lane.



CONVENTIONAL BIKE LANES

On-street bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signs. The bike lane is located directly adjacent to motor vehicle travel lanes and is used in the same direction as motor vehicle traffic. Bike lanes are typically on the right side of the street, between the adjacent travel lane and curb, road edge or parking lane.

Typical Application

- Bike lanes may be used on any street with adequate space, but are most effective on streets with moderate traffic volumes ≥ 6,000 ADT (≥ 3,000 preferred).
- Bike lanes are most appropriate on streets with moderate speeds ≥ 25 mph.
- Appropriate for skilled adult riders on most streets.
- May be appropriate for children when configured as 6+ ft wide lanes on lower-speed, lower-volume streets with one lane in each direction.

Design Features

(A) Mark inside line with 6” stripe. Mark 4“ parking lane line or “Ts”.[1]

(B) Include a bicycle lane marking (MUTCD Figure 9C-3) at the beginning of blocks and at regular intervals along the route (MUTCD 9C.04).

(C) 6 ft width preferred adjacent to on-street parking (5 ft min.).

(D) 5–6 ft preferred adjacent to curb and gutter (4 ft min.) or 4 ft more than the gutter pan width.

Further Consideration

- On high speed streets (≥ 40 mph) the minimum bike lane should be 6 ft.
- On streets where bicyclists passing each other is to be expected, where high volumes of bicyclists are present, or where added comfort is desired, consider providing extra wide bike lanes up to 7 ft wide, or configure as a buffered bicycle lane.
- It may be desirable to reduce the width of general purpose travel lanes in order to add or widen bicycle lanes.
- On multi-lane and/or high speed streets, the most appropriate bicycle facility to provide for user comfort may be buffered bicycle lanes or physically separated bicycle lanes.

Manhole Covers

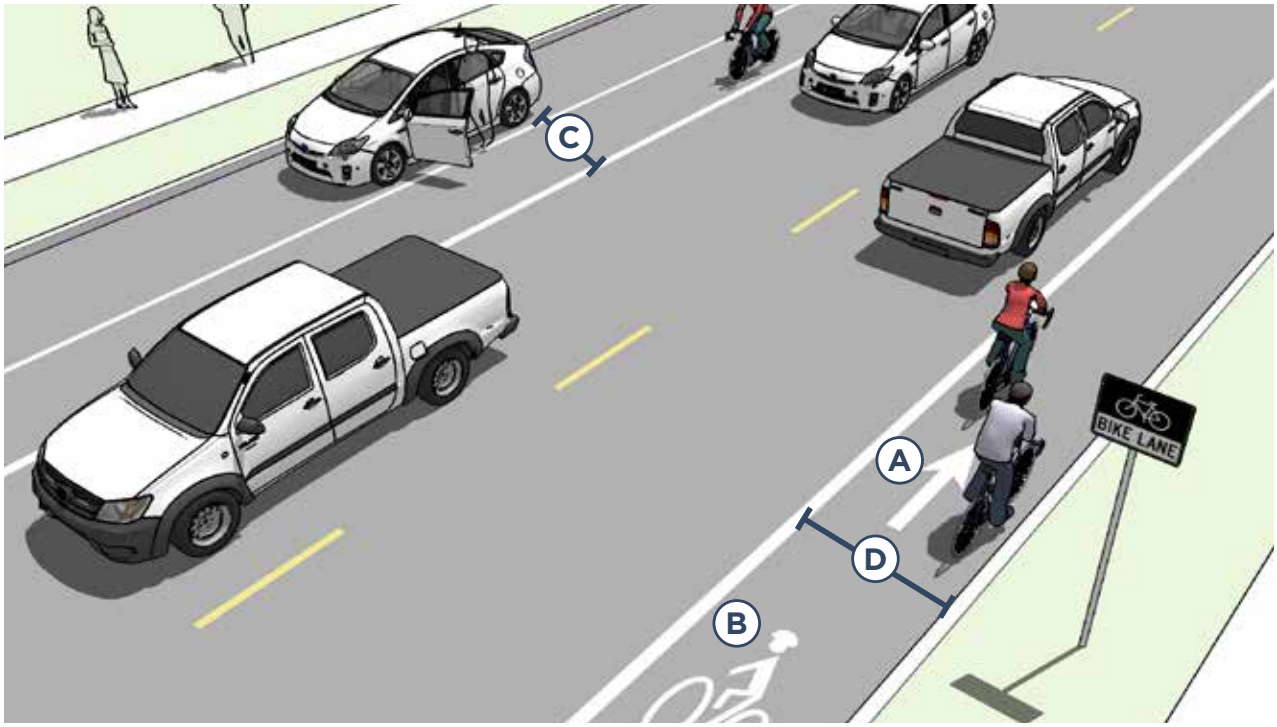
Manhole surfaces should be manufactured with a shallow surface texture in the form of a tight, nonlinear pattern.

Manholes, drainage grates, or other obstacles should be set flush with the paved roadway. Roadway surface inconsistencies pose a threat to safe riding conditions for bicyclists.

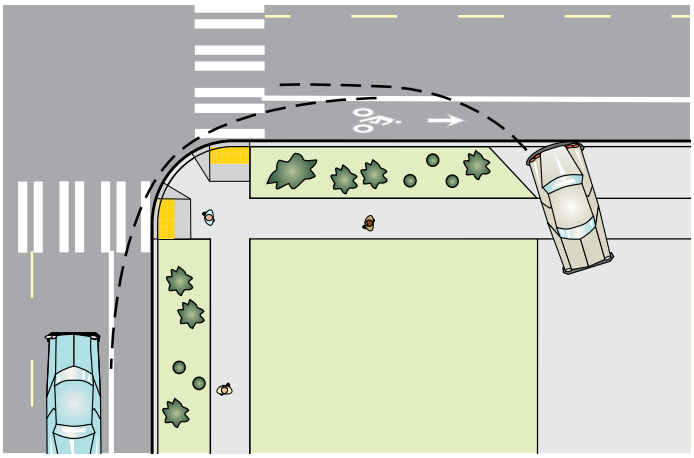
Crash Reduction

Before and after studies of bicycle lane installations show a wide range of crash reduction factors. Some studies show a crash reduction of 35 percent (CMF ID: 1719) for vehicle/bicycle collisions after bike lane installation.

1 - Studies have shown that marking the parking lane encourages people to park closer to the curb. FHWA. Bicycle Countermeasure Selection System. 2006.



Place Bike Lane Symbols to Reduce Wear



Bike lane word, symbol, and/or arrow markings (MUTCD Figure 9C-3) shall be placed outside of the motor vehicle tread path in order to minimize wear from the motor vehicle path **(NACTO 2012).**

Conventional Lane

Bicycle lanes provide an exclusive space, but may be subject to unwanted encroachment by motor vehicles.

Conventional Bike Lane

Bike lane symbols and lane stripping tell motorists and cyclists where to position themselves.

UPHILL BIKE LANES (CLIMBING LANES)

Uphill bike lanes (also known as “climbing lanes”) enable motorists to safely pass slower-speed bicyclists, thereby improving conditions for both travel modes.

Typical Application

- On shared roadways with a hill, where cyclists will be slowed by the uphill grade.
- Typically found on retrofit projects, as newly constructed roads should provide adequate space for bicycle lanes in both directions of travel.

Design Features

(A) Uphill bike lanes should be 6-7 feet wide (wider lanes are preferred because extra maneuvering room on steep grades can benefit bicyclists).

(B) Can be combined with shared lane markings for downhill bicyclists who can more closely match prevailing traffic speeds.

Further Consideration

- Accommodating an uphill bicycle lane often includes delineating on-street parking (if provided), narrowing travel lanes and/or shifting the centerline if necessary.
- A bike lane sign (MUTCD R3-17) may be used to increase visibility of the climbing lane.

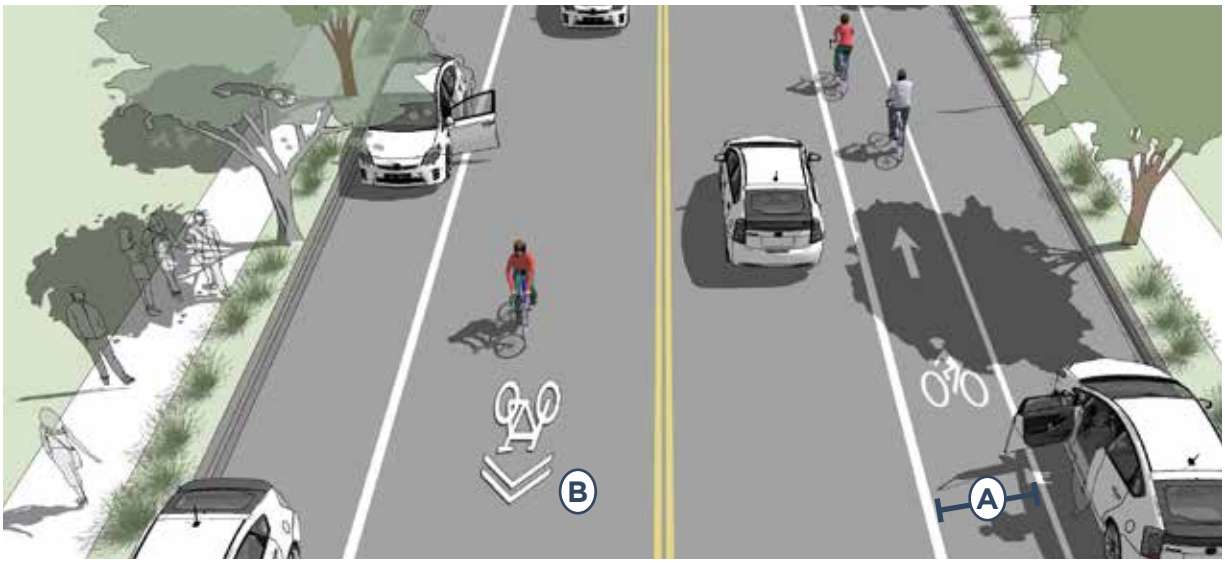
Crash Reduction

By separating vehicle and bicycle traffic, climbing lanes enable motorists to safely pass slower-speed bicyclists, thereby improving conditions for both travel modes.

Climbing Bike Lane

A climbing lane is added on the uphill portion of the roadway.

A climbing lane, with bicycle pavement markings, safely positions cyclists for the uphill portion of the roadway.



BUFFERED BIKE LANES

Buffered bike lanes are conventional bicycle lanes paired with a designated buffer space, separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane.

Typical Application

- Anywhere a conventional bike lane is being considered.
- On streets with high speeds and high volumes or high truck volumes.
- On streets with extra lanes or lane width.
- Appropriate for skilled adult riders on most streets

Design Features

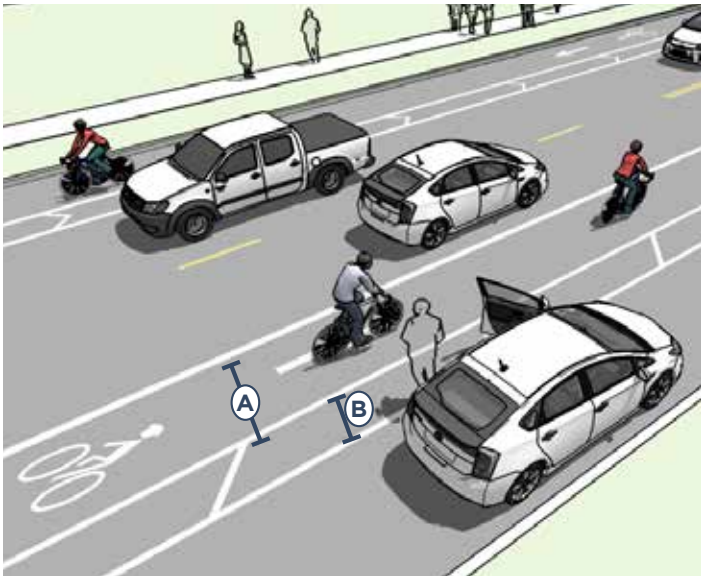
(A) The minimum bicycle travel area (not including buffer) is 5 ft wide.

(B) Buffers should be at least 2 ft wide. If buffer area is 4 ft or wider, white chevron or diagonal markings should be used.

- For clarity at driveways or minor street crossings, consider a dotted line.
- There is no standard for whether the buffer is configured on the parking side, the travel side, or a combination of both.

Further Consideration

- Color may be used within the lane to discourage motorists from entering the buffered lane.
- A study of buffered bicycle lanes found that, in order to make the facilities successful, there needs to also be driver education, improved signage and proper pavement markings.[1]
- On multi-lane streets with high vehicles speeds, the most appropriate bicycle facility to provide for user comfort may be physically separated bike lanes.
- NCHRP Report #766 recommends, when space in limited, installing a buffer space between the parking lane and bicycle lane where on-street parking is permitted rather than between the bicycle lane and vehicle travel lane.[2]



Crash Reduction

A before and after study of buffered bicycle lane installation in Portland, OR found an overwhelmingly positive response from bicyclists, with 89 percent of bicyclists feeling safer riding after installation and 91 percent expressing that the facility made bicycling easier.[3]

1 Monsere, C.; McNeil, N.; and Dill, J., "Evaluation of Innovative Bicycle Facilities: SW Broadway Cycle Track and SW Stark/Oak Street Buffered Bike Lanes. Final Report" (2011).Urban Studies and Planning Faculty Publications and Presentations.
2 National Cooperative Highway Research Program. Report #766: Recommended Bicycle Lane Widths for Various Roadway Characteristics.
3 National Cooperative Highway Research Program. Report #766: Recommended Bicycle

Buffered Bicycle Lane

Pavement markings delineate space for cyclists to ride in a comfortable facility.

WAYFINDING SIGN TYPES

The ability to navigate through a city is informed by landmarks, natural features, and other visual cues. Signs throughout the city should indicate to bicyclists the direction of travel, the locations of destinations and the travel time/distance to those destinations. A bicycle wayfinding system consists of comprehensive signing and/or pavement markings to guide bicyclists to their destinations along preferred bicycle routes.

Typical Application

- Wayfinding signs will increase users' comfort and accessibility to the bicycle network.
- Signage can serve both wayfinding and safety purposes including:
  - Helping to familiarize users with the network
  - Helping users identify the best routes to destinations
  - Addressing misperceptions of time and distance
  - Helping overcome a "barrier to entry" for people who are not frequent bicyclists (e.g., "interested but concerned" bicyclists)

Design Features

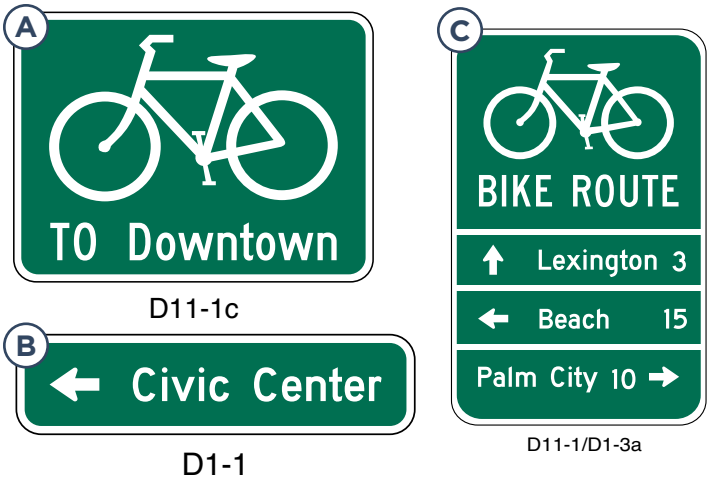
A Confirmation signs indicate to bicyclists that they are on a designated bikeway. Make motorists aware of the bicycle route. Can include destinations and distance/time but do not include arrows.

B Turn signs indicate where a bikeway turns from one street onto another street. These can be used with pavement markings and include destinations and arrows.

C Decisions signs indicate the junction of two or more bikeways and inform bicyclists of the designated bike route to access key destinations. These include destinations, arrows and distances. Travel times are optional but recommended.

Further Consideration

- Bicycle wayfinding signs also visually cue motorists that they are driving along a bicycle route and should use caution. Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes.
- Too many road signs tend to clutter the right-of-way, and it is recommended that these signs be posted at a level most visible to bicyclists rather than per vehicle signage standards.
- A community-wide bicycle wayfinding signage plan would identify:
  - Sign locations
  - Sign type – what information should be included and design features
  - Destinations to be highlighted on each sign – key destinations for bicyclists
  - Approximate distance and travel time to each destination
- Green is the color used for directional guidance and is the most common color of bicycle wayfinding signage in the US, including those in the MUTCD.
- Check wayfinding signage along bikeways for signs of vandalism, graffiti, or normal wear and replace signage along the bikeway network as-needed.



Community Logos on Signs

Wayfinding signs can include a local community identification logo, as this example from Oakland, CA.

Custom Street Signs (Topeka. KS)

confirmation sign, to let all users know the street is adapted for bicyclists.

WAYFINDING SIGN PLACEMENT

Signs are placed at decision points along bicycle routes, typically at the intersection of two or more bikeways and at other key locations leading to and along bicycle routes.

Typical Application

Confirmation Signs

- Placed every ¼ to ½ mile on off-street facilities and every 2 to 3 blocks along on-street bicycle facilities, unless another type of sign is used (e.g., within 150 ft of a turn or decision sign).
- Should be placed soon after turns to confirm destination(s). Pavement markings can also act as confirmation that a bicyclist is on a preferred route.

Turn Signs

- Near-side of intersections where bike routes turn (e.g., where the street ceases to be a bicycle route or does not go through).
- Pavement markings can also indicate the need to turn.

Decision Signs

- Near-side of intersections in advance of a junction with another bicycle route.
- Along a route to indicate a nearby destination.

Design Features

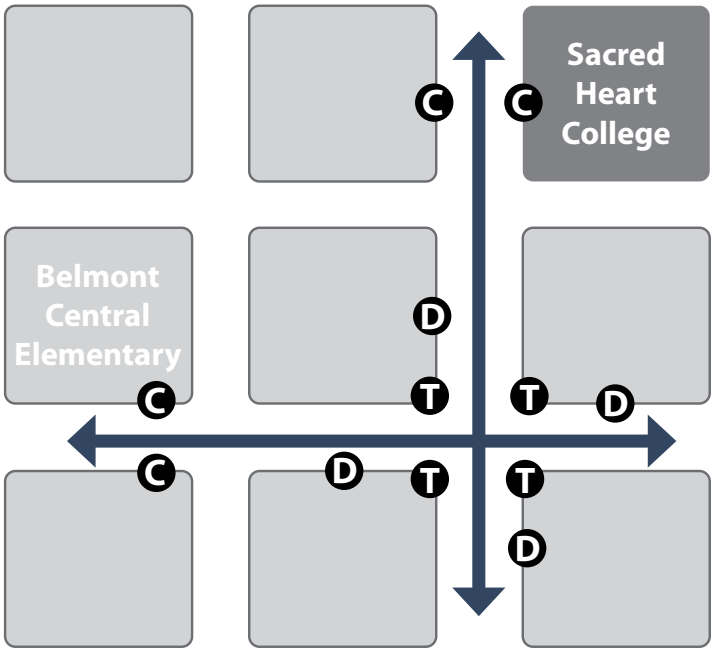
- MUTCD guidelines should be followed for wayfinding sign placement, which includes mounting height and lateral placement from edge of path or roadway.
- Pavement markings can be used to reinforce routes and directional signage.

Further Consideration

It can be useful to classify a list of destinations for inclusion on the signs based on their relative importance to users throughout the area. A particular destination's ranking in the hierarchy can be used to determine the physical distance from which the locations are signed. For example, primary destinations (such as the downtown area) may be included on signage up to 5 miles away. Secondary destinations (such as a transit station) may be included on signage up to two miles away. Tertiary destinations (such as a park) may be included on signage up to one mile away.

Crash Reduction

There is no evidence that wayfinding signs have any impact on crash reduction or user safety.



SHARED USE PATH

Shared use paths can provide a desirable facility, particularly for recreation, and users of all skill levels preferring separation from traffic. Bicycle paths should generally provide directional travel opportunities not provided by existing roadways.

Typical Application

- In abandoned rail corridors (commonly referred to as Rails-to-Trails or Rail-Trails.
- In active rail corridors, trails can be built adjacent to active railroads (referred to as Rails-with-Trails.
- In utility corridors, such as powerline and sewer corridors.
- In waterway corridors, such as along canals, drainage ditches, rives and beaches.
- Along roadways.

Design Features

Width

- 8 ft is the minimum allowed for a two-way bicycle path and is only recommended for low traffic situations.
- 10 ft is recommended in most situations and will be adequate for moderate to heavy use.
- 12 ft is recommended for heavy use situations with high concentrations of multiple users. A separate track (5' minimum) can be provided for pedestrian use.

Lateral Clearance

- A 2 ft or greater shoulder on both sides of the path should be provided. An additional ft of lateral clearance (total of 3') is required by the MUTCD for the installation of signage or other furnishings.
- If bollards are used at intersections and access points, they should be colored brightly and/or supplemented with reflective materials to be visible at night.

Overhead Clearance

- Clearance to overhead obstructions should be 8 ft minimum, with 10 ft recommended.

Striping

- When striping is required, use a 4 inch dashed yellow centerline stripe with 4 inch solid white edge lines.
- Solid centerlines can be provided on tight or blind corners, and on the approaches to roadway crossings.

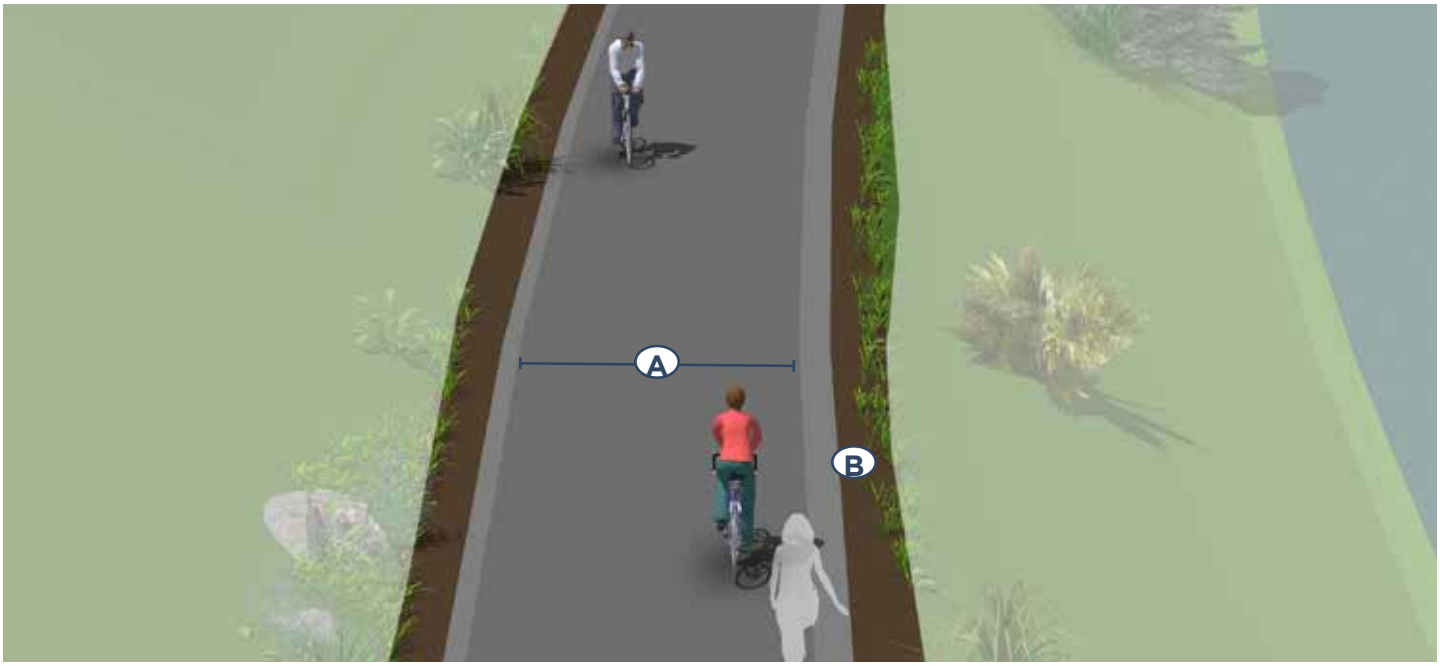
Further Consideration

The provision of a shared use path adjacent to a road is not a substitute for the provision of on-road accommodation such as paved shoulders or bike lanes, but may be considered in some locations in addition to on-road bicycle facilities. To reduce potential conflicts in some situations, it may be better to place one-way sidepaths on both sides of the street.

Crash Reduction

Shared use paths reduce injury rates for cyclists, pedestrians, and other nonmotorized modes by 60 percent compared with on street facilities.[1]

1Teschke, Kay. Route Infrastructure and the Risk of Injuries to Bicyclists. American Public Health Association. December 2012.



SIDEPATH

Shared use paths can provide a desirable facility, particularly for recreation, and users of all skill levels preferring separation from traffic. Bicycle paths should generally provide directional travel opportunities not provided by existing roadways.

Typical Application

- Along Roadways

Design Features

- Guidance for sidepaths should follow that for general design practices of shared use paths.
- A high number of driveway crossings and intersections create potential conflicts with turning traffic. Consider alternatives to sidepaths on streets with a high frequency of intersections or heavily used driveways.
- Where a sidepath terminates special consideration should be given to transitions so as not to encourage unsafe wrong-way riding by bicyclists.

Further Consideration

- Crossing design should emphasize visibility of users and clarity of expected yielding behavior. Crossings may be STOP or YIELD controlled depending on sight lines and bicycle motor vehicle volumes and speeds.
- The provision of a shared use path adjacent to a road is not a substitute for the provision of on-road accommodation such as paved shoulders or bike lanes, but may be considered in some locations in addition to on-road bicycle facilities.
- To reduce potential conflicts in some situations, it may be better to place one-way sidepaths on both sides of the street.

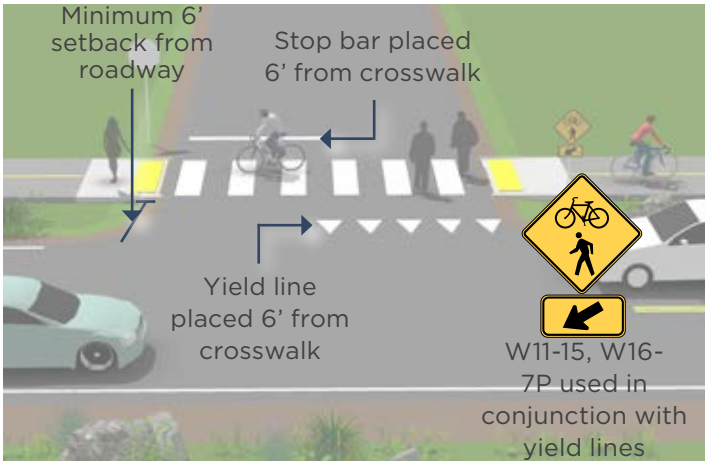
Crash Reduction

Shared use paths reduce injury rates for cyclists, pedestrians, and other nonmotorized modes by 60 percent compared with on street facilities.[1]

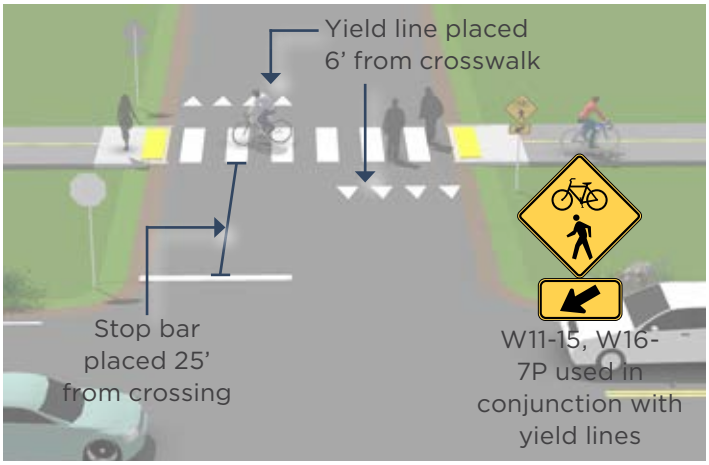
1Teschke, Kay. Route Infrastructure and the Risk of Injuries to Bicyclists. American Public Health Association. December 2012.

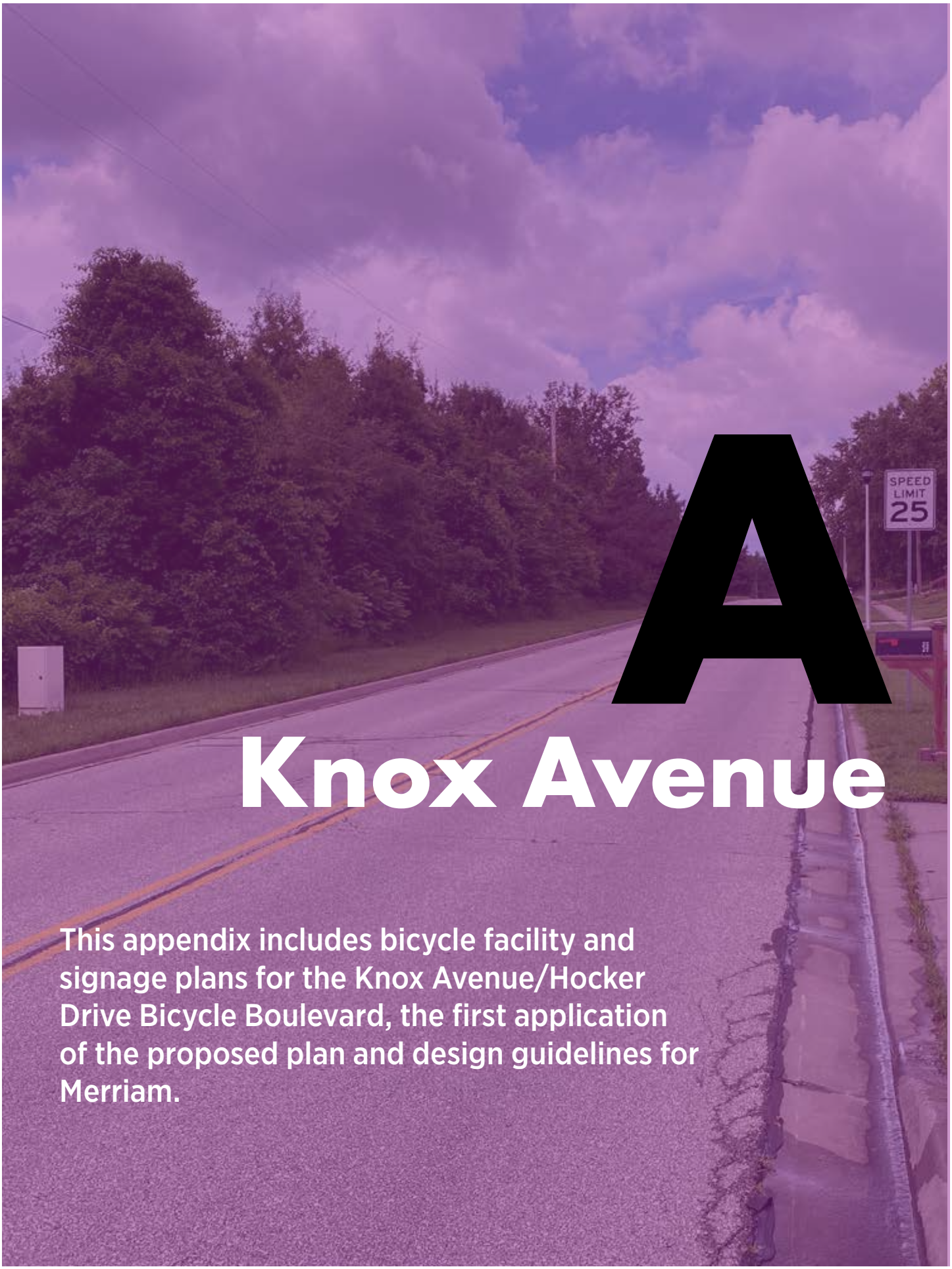
Crossing Approaches

Adjacent Crossing - A separation of 6 feet emphasizes the conspicuity of riders at the approach to the crossing.



Setback Crossing - A set back of 25 feet separates the path crossing from merging/turning movements that may be competing for a driver's attention.





A Knox Avenue

This appendix includes bicycle facility and signage plans for the Knox Avenue/Hocker Drive Bicycle Boulevard, the first application of the proposed plan and design guidelines for Merriam.

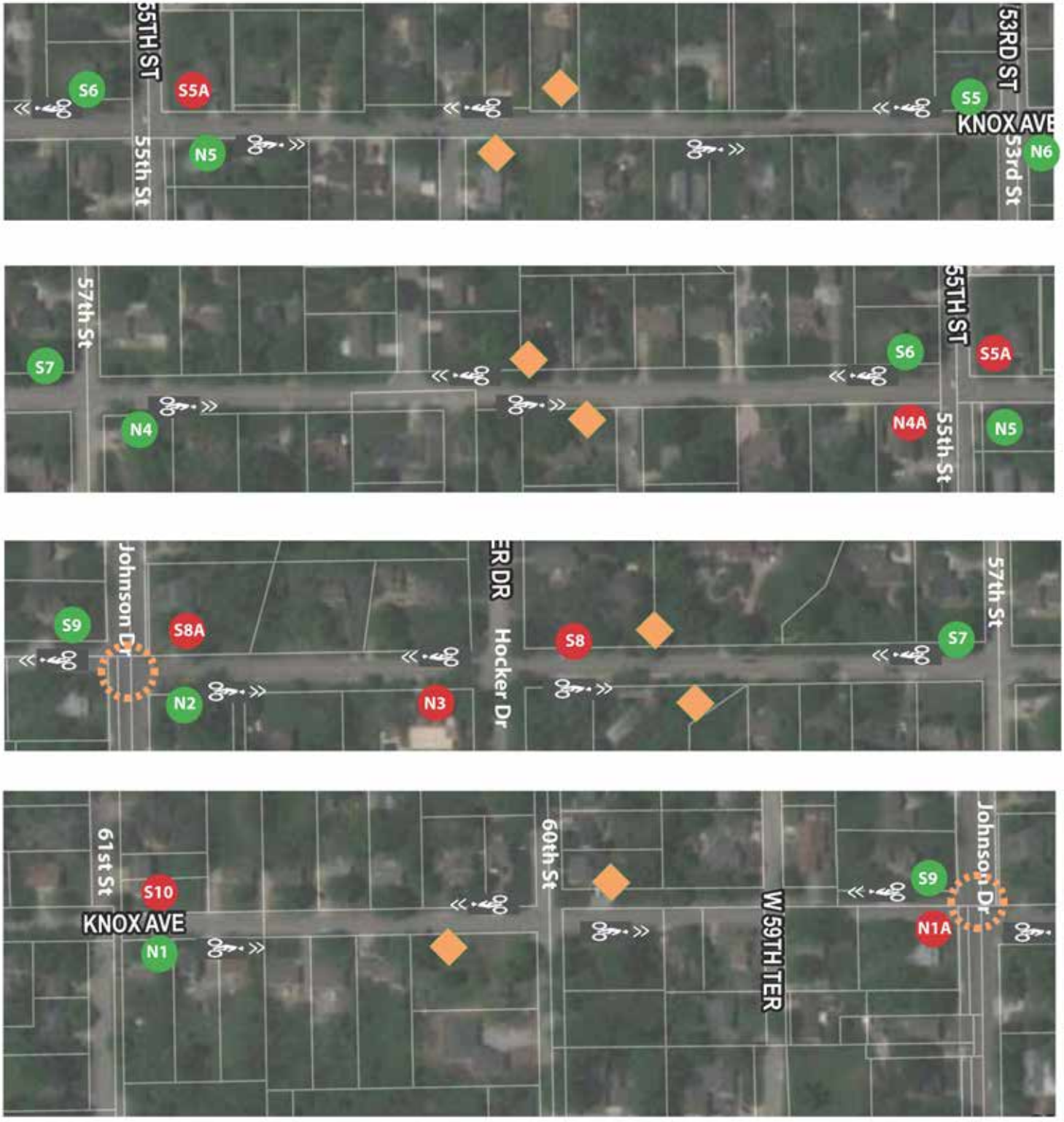
Sign Locator

D11-1C Bike Route/Destination Sign

D1-1,2,3 Destination Sign

R4-11 Bicycles May Use Full Lane Sign

Sign Locator

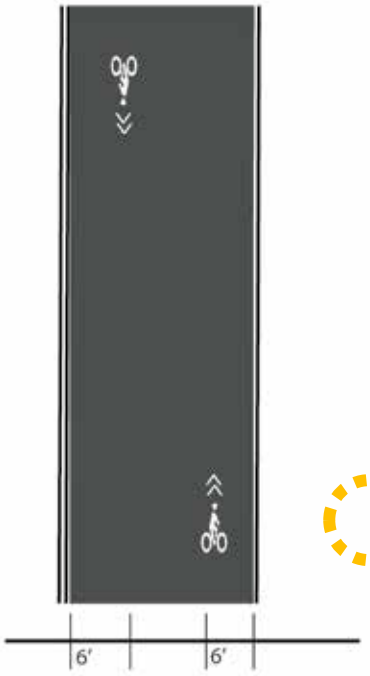


Special intersection treatment at Knox Avenue and Johnson Drive

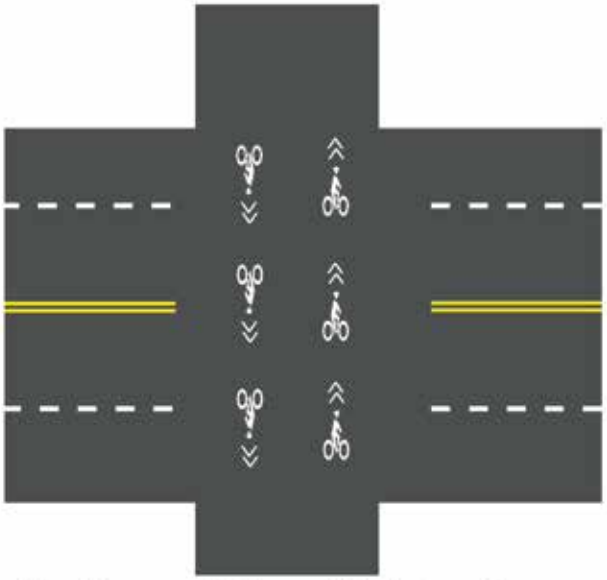
Standard Signs

Shared Lane Marking Placement

Knox Avenue
32 foot section

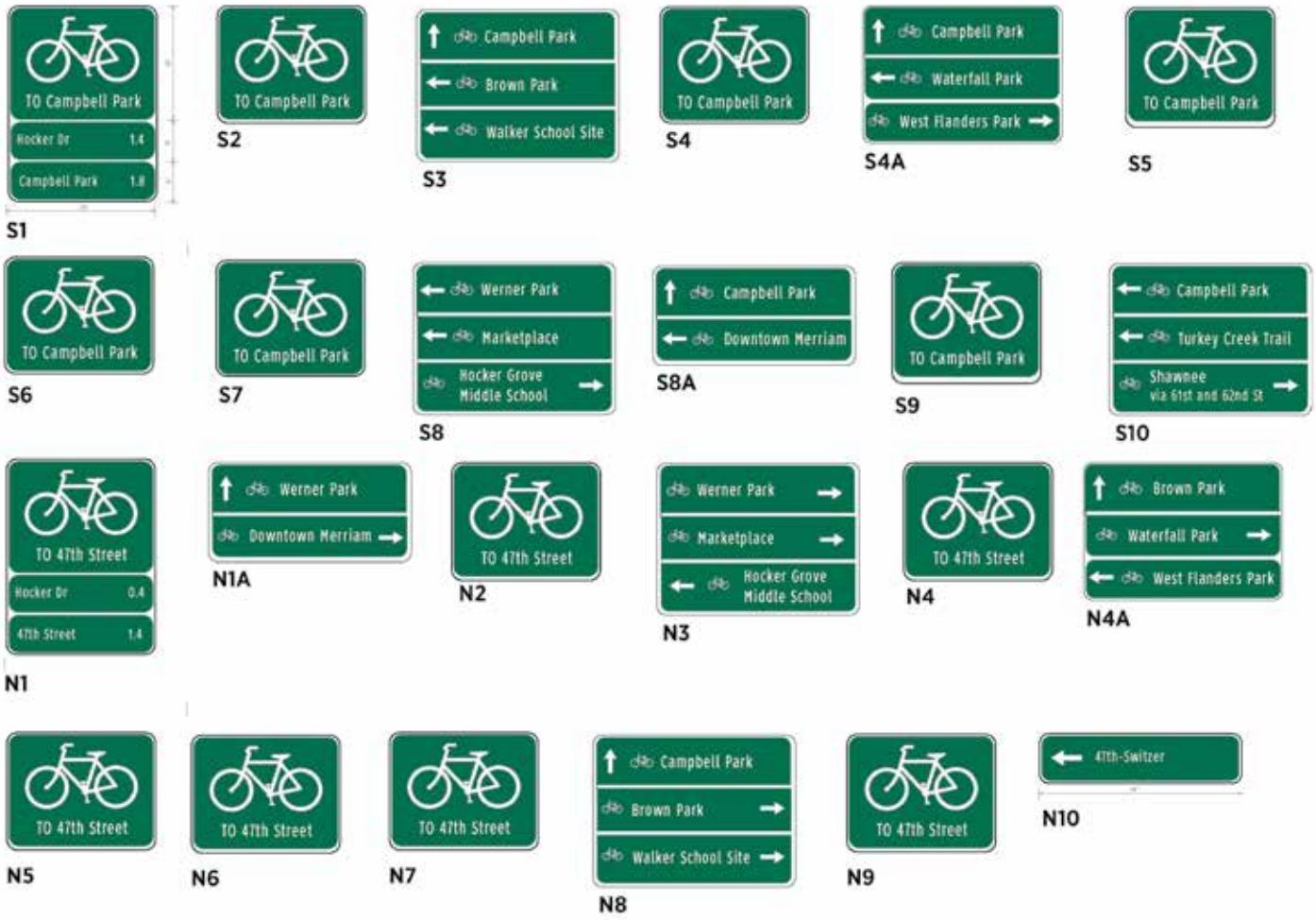


Knox Avenue
Hocker Drive
24 foot section

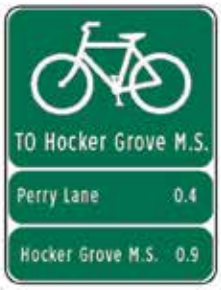


Knox Avenue and Johnson Drive Intersection

Knox Avenue Signage



Hocker Drive Signage

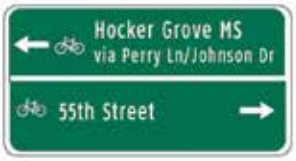


W1

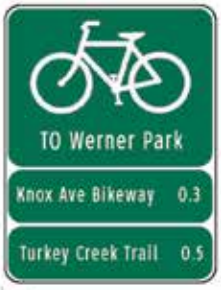
W2

W3

W4



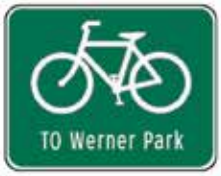
W5



E1

E2

E3



E4

E5