

# Knoxville Bicycle Facilities Plan

Final Report  
February 2015



Kimley»Horn

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prepared for



prepared by



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# **Knoxville Bicycle Facilities Plan**

## **Final Report**

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## I Introduction

Knoxville, Tennessee is experiencing a bicycling renaissance. With interest, resources, and advocacy on the rise, the City of Knoxville determined the time was right for laying out a blueprint for the future of its bicycle infrastructure.

The Knoxville Bicycle Facilities Plan has been developed to assist in advancing Knoxville as a city where biking is safe, convenient, and a desirable mode of transportation for residents and visitors. The City understands that biking is a key component of a diverse transportation network, promoting healthy lifestyles and making its streets more vibrant and attractive. For people to choose biking over other modes of transportation, facilities must be provided that are safe, comfortable, and aesthetically pleasing, while also connecting logical desire lines between recognized origins and destinations. A hierarchy of bicycle facilities must be planned, designed, and implemented that provide access and mobility to all users, regardless of age or ability, allowing for a more personable travel experience, patronage of businesses, and the pursuit of active, healthy lifestyles.

**Biking is a key component of a diverse transportation network, promoting healthy lifestyles and making streets more vibrant and attractive.**

The Knoxville Bicycle Facilities Plan was a collaborative effort of the City of Knoxville and the Knoxville Regional Transportation Planning Organization (TPO). The Plan is intended to provide a framework of physical infrastructure improvements to make Knoxville a safer and more comfortable place to bicycle for both recreation and transportation.

### I.1 Plan Overview

The Plan is divided into four sections. This **Introduction** provides information regarding the purpose of the Plan and public participation process. **Framework** summarizes baseline conditions, planning considerations, and facility types. The bulk of the Plan, including recommendations,

prioritization, cost estimates, and phasing are presented in the section entitled **Implementation**. Finally, more detailed analyses of select recommendations are included in **Project Cut Sheets**.

### Public Participation

The Knoxville Bicycle Facilities Plan was crafted through a process that included meaningful, continuous public participation.

The planning process began with a kickoff meeting with City staff where initial strategic goals were discussed for the Plan. Moving forward, plan development was guided by a Steering Committee composed of a range of City departments, TPO staff, TDOT staff, Knoxville Area Transit staff, local advocates, and business and community leaders. Members of the Steering Committee are listed on the title page of this report. The Steering Committee met on three occasions to offer strategic input on development of the Plan:

- Network Workshop – The Steering Committee met on March 11, 2014 to ratify the existing bicycle network and assist in identifying 50 miles of priority corridors for detailed fieldwork.
- Recommendations Review Workshop – On May 20, 2014 the Steering Committee met to review the draft recommendations including facility types, location of improvements, and areas of special consideration.
- Prioritization Workshop – On August 13, 2014, the Steering Committee participated in a workshop to review draft prioritization criteria, provide insight on additional criteria that should be included, and comment on the initial project prioritization.

In addition to the Steering Committee, the broader public was afforded the opportunity to be active in the planning process. A public open house was held on May 21, 2014 to present the draft recommendations for the Plan and solicit feedback on the validity of those recommendations. Over 50 people attended the meeting and were able to review the purpose of the Plan, facility types, and individual projects. Project lists were provided to every participant and large maps were available for individuals to memorialize their input in graphic form. Additionally, comment sheets were provided and an online survey was conducted. For more information on the comments received, please see Section 2.3 of this document.

A second public meeting will be held in January 2015 to present this draft Plan to the public.



## 2 Framework

The Knoxville Bicycle Facilities Plan was developed through a deliberate planning process. The sections that follow succinctly document that process.

### 2.1 Network Identification and Evaluation

To establish a baseline, existing and planned/proposed bicycle infrastructure and signed routes were documented. **Table 2.1-1** and **Table 2.1-2** present this baseline information. Utilizing this as a basis, an initial bicycle network map was developed and presented to the Steering Committee for review and comment. During the Network Workshop held on March 11, 2014, Steering Committee members spent several hours reviewing large scale maps of the network. Markers were used to make recommendations for adjustments to the network.

Following the development of the general bikeway network, Steering Committee members identified a smaller study network (i.e., approximately 50 miles) that would receive detailed field assessment by the consultant team. The intention was that segments included in the study network would be higher priority corridors that make important connections or are more likely to be completed in the short- to mid-term.

**High priority corridors that make important connections were identified for detailed fieldwork and evaluation.**

**Table 2.1-1: Existing Bicycle Facilities**

EXISTING FACILITIES	APPROXIMATE LINEAR MILEAGE
Bike Lanes	6
Signed Routes	28
Shared Lane Markings (Sharrows)	0.25
Greenways and Trails	80

**Table 2.1-2: Planned/Proposed Bicycle Facilities**

PROPOSED FACILITIES	APPROXIMATE ADDITIONAL LINEAR MILEAGE
Bike Lanes	5
Signed Routes	3
Shared Lane Markings (Sharrows)	6

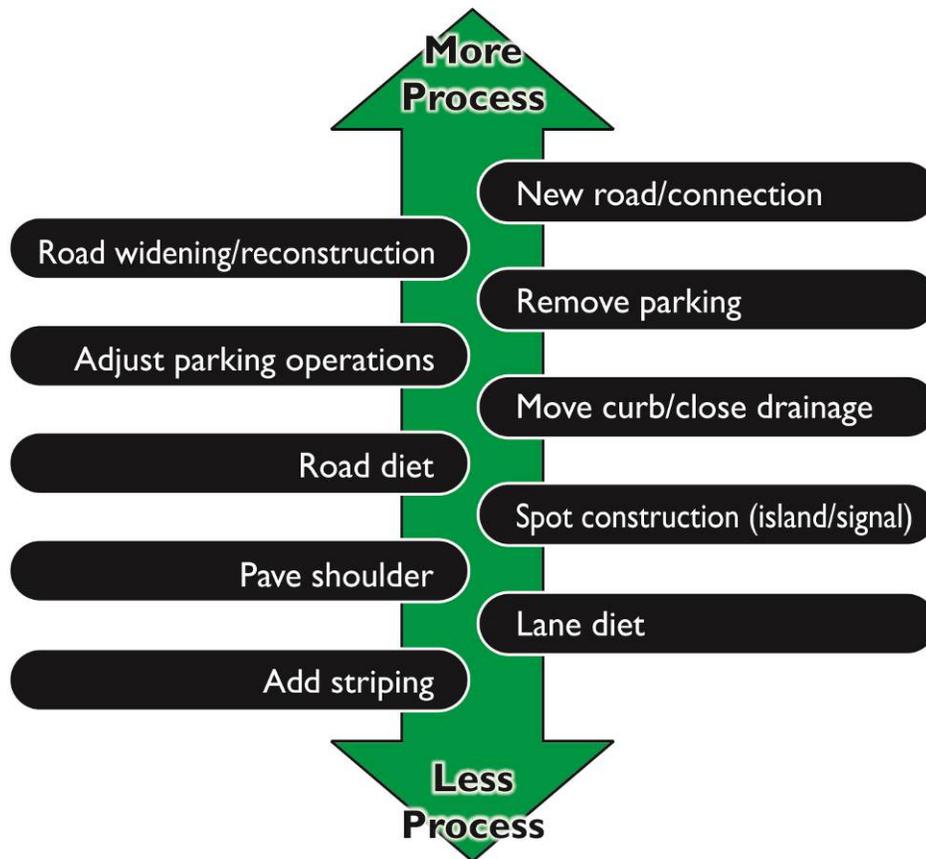
NOTE: While the Knoxville-Knox County Park, Recreation, and Greenways Plan does include 800 miles of desired greenways, this encompasses all greenways and trails envisioned to complete an entire citywide network. These were not included in the above table as it is intended to represent projects that are nearing implementation.

From March 12-14, 2014, the consultant team along with City and TPO staff spent the better part of three days in the field giving detailed analysis to the study network. The study team went above and beyond the identified target of 50 miles, ultimately evaluating over 80 miles of the study network. During this effort, team members measured rights-of-way and existing conditions, took detailed notes, photographed, observed vehicular and bicyclist behaviors, and spoke with users. While capturing existing street characteristics, the team also began to develop initial recommendations for each area being studied. These recommendations were recorded on fieldwork forms and then transferred to GIS.



## 2.2 Draft Recommendations

Based on Steering Committee input and fieldwork, a set of draft recommendations were formulated. A broad range of recommended facility types were considered, along with the degree of process necessary. “Degree of process” can be defined as the amount of planning, design, public involvement, and cost required to implement a recommendation. **Figure 2.2-1** depicts these considerations as part of a process continuum. Actions at the bottom of the continuum require less process, while those at the top require more process. Additionally, facility types that were part of the draft recommendations are shown in **Figure 2.2-2**.



**Figure 2.2-1:** Process Continuum

### Figure 2.2-2: Facility Types



**Bike Lane**  
Pavement marking designating a portion of roadway for preferential use by bicycles.



**Buffered Bike Lane**  
Type of bike lane with additional striped buffer zones to provide increased separation from faster moving motor vehicle traffic.



**Climbing Lane**  
Bike lane provided on uphill and shared lane marking on downhill. Used where existing road width will support addition of only one bike lane.



**Advisory Bike Lane**  
Removing the center line from a road in order to have room to stripe “advisory” bike lanes. The dashed lines (as opposed to solid) allow motor vehicles to occupy this space when a bicyclist is not using it.



**Colored Bike Lane**  
Bike lane that uses color to create additional awareness of right-of-way for bicyclists. Typically used where modal conflicts are more likely to occur.



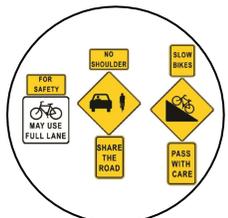
**Shared Roadway**  
Signs remind motorists of requirements to share the road. Used on rural roads and neighborhood streets where there are good sight distance and low traffic volumes.



**Greenway or Shared Use Path**  
Off-street bicycle and pedestrian facility physically separated from motor vehicle traffic.



**Shared Lane Marking (Sharrow)**  
Pavement marking that indicates cyclists’ safest path of travel and reminds motorists of requirements to share the road. Used where speed limit is 35 mph or lower.



**Shared Road with Safety Treatment**  
Used on two-lane rural roads where there are no continuous shoulders. Uses safety signs and short shoulder sections to allow cars to pass bikes on hills.



**Paved and Striped Shoulder**  
Paved and striped area on edge of road that can be utilized for bicycle travel. Usually no less than 4 feet wide. Most often used on rural roadways.



**One-Way Separated Bike Lane (Cycle Track)**  
One-way bicycle facility physically separated from motor vehicle traffic and pedestrians.



**Two-Way Separated Bike Lane (Cycle Track)**  
Two-way bicycle facility physically separated from motor vehicle traffic and pedestrians.



**Bike Boulevard**  
Low traffic street with bicycle friendly traffic calming to create a low stress bikeway.



**Contra Flow Bike Lane**  
Bike lane separated by a yellow centerline pavement marking with one-way motor vehicle traffic, to allow contra flow bicycle traffic.

## 2.3 Steering Committee and Public Review of Draft Recommendations

Draft recommendations were presented to the Steering Committee on May 20, 2014 and the general public on May 21, 2014 at a public open house. Comments were solicited and opportunities to provide input were offered through several avenues, including marking maps, completing comment forms, and responding to an online survey. Of those that filled out a comment sheet at the public open house, 78% say they commute by bicycle or bicycle recreationally. Of those that completed the online survey, 52% commute by bicycle, 89% bicycle for recreation or exercise, and 51% run errands or visit friends by bicycle.

Overall, comments received through all methods of response were positive, generally ratifying the draft recommendations and supporting a strategic approach to completing critical gaps in the network. The following summarizes the input that was received.

### **Major Themes/Areas of Greatest Interest**

Through review of all input received, the following major themes or areas of greatest interest emerged:

- Chapman Highway – South Knoxville
- Broadway – Downtown to Fountain City
- Connect First Creek Greenway to remainder of network
- Connect Third Creek Greenway to remainder of network
- Downtown to Island Home/Ijams/Urban Wilderness
- Riverside/Holston
- Parkridge to Downtown
- Kingston Pike – Connection to West Town Mall area
- Middlebrook Pike



commute by bicycle



bicycle for recreation or exercise



run errands or visit friends by bicycle

**Figure 2.3-1:**  
Survey Respondents' Trip Purposes

### Scoring from Comment Sheets at Public Meeting

Thirty-two comment sheets were received at the public meeting, representing 65% of those attending the public open house. Attendees were asked to indicate which of the 214 draft recommended projects were important or not important to them personally. Based on comments received, each project was scored to indicate level of public support. No project received a significant negative response, while 18% of the projects had a neutral response. Projects that were cited as “important” by 25% or more of respondents are presented in **Table 2.3-1**.

**Table 2.3-1: Public Meeting Project Scoring**

LOCATION	FROM	TO	FACILITY RECOMMENDATION	% FOUND IMPORTANT
CLINCH AVE	WALNUT ST	MARKET ST	Contraflow Bike Lane	25.00%
CLINCH AVE	TWENTY SECOND ST	ELEVENTH ST	Sharrow	34.38%
ISLAND HOME AVE	SEVIER AVE	MAPLEWOOD DR	Bike Lane	25.00%
N BROADWAY	N CENTRAL ST	W JACKSON AVE	Bike Lane	34.38%
N BROADWAY	N CENTRAL ST	N HALL OF FAME DR	Climbing Lane	40.63%
N BROADWAY	CHURCH ST	OLD BROADWAY	Paved and Striped Shoulder	31.25%
N CENTRAL ST	E MORELIA AVE	E WOODLAND AVE	Sharrow	25.00%
RIVERSIDE DR	HISTORIC PRESERVATION DR	LAURANS AVE	Bike Lane	28.13%
S GAY ST	W HILL AVE	COUNCIL PL	Sharrow	25.00%
SEVIER AVE	COUNCIL PL	ISLAND HOME AVE	Bike Lane	25.00%
WORLDS FAIR PARK DR	HORTON RD	W JACKSON AVE	Sharrow	25.00%

### **Mapping Comments**

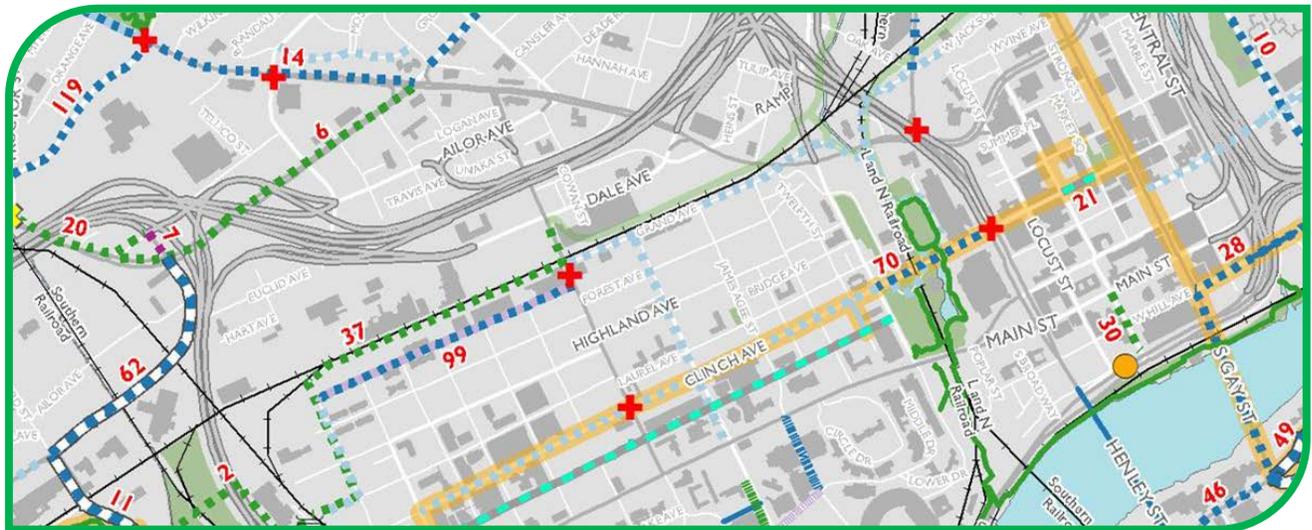
Attendees at the Steering Committee meeting and public open house were provided the opportunity to record comments on maps that depicted draft recommendations. Many of the comments received directly supported the draft recommendations presented, while others offered additional routes and facilities that were desired. While many new routes/facilities were suggested based on individual personal preference, the following represent comments that were more broadly supported:

- Bike Lanes on Hall of Fame Drive (E. Summit Hill Drive to E. Hill Avenue)
- Bike Lanes on Chapman Highway
- Greenway Connection from Tyson Park/Third Creek Greenway to Proposed Greenway along Dale Avenue
- Contra Flow Bike Lane on White Avenue (22<sup>nd</sup> Street to 12<sup>th</sup> Street)
- Climbing Lane on Liberty Street (Sutherland Avenue to Division Street)
- Shared Roadway on Nubbin Ridge Road/Westland Drive



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### 3 Implementation

Project implementation is critical to advancing Knoxville as a city where biking is safe, convenient, and a desirable mode of transportation for residents and visitors. This section provides:

- Summary of the project prioritization process and methodology;
- Overview of project ranking;
- Review of cost estimating methodology; and
- Defining of project phases to establish implementation periods.

#### 3.1 Project Prioritization

The Knoxville Bicycle Facilities Plan is envisioned to have a 10-year horizon; however, with over 220 projects identified, it is apparent that not all projects can be implemented within the 10-year period of the Plan. Additionally, it is important to gain some understanding of which projects will provide the most benefit and how projects relate to one another from an implementation perspective. For these reasons, a prioritization methodology was devised to score projects comparatively. Strong emphasis was given to identifying projects that link together to form greater networks and complete critical connections.

A number of variables were used to “score” each recommended project. The variables utilized were both quantitative and qualitative in nature to provide a balance to project prioritization. While it was desirable for scoring to reflect objective merits such as access, safety, and connectivity, it was also important for more subjective considerations to be weighed like probability of use and existing riding conditions. The prioritization methodology is presented in **Table 3.1-1**.

**Table 3.1-1: Prioritization Methodology**

VARIABLES	SCORING	NOTES
<b>Quantitative Variables</b>		<b>Max Score 52</b>
<b>Access (miles to destination)</b>	<b>Max Score 12</b>	
0-.25 mile	2 per land use	2 points given for intersecting each destination class (Residential, Commercial, Parks, Office, Schools, Colleges/Universities)
<b>Level of Effort to Implement</b>	<b>Max Score 10</b>	
Low	10	
Medium	6	
High	2	
<b>Safety</b>	<b>Max Score 10</b>	
Speed Limit	5	Project on or adjacent to a road which has a posted speed limit 45 mph or greater
	3	Project on or adjacent to a road which has a posted speed limit 35-40 mph
Separated Facility	5	Project that is separated or protected from a road with a speed limit 35 mph or greater (i.e., greenway, cycle track, buffered bike lane)
<b>Connectivity</b>	<b>Max Score 10</b>	
Connects to an existing facility at both ends	10	No points for connecting to a “loop” greenway
Connects to an existing facility at one end	5	
<b>Critical Corridor</b>	<b>Max Score 10</b>	
Within a critical corridor	10	
Crosses or “feeds” into a critical corridor	5	
<b>Qualitative Variables</b>		<b>Max Score 48</b>
<b>Network Barrier</b>	<b>Max Score 16</b>	
Severe barrier	16	
Significant barrier	10	
Difficult barrier	8	
Minor barrier	4	
<b>Probability of Use</b>	<b>Max Score 16</b>	
Extremely high probability of use	16	
High probability of use	10	
Medium probability of use	8	
Low to medium probability of use	4	
<b>Existing Riding Conditions</b>	<b>Max Score 16</b>	
Terrible for all bicyclists	16	
Uncomfortable for most bicyclists	10	
Uncomfortable for many bicyclists	8	
Slightly uncomfortable for some bicyclists	4	



It was determined that recommendations for shared lane markings (sharrows) and shared roadways would not be included in the prioritization process. The intent of the prioritization is to determine the phasing for the expenditure of capital funds on construction projects. Since the cost for pavement markings and signage are relatively low by comparison, shared lane markings and shared roadway projects will be implemented on an annual, systematic basis either independently or in conjunction with adjacent capital projects.

### 3.2 Project Ranking

Based on the prioritization methodology presented in Section 3.1, 120 capital construction recommendations were ranked and a complete listing is included in **Appendix A**. These are ranked by priority with recommendation type, required actions, project length, cost per linear foot, opinion of probable cost, and implementation phase. Similarly, **Appendix B** lists over 100 shared lane marking and shared roadway projects. **Appendix C** contains a mapbook that depicts all projects geographically with numbering that corresponds to the project ranking.

### 3.3 Project Costs

Opinions of probable cost were generated for each project using unit cost pricing, which is presented by facility type and action required in **Table 3.3-1**. Over \$41 million of capital construction projects are included in the Plan along with almost \$1 million of shared lane markings and shared roadway projects. **Table 3.3-2** and **Table 3.3-3** provide an overview of cost by facility type.

**Table 3.3-1: Cost by Facility Type/Action Required**

FACILITY TYPE/ACTION REQUIRED	COST PER LINEAR FOOT
Advisory Bike Lane/Restripe	\$30.00
Bike Lane/Lane Diet	\$30.00
Bike Lane/Pave Existing Shoulder	\$91.00
Bike Lane/Road Diet	\$31.00
Bike Lane/Widen Road (Closed Section)	\$756.00
Bike Lane/Widen Road (Open Section)	\$390.00
Buffered Bike Lane/Lane Diet or Road Diet	\$31.00
Buffered Bike Lane/Stripe Existing Shoulder	\$19.00
Climbing Lane/Lane Diet	\$25.00
Climbing Lane/Restripe	\$15.00
Climbing Lane/Widen Road (Closed Section) (1 side)	\$380.00
Climbing Lane/Widen Road (Open Section) (1 side)	\$273.00
Contra Flow Lane/Lane Diet	\$30.00
Contra Flow Lane/Restripe	\$15.00
Contra Flow Lane/Widen Road (Closed Section) (1 side)	\$380.00

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FACILITY TYPE/ACTION REQUIRED	COST PER LINEAR FOOT
Contra Flow Lane/Widen Road (Open Section) (1 side)	\$273.00
Greenway	\$109.00
Paved and Striped Shoulder/Pave and Stripe Shoulder	\$91.00
Paved and Striped Shoulder/Restripe	\$30.00
Paved and Striped Shoulder/Signage Only	\$1.00
Paved and Striped Shoulder/Stripe Existing Shoulder	\$15.00
Separated Bike Lane (Cycle Track)/Road Diet	\$31.00
Separated Bike Lane (Cycle Track)/Widen Road	\$362.00
Shared Roadway	\$1.00
Shared Roadway with Safety Treatment/TBD	\$50.00
Sharrow	\$4.00

**Table 3.3-2: Cost by Facility Type for Capital Construction Projects**

FACILITY TYPE	NO. OF PROJECTS	TOTAL LINEAR MILES	TOTAL COST
Advisory Bike Lanes	1	0.48	\$76,800
Bike Lane	46	22.68	\$18,273,400
Buffered Bike Lane	13	5.27	\$755,000
Climbing Lane	14	6.52	\$6,645,500
Contra Flow Bike Lane	3	1.15	\$251,400
Greenway	13	10.44	\$5,985,600
Paved and Striped Shoulder	15	12.29	\$1,701,400
Separated Bike Lane (Cycle Track)	4	2.11	\$715,100
Shared Roadway w/Safety Treatment	11	15.71	\$3,870,000
<b>TOTAL</b>	<b>120</b>	<b>76.66</b>	<b>\$38,274,200</b>

**Table 3.3-3: Cost by Facility Type for Shared Lane Markings and Shared Roadway Projects**

FACILITY TYPE	NO. OF PROJECTS	TOTAL LINEAR MILES	TOTAL COST
Sharrow	84	42.28	\$892,900
Shared Roadway	20	14.43	\$76,200
<b>TOTAL</b>	<b>104</b>	<b>56.71</b>	<b>\$969,100</b>

### 3.4 Project Phasing

Breakpoints were established to categorize projects by three implementation phases:

- Short-Term (0-5 years)
- Mid-Term (5-10 years)
- Long-Term (10+ years)

In constructing the implementation phases care was taken to provide a manageable number and cost of projects in the two phases that comprise the 10-year horizon of the Plan. While the exact amount of capital funds that will be available in the 0-5 year and 5-10 year periods is unknown at this time, based on Knoxville’s historical expenditures on bicycle infrastructure it is reasonable to assume that \$1-2 million per year is already attainable through the combination of local, state, and federal funding. Additionally, as more bicycle infrastructure is built and a larger, more connected network is realized, it is anticipated that greater usage of and demand for facilities will result in more funding being allocated annually as time passes. Further, to truly advance bicycling as a safe, convenient, and desirable form of transportation, the City is encouraged to dedicate more money year over year to bicycle infrastructure. In 2015, Knoxville has budgeted \$250,000 in local funding for bicycle infrastructure, which equates to approximately \$1.40 per capita. For comparison, **Table 3.4-I** provides information on mid-sized cities’ dedicated local spending for bicycling and walking infrastructure.

**Table 3.4-I: Spending by Mid-Sized Cities on Bicycling and Walking**

CITY	2012 POPULATION	2012 DEDICATED CITY BUDGET FUNDS TO BICYCLING AND WALKING	2012 BICYCLING AND WALKING FUNDS BUDGETED PER CAPITA
Albany, NY	97,853	\$955,041	\$9.76
Burlington, VT	42,448	\$3,100,000	\$73.03
Charleston, SC	120,529	\$3,100,000	\$25.72
Chattanooga, TN	168,639	\$285,000	\$1.69
Fort Collins, CO	144,608	\$295,000	\$2.04
Missoula, MT	66,853	\$1,361,120	\$20.36
Salt Lake City, UT	187,414	\$819,000	\$4.37

Source: Alliance for Biking & Walking

Although the above implementation phases have been established, these designations are for planning purposes only; improvements should be implemented logically and as opportunities arise. For example, if circumstances provide an opportunity to complete a Mid-Term project two years after the Plan is adopted, the improvement should be made, regardless of its designation as “Mid-Term.” Use of common sense and good judgment must prevail. If a project in the Short-Term period is heavily reliant on a Mid-Term project to be successful (e.g., completing a connection), then it may make sense to hold off on the Short-Term project until resources are available to implement it along with the related Mid-Term project. Similarly, should the City learn that a street is to be resurfaced, then that is the time to put a new striping pattern (e.g., bike lanes) in place, regardless of the timing of the recommendation based on its implementation phase. Finally, while the prioritization scheme placed several greenway projects in the Short-Term period, the reality is that these types of projects can take many years to move from vision to reality. While priority would hope for these greenways to be implemented in the first five years, acquiring right-of-way, securing easements, performing design, achieving environmental clearance, and finding construction funding may dictate that these projects span a longer horizon. However, even if complete realization of these greenways takes longer, the City is encouraged to at least initiate the implementation process within the specified period, if at all possible.

### Capital Cost Breakdowns

Breakdowns of capital cost by phase and facility type are presented in **Table 3.4-2**. In years 0-5 \$7.6 million is needed; when broken down over the five-year period this averages approximately \$1.5 million annually. Mid-Term projects account for nearly \$14 million, but have the benefit of more time for planning, securing funding, and building public and political support in the 5-10 year period. Long-Term projects total almost \$20 million and are outside the implementation scope of the Plan.

**Table 3.4-2: Capital Cost by Phase and Facility Type**

FACILITY TYPE	SHORT-TERM (0-5 YEARS)	MID-TERM (5-10 YEARS)	LONG-TERM (10+ YEARS)	TOTAL
Advisory Bike Lanes	-	-	\$76,800	\$76,800
Bike Lane	\$3,309,700	\$8,859,100	\$6,104,600	\$18,273,400
Buffered Bike Lane	\$113,300	\$78,000	\$563,700	\$755,000
Climbing Lane	\$59,900	\$1,271,200	\$5,314,400	\$6,645,500
Contra Flow Bike Lane	\$87,500	\$10,300	\$153,600	\$251,400
Greenway	\$3,104,200	\$562,200	\$2,319,200	\$5,985,600
Paved and Striped Shoulder	-	\$382,200	\$1,319,200	\$1,701,400
Separated Bike Lane (Cycle Track)	\$8,500	\$661,400	\$45,200	\$715,100
Shared Roadway w/Safety Treatment	\$216,000	\$769,100	\$2,884,900	\$3,870,000
<b>TOTAL</b>	<b>\$6,899,100</b>	<b>\$12,593,500</b>	<b>\$18,781,600</b>	<b>\$38,274,200</b>



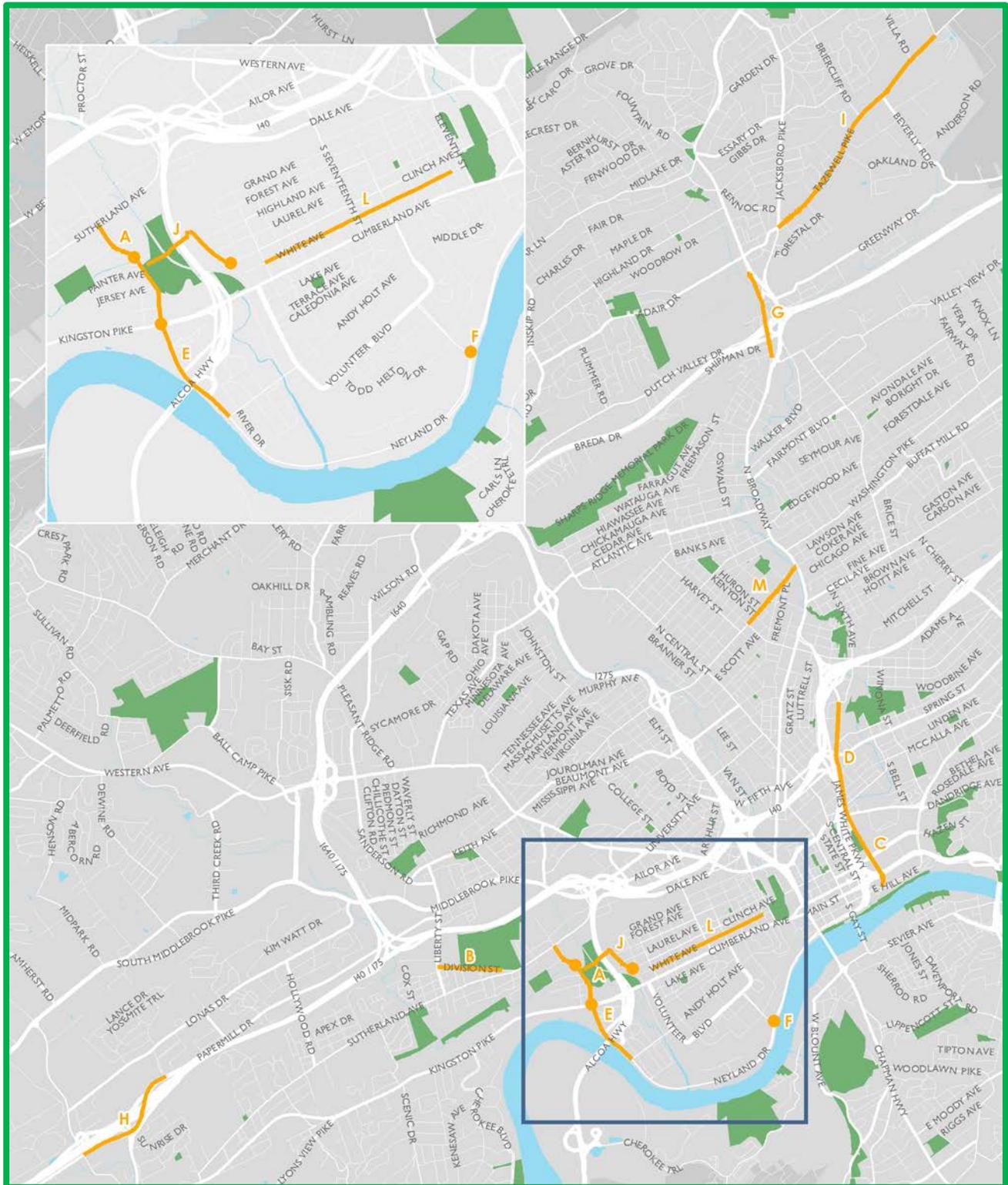
## 4 Project Cut Sheets

Project cut sheets were developed for a select group of recommended projects. The intent of these cut sheets is to provide greater detail on a variety of project types and settings that can be used as templates for the advancement of not only the specific project profiled but also other similar project types. Project cut sheets are presented on the following pages and include information on current conditions, recommended improvements, implementation considerations, and estimated cost. **Table 4.1-1** summarizes the cut sheets, while **Figure 4.1-1** depicts their locations.

**Table 4.1-1: Project Cut Sheet Summary**

ID	LOCATION	RECOMMENDATION
A	CONCORD ST from Kingston Pike to Sutherland Ave	Bike Lane, Buffered Bike Lane, and Greenway Crossing Improvements
B	DIVISION ST from Young-Williams Animal Center to Liberty St	Climbing Lane and Sharrows
C	HALL OF FAME DR from E Hill Ave to Summit Hill Dr	Bike Lane
D	HALL OF FAME DR from Summit Hill Dr to N 6th Ave	Buffered Bike Lane
E	NEYLAND DR from Kingston Pike to Joe Johnson Dr	Bike Lane or Greenway
F	NEYLAND GREENWAY CROSSING at Neyland Dr and Lake Loudoun Blvd	Intersection Crossing Improvements
G	OLD BROADWAY from Mineral Springs Ave to Proposed Multi-Use Path	Bike Lane
H	PAPERMILL DR from Kirby Rd to Weisgarber Rd	Cycle Track
I	TAZEWELL PIKE from Jacksboro Pike to Shannondale Rd	Shared Roadway with Safety Treatment
J	TYSON PARK RAILROAD UNDERPASS / METRON CENTER WAY from Third Creek Greenway to Clinch Ave	Railroad Underpass and Greenway
K	WALDEN DR / S WEISGARBER RD	Bicycle Connector
L	WHITE AVE from 22nd St to 12th St	Contra Flow Bike Lane and Sharrows
M	WOODLAND AVE from Glenwood Ave to Broadway	Bike Lane

**Knoxville Bicycle Facilities Plan**  
**Final Report**



**Figure 4.1-I: Project Cut Sheet Locations**

## A – Concord Street (#11 & #75)

### Conditions and Observations

Concord Street provides a critical link between Sutherland Avenue, Kingston Pike, and Neyland Drive. The Third Creek Greenway crosses Concord Street in a midblock location. Concord Street connects across the railroad tracks, and is a major access point for Tyson Park and Cherokee Mills. Concord Street is 4 lanes with a 2013 traffic volume of approximately 6,300 vehicles per day. Proposed bicycle improvements along this section will connect with recommended facilities along Neyland Drive and Sutherland Avenue.

<b>PROJECT EXTENTS</b>	Kingston Pike to Sutherland Avenue
<b>PROJECT LENGTH</b>	0.5 miles
<b>FACILITY TYPE</b>	Buffered and Striped Bike Lanes with Road Diet
<b>ESTIMATED COST</b>	\$95,000

### Recommended Improvements

Traffic volumes indicate a road diet can be applied to reduce this facility to two travel lanes plus bicycle lanes. Between Kingston Pike and the Third Creek Greenway crossing, striped bicycle lanes are recommended. Transitioning from the Third Creek Greenway to Sutherland Avenue, buffered bicycle lanes are recommended. The bicycle lanes in both sections are recommended to be 5 feet wide, and the buffered section will include a 2-foot buffer area between the bicycle lanes and the vehicle travel lanes. The buffered area should include hatching and fold-over bollards.

The Third Creek Greenway crossing is recommended to be enhanced with painted stop bars on the trail, repainted crosswalk markings, detectable warnings on the ramps, “sharks teeth” painted yield markings in line with existing “yield to pedestrians here” signs, in-road centerline yield to pedestrian placards, and rectangular rapid flashing beacons on roadway approaches.

### Implementation Considerations

The bicycle lanes will terminate in advance of the intersection with Kingston Pike. At the intersection with Sutherland Avenue, the current right-turn configuration will have to be modified into a merge section, meaning the bicycle lane will not start on the southbound side until the vehicle merge lane ends. The bicycle lane on the northbound side will continue up to the intersection to ease the transition to the eastbound Sutherland Avenue buffered bicycle lane.

### Visualization – Third Creek Greenway crossing of Concord Street



## **B – Division Street (#85)**

### **Conditions and Observations**

Division Street is home to several significant destination points (e.g., a campus of Pellissippi State Community College, John Tarleton Park, Juvenile Court, etc.) and also serves as an important cut-through for bicyclists traveling between Sutherland Avenue, Liberty Street and its parallel greenway, and ultimately Papermill Drive or Middlebrook Pike. The terrain of Division Street results in an uphill climbing section that may pose difficulties for cyclists. This road is a relatively narrow section, which at its current width cannot accommodate bicycle lanes.

<b>PROJECT EXTENTS</b>	Young-Williams Animal Center to Liberty Street
<b>PROJECT LENGTH</b>	0.44 miles
<b>FACILITY TYPE</b>	Climbing bicycle lane
<b>ESTIMATED COST</b>	\$892,000

### **Recommended Improvements**

A 5-foot wide climbing lane is recommended for the westbound direction of Division Street. The climbing lane functions as a dedicated striped bicycle lane for bicyclists traveling in that direction. Sharrows should be marked in the eastbound direction to alert motorists to the presence of bicyclists within the travel lane. The low travel volumes on this roadway and higher speeds that a bicycle can attain in the downhill sections will allow the eastbound travelway to comfortably accommodate bicyclists within the travel lane.

### **Implementation Considerations**

In order to construct the climbing lane, additional pavement will need to be added to Division Street. Ample right-of-way exists on the north side of the road to accommodate this without the need to acquire additional property or relocate utilities. In order to minimize the additional width needed, it is recommended the northern side of the road be converted to a curb and gutter section. Additionally, this improvement will need to interface with the proposed contra flow bicycle lane recommended for Division Street between the Young-Williams Animal Center and Sutherland Avenue.

### **Visualization – Division Street by John Tarleton Park**



## C – Hall of Fame Drive (#10)

### Conditions and Observations

Hall of Fame Drive is a major connection to points of interest for both Knoxville residents and visitors, linking destination points such as Cal Johnson Park, the Knoxville Transit Center, the Civic Coliseum, James White Fort, Outdoor Knoxville, the Women’s Basketball Hall of Fame, and the Neyland and James White Greenways. Traffic volumes on this roadway (north of this project’s extents) were approximately 13,500 vehicles per day in 2013, with a speed limit of 35 mph. The average lane width within this four-lane section is 11 feet. As a result, the current laneage and pavement width are not sufficient for the addition of striped bicycle lanes.

<b>PROJECT EXTENTS</b>	East Hill Avenue to Summit Hill Drive
<b>PROJECT LENGTH</b>	0.55 miles
<b>FACILITY TYPE</b>	Striped Bicycle Lanes with Road Diet
<b>ESTIMATED COST</b>	\$90,000

### Recommended Improvements

Within this section, a striped bicycle lane is recommended as a part of a road diet project. The overall road section would be restriped as a two lane road with a two-way center turn lane. A 6-foot striped bicycle lane could then be marked on each side of the road. The volumes on this road are suitable to accommodate a reduction in overall travel lanes.

### Implementation Considerations

Hall of Fame Drive is a major route for event traffic going to the Civic Coliseum and other nearby destinations. As a result, the center turn lane created as a part of this road diet will function as a reversible lane to accommodate event traffic.

### Visualization – Hall of Fame Drive near Cal Johnson Park



## D – Hall of Fame Drive (#42)

### Conditions and Observations

Hall of Fame Drive is a major north-south connection bordering East Knoxville and the Magnolia Warehouse District. A striped bicycle lane currently exists on the section between Sixth Avenue and Summit Hill Drive. This section connects to several existing and proposed bicycle facilities, such as striped bicycle lanes on Sixth Avenue, Fifth Avenue, and Magnolia Avenue.

<b>PROJECT EXTENTS</b>	Summit Hill Drive to N 6 <sup>th</sup> Avenue
<b>PROJECT LENGTH</b>	0.78 miles
<b>FACILITY TYPE</b>	Buffered Bike Lanes
<b>ESTIMATED COST</b>	\$78,000

### Recommended Improvements

Restripe Hall of Fame Drive to accommodate buffered bicycle lanes. This will include a 5-foot striped bicycle lane on each side, bordered by a 2-foot buffer area between the bicycle lanes and the vehicle travel lanes. Where it is needed, width for this treatment should be borrowed from the travel lanes or the center turn lane. Given the existing pavement width, travel lanes will at a minimum be reduced to 10' wide. The buffered area should include hatching and fold-over bollards.

### Implementation Considerations

The buffered bicycle lanes will transition to regular striped bicycle lanes as the right-turn lanes are added around the 5<sup>th</sup> Avenue intersection.

### Visualization – Hall of Fame Drive at Summit Hill Drive



## E – Neyland Drive (#32)

### Conditions and Observations

Neyland Drive is one of the major entry points to the University of Tennessee campus and downtown Knoxville. The primary entrance to the UT Ag Campus is Joe Johnson Drive, which connects directly to Neyland Drive. The UT Sorority Village and UT Visitor’s Center also connect to Neyland Drive close to its intersection with Kingston Pike. The Neyland Greenway begins at the southern side of the UT Visitor’s Center parking area and continues on the west side of the road all the way to Joe Johnson Drive, where it crosses over to the east side. Neyland Drive transitions to Concord Street as it crosses Kingston Pike. Recommended improvements to Concord Street include a road diet with striped bicycle lanes.

<b>PROJECT EXTENTS</b>	Kingston Pike to Joe Johnson Drive
<b>PROJECT LENGTH</b>	0.46 miles
<b>FACILITY TYPE</b>	Striped Bicycle Lanes or Multi-Use Path
<b>ESTIMATED COST</b>	\$1,250,500

### Recommended Improvements

Striped bicycle lanes or a continuation of the Neyland Greenway should be considered as a part of this improvement. Striped bicycle lanes would require additional pavement or a road diet to be implemented. Removing one of the northbound lanes between Kingston Pike and the northbound Alcoa Highway exit ramp would result in a section consistent with the proposed road diet on Concord Street. However, it may impose undesirable traffic delays at the Kingston Pike intersection. If this approach is followed, it will also have a significant impact on traffic movement following special events on campus. A traffic study will need to be conducted for Neyland Drive and its corresponding intersections to determine whether a road diet is a feasible treatment for this facility. Widening the roadway entails some significant challenges, with minimal right-of-way availability, an existing curb and sidewalk section on the east side of the road, and utilities and guard rail located close to the west side of the road.

The alternative to striped bicycle lanes would be to extend the Neyland Greenway from its current terminus at the UT Visitor’s Center up to the intersection with Kingston Pike. As with widening the roadway, extending the greenway will entail navigating limited available right-of-way and utility constraints. The existing crosswalk and signalized intersection at Ann Baker Furrow Boulevard provides adequate crossing opportunities to Sorority Village. However, the intersection of Neyland Drive and Kingston Pike will have to be upgraded to include crosswalks on all four legs with corresponding pedestrian signals. Following the implementation of striped bicycle lanes on Concord Street, signage will need to be provided at this intersection directing bicyclists to these facilities.

### Implementation Considerations

As a part of this project, improvements should be made to the intersection of the northbound Alcoa Highway off-ramp with Neyland Drive. Currently there is no way to connect between the Alcoa Highway Greenway and the Neyland Greenway. A high-visibility crosswalk with corresponding pedestrian signals should be installed at the terminus of the Alcoa Highway Greenway, with a gap in the guardrail and receiving facilities to connect to the Neyland Greenway. Restrictions on right turning traffic from the exit ramp may need to be considered to create a safer crossing experience.

**Visualization – Neyland Drive Bicycle Lanes with Road Diet**



**Visualization – Neyland Drive Bicycle Lanes with Road Widening**



**Visualization – Neyland Drive Greenway Extension**



## F – Neyland Greenway

### Conditions and Observations

The Neyland Greenway is a multi-use path in the UT/Downtown area. This greenway parallels Neyland Drive, allowing pedestrians and bicyclists to travel on a separated facility next to this high-volume, high-speed roadway. At the intersection of Neyland Drive and Lake Loudoun Boulevard, this greenway crosses the road, moving from beside the river to beside the railroad. As currently configured, this intersection does not clearly communicate how cyclists coming from Lake Loudoun Boulevard are supposed to get onto the greenway.

<b>PROJECT EXTENTS</b>	Intersection of Neyland Drive and Lake Loudoun Boulevard
<b>PROJECT LENGTH</b>	--
<b>FACILITY TYPE</b>	Greenway/Road Crossing Improvements
<b>ESTIMATED COST</b>	\$30,000

### Recommended Improvements

A series of intersection improvements are recommended to help bicyclists and pedestrians more safely access the Neyland Greenway from this location. A high visibility crosswalk is recommended on the Lake Loudoun Boulevard approach, on the east side of the railroad track. The sidewalk on each side of the intersection at this location is flush with the pavement, meaning no curb ramps or other treatments are needed to make this accessible. The crosswalk should be outfitted with pedestrian crossing push-button signals at each end. When pushed, these signals would provide a pedestrian crossing phase where right turns from southbound Neyland Drive onto Lake Loudoun Boulevard are prohibited. The addition of a crosswalk is consistent with the current intersection treatment and is positioned on the intersection side of the railroad track in order to line up with the greenway. The current right-turn lane in this location has a protected-only signal head, so no additional modifications would be needed to the signal equipment. A sign would be installed in advance of the crosswalk notifying bicyclists to use the crosswalk to access the Neyland Greenway. A two-stage left turn box (i.e. “bike box”) could also be considered as an alternate treatment.

### Implementation Considerations

Further study is needed to determine the optimal treatment and placement of crossing facilities. A crossing on Lake Loudoun Boulevard prior to the intersection was considered, but was rejected due to potential reduced visibility of the crossing for turning traffic from northbound Neyland Drive.

### Visualization – Intersection of Lake Loudoun Boulevard and Neyland Drive



## G – Old Broadway (#12 & #43)

### Conditions and Observations

Old Broadway serves as an important connection between downtown and Fountain City. Old Broadway provides users the opportunity to bypass the heavy traffic volumes and turning movements associated with the Broadway and I-640 interchange, ultimately connecting to Greenway Drive, Tazewell Pike, and adjacent retail. Old Broadway is a 4-lane facility between Mineral Springs Avenue and Tazewell Pike, and then transitions to two lanes until its intersection with Broadway. 2013 traffic volumes within the 4-lane section were approximately 9,000 vehicles per day.

<b>PROJECT EXTENTS</b>	Mineral Springs Avenue to Broadway
<b>PROJECT LENGTH</b>	0.6 miles
<b>FACILITY TYPE</b>	Striped Bicycle Lanes with Road Diet
<b>ESTIMATED COST</b>	\$98,000

### Recommended Improvements

Restripe Old Broadway to accommodate striped bicycle lanes. For the 4-lane portion this will involve a road diet to two travel lanes plus striped bicycle lanes. For the 2-lane section, this will include restriping the existing section to accommodate 10-foot travel lanes plus striped bicycle lanes. This improvement should be paired with an access management study to help better define the driveway areas in this section, thereby creating a more consistent and predictable travel environment for bicyclists. This improvement will need to begin north of the railroad underpass. However, when this bridge is replaced additional width should be considered to accommodate the striped bicycle lanes.

### Implementation Considerations

The intersection with Tazewell Pike, Greenway Drive, and Old Broadway will either need to include a small widening section or the bicycle lanes will need to be discontinued through the intersection. If the bicycle lanes are continued, additional pavement will be needed to create a continuous section for bicycles traveling straight through the intersection. However, with the unique geometry of this intersection confusion may be reduced by advocating for bicyclists to take the lane through this section. This would need to be reiterated through signage.

### Visualization – Old Broadway at I-640 Underpass



## H – Papermill Drive (#41)

### Conditions and Observations

Papermill Drive serves as a significant roadway connection through West Knoxville. The portion of Papermill Drive between Weisgarber Road and Kirby Road provides connections to major roadways such as I-40, Northshore Drive and Kingston Pike, Weisgarber Road and ultimately Middlebrook Pike. The Papermill Bluff Greenway also runs between Kirby Road and Weisgarber Road, running north of I-40 and connecting with the Weisgarber Greenway. The entrances and exits to I-40 currently present significant navigational and safety challenges to on-road cyclists.

<b>PROJECT EXTENTS</b>	Kirby Road to Weisgarber Road
<b>PROJECT LENGTH</b>	0.83 miles
<b>FACILITY TYPE</b>	Separated Bike Lanes (Cycle Track)
<b>ESTIMATED COST</b>	\$506,000

### Recommended Improvements

In order to improve the traveling experience for on-road cyclists, separated bike lanes (cycle track) should be evaluated. Although additional study would be needed to determine the feasibility and placement of this facility, initial assessment leans toward a two-way cycle track paralleling westbound Papermill Drive. Installing the cycle track in this location takes advantage of the wide shoulder already in place for much of the facility while also avoiding the difficult weave section for vehicles entering I-40 East. Space exists to accommodate the cycle track between the I-40 West entrance ramp and Weisgarber Road, resulting in two 6-foot cycle track lanes, a 2-foot buffer, and three 11-foot travel lanes. However, the section of Papermill Drive between the I-40 West entrance ramp and Kirby Road will require significant reconstruction and retrofitting. This section is heavily constrained by a retaining wall and interstate right of way. Implementation of a two-way cycle track will involve adding signalization and signage elements to all the intersections in this corridor.

### Implementation Considerations

The intent of this recommendation is to accommodate those cyclists that want to travel in the roadway. However, the Papermill Bluff Greenway running alongside Papermill Drive in this location also offers good accommodation. Network connectivity for greenway users could be improved by considering a mid-block signalized greenway crossing on Weisgarber Road south of Lonas Drive.

### Visualization – Papermill Road at I-40



## I – Tazewell Pike (#17)

### Conditions and Observations

Tazewell Pike (State Route 331) is a two-lane undivided roadway with over 15,000 vehicles per day according to a 2013 traffic count near Jacksboro Pike. The speed limit of this roadway is 40 miles per hour. Tazewell Pike serves regional traffic traveling into and out

of Knoxville, and also serves as a major connection to residential and commercial uses in the Fountain City, Shannondale, Harrill Hills, Oakland, and Smithwood neighborhoods. The roadway network in this area provides few alternative connections for through traffic, resulting in Tazewell Pike serving as the primary conduit for all modes of travel. This section of Tazewell Pike connects to proposed shoulder improvements on Jacksboro Pike and proposed sharrows on Adair Drive.

<b>PROJECT EXTENTS</b>	Jacksboro Pike to Shannondale Road
<b>PROJECT LENGTH</b>	1.71 miles
<b>FACILITY TYPE</b>	Shared Road with Safety Treatment
<b>ESTIMATED COST</b>	\$216,000

### Recommended Improvements

A series of improvements are recommended at key intersections to improve the bicycling experience along Tazewell Pike. Additional study is recommended to determine the implications of each proposed recommendation prior to their implementation.

*Shannondale Road at Tazewell Pike:* The intersection of Tazewell Pike at Shannondale Road signals a transition from a more regional connector to an urban thoroughfare. A gateway treatment at this location would cue drivers that they are entering a more urban environment with cyclists and pedestrians. This gateway is recommended to include the following improvements:

- Reduce the speed limit to 35 mph in advance of (east of) the intersection;
- Construct a mini roundabout; and
- Install gateway signage, with elements that can be repeated through the corridor.

*Briercliff Road at Tazewell Pike:* Briercliff Road serves (with Essary Drive) as the primary conduit through the Harrill Hills neighborhood. A mini roundabout is recommended to reemphasize the urbanized character of the roadway and to create a lower speed and more predictable intersection.

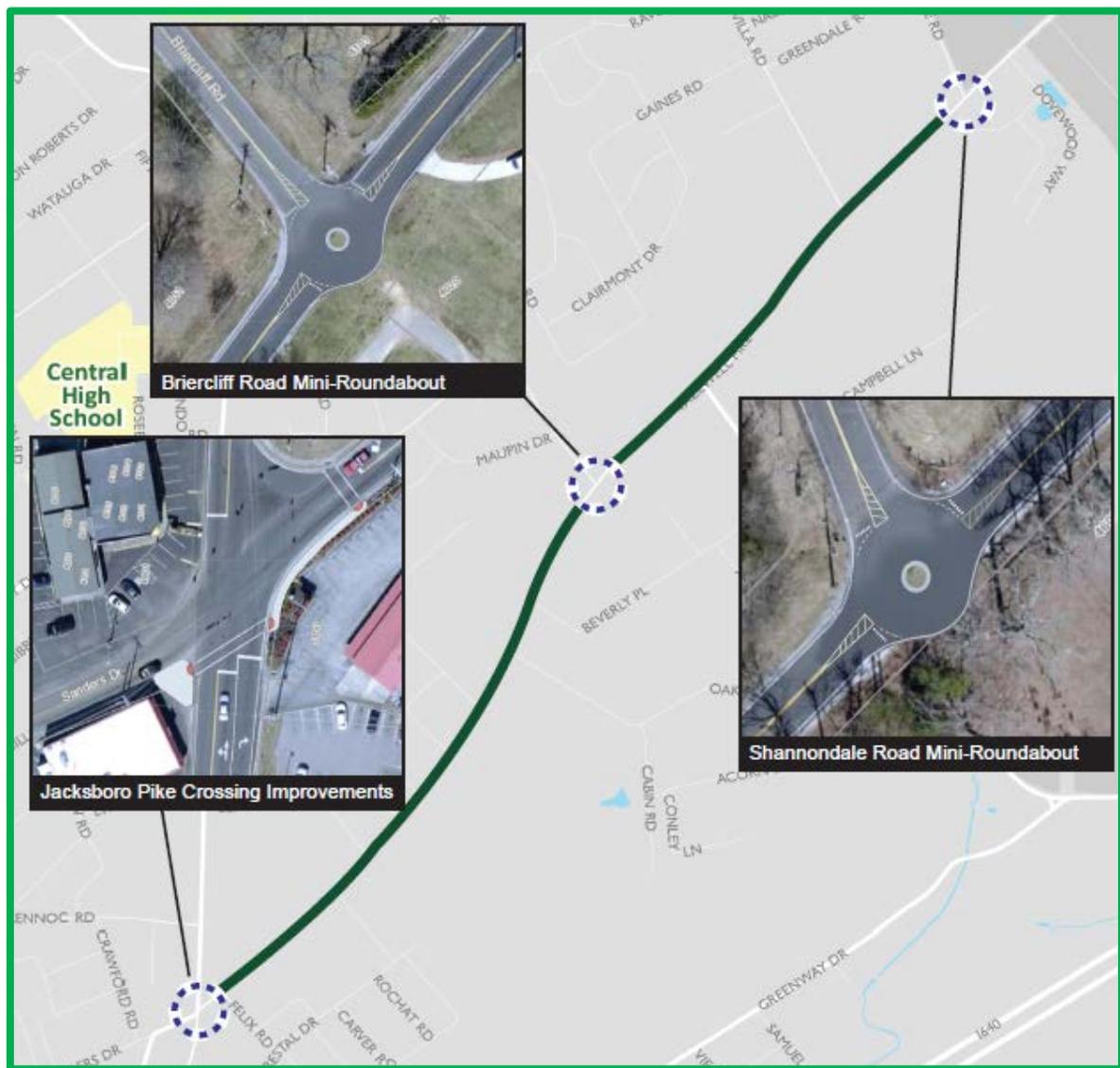
*Jacksboro Pike at Tazewell Pike:* This signalized intersection includes a skewed geometry and an offset crossing onto Sanders Drive. The southeast quadrant of the intersection has a building very near the roadway, limiting sight distance and causing confusion about the right location to turn. To address these issues, the following improvements are recommended:

- Paint white edge of travel lines where they do not currently exist;
- Consider restricting right turns from Saunders;
- Tighten the turn radius by installing an island in the southwest intersection quadrant; and
- For cyclists wishing to cross the intersection as pedestrians, construct a sidewalk and curb ramps connecting the crosswalks in the southeast intersection quadrant.

### Implementation Considerations

To move the concepts illustrated here towards implementation, a full corridor study is recommended that would evaluate the impacts of potential bicycle improvements to the transportation network. The safety improvements recommended for this roadway are envisioned as near term, lower cost improvements. However, as demand for cycling grows in the area, long-term improvements could include the installation of striped bicycle lanes on Tazewell Pike. Constructing striped bicycle lanes would require utility relocation in the corridor, but the offset of structures along the corridor likely means there will be little impact to buildings. Conditions along the corridor become more constrained between Smithwood Road and Jacksboro Pike, so a transition from bicycle lanes to sharrows may need to be considered.

### Visualization – Tazewell Pike between Jacksboro Pike and Shannondale Road



## J – Tyson Park Railroad Underpass (#2)

### Conditions and Observations

The City of Knoxville bicycle route system includes the Third Creek Greenway through Tyson Park as well as parallel one-way bicycle routes on Clinch Avenue and White Avenue. These bicycle facilities provide connections between Tyson Park, the UT campus, and the Fort Sanders neighborhood. To connect between these two major

bicycle and pedestrian travel areas, it is necessary to make a connection across the railroad track. As a result, the bicycle route currently is routed down to Cumberland Avenue, where it continues through the existing railroad underpass. Cumberland Avenue is a high traffic area with numerous driveways and turning vehicles, rendering it difficult to use for bicyclists. The planned road diet on this facility will widen sidewalks but will not continue through the railroad underpass.

<b>PROJECT EXTENTS</b>	Third Creek Greenway to Clinch Ave
<b>PROJECT LENGTH</b>	0.43 miles
<b>FACILITY TYPE</b>	Railroad Underpass and Greenway
<b>ESTIMATED COST</b>	Railroad Underpass - TBD Greenway - \$249,000

### Recommended Improvements

The current bicycle route connection on Cumberland Avenue is not sustainable long-term. As a result, the area between Highland Avenue and Cumberland Avenue was evaluated to determine the best location for a future railroad underpass for pedestrian and bicycle use. Each potential crossing location is noted here:

*White Avenue:* A connection here would link directly to the existing bicycle routes, as well as the recommended contra flow bicycle lane. However, with a parking deck located at the western terminus of the roadway, this is not a feasible connection point.

*Clinch Avenue:* A connection on Clinch Avenue would connect to the existing bicycle route. The railroad is about 8 feet above the roadway on the Clinch side, and higher on the Metron Center side. Surrounding land uses on the Clinch side are residential in nature.

*Laurel Avenue:* There is limited residential activity near the western terminus of Laurel Avenue. The topography in this area results in the roadway being slightly above the railroad track, making an underpass unlikely.

*Highland Avenue:* There is no logical receiving facility for a potential pedestrian and bicycle connector, making this an infeasible connection point.

Of these potential connection points, a railroad underpass is most feasible connecting at Clinch Avenue to Metron Center Way.

Once the proposed railroad underpass links the two sides of the tracks together, the next step is to connect the new facility to the Third Creek Greenway. Several challenges exist for this connection. There is a short line railroad track that runs through Tyson Park parallel to Tyson McGhee Park Street, which is elevated above the roadway in many locations. Metron Center Way connects through to Tyson McGhee Park Street, but currently has a section that is gated. To

facilitate this connection, the railroad underpass should connect to an extension of the Third Creek Greenway running parallel to Metron Center Way. This facility can build upon existing sidewalk sections that exist on the connection to Tyson McGhee Park Street as well as the existing at-grade railroad crossing in this location. This connection also links to the Knoxville Skatepark and the Tyson Family Tennis Center.

### Implementation Considerations

Interim improvements are needed to the existing railroad underpass at Cumberland Avenue. The planned road diet on Cumberland Avenue includes the construction of a wide sidewalk. However, this improvement is not currently recommended to carry through the underpass. Further study should be conducted to determine whether this wide sidewalk can continue through all the way to the Third Creek Greenway connection in Tyson Park.

### Visualization – Potential Railroad Underpass



## K – Walden Drive/S. Weisgarber Road

### Conditions and Observations

Walden Drive is a portion of a City of Knoxville signed bicycle route. Walden Drive currently tees into Northshore Drive. One block away from this intersection, connected by an alleyway, is S. Weisgarber Road. Right now bicyclists traveling west on Walden are instructed to turn right onto Northshore Drive, go for one block, and then turn left onto Baum Drive to continue their route. Northshore Drive is a heavy volume street and merging into traffic and ultimately turning across this road in a short span poses difficulty for cyclists.

<b>PROJECT EXTENTS</b>	Alley between Northshore Drive and S. Weisgarber Road
<b>PROJECT LENGTH</b>	125 feet
<b>FACILITY TYPE</b>	Bicycle connector
<b>ESTIMATED COST</b>	\$2,500

### Recommended Improvements

By improving the alley between S Weisgarber Road and Northshore Drive, this project will create a bicycle connector that functions as an extension of Walden Drive. Existing parking within the alley can be accommodated as currently configured while retaining approximately 24 feet of pavement to safely accommodate two-way bicycle traffic. In order to emphasize the potential presence of bicyclists in this area, sharrows should be painted on both Walden Drive and the alley. Route signage should be updated to indicate the preferred bicycle route is now through the alleyway onto S. Weisgarber Road rather than onto Northshore Drive. Bicycle crossing signs with a Rectangular Rapid Flashing Beacon and push button signals along with pavement markings should be considered on Northshore Drive to alert motorists to the presence of crossing cyclists.

### Implementation Considerations

Since this alley is not part of the official roadway network, this improvement will necessitate conversations with nearby merchants to satisfactorily accommodate bicyclists without reducing the functionality of the alley for adjacent businesses.

### Visualization – Intersection of Walden Drive and Northshore Drive



## L – White Avenue (#18)

### Conditions and Observations

White Avenue is a one-way street connecting residential, university, and medical uses. There is a large demand for bicycle travel along this corridor in two directions for several reasons. First, the corridor is more appealing from a terrain standpoint than other parallel routes. Second, White Avenue more easily accesses many nearby destination points than the parallel Clinch Avenue. Third, this route has more desirable vehicular travel speeds and volumes than Cumberland Avenue making it better suited to bicycle traffic.

<b>PROJECT EXTENTS</b>	22 <sup>nd</sup> Street to 12 <sup>th</sup> Street
<b>PROJECT LENGTH</b>	0.84 miles
<b>FACILITY TYPE</b>	Contra flow bicycle lane
<b>ESTIMATED COST</b>	\$87,500

### Recommended Improvements

Construct a contra flow bike lane going west on White Avenue. This corridor has on-street parking, so the contra flow lane will need to be wide enough to safely accommodate bicyclists while avoiding the door zone. A contra flow lane width of 5 feet with a 3-foot buffer area for the door zone is recommended. Bicyclists traveling in the direction of auto traffic will be accommodated by adding sharrow pavement markings to the eastbound direction.

### Implementation Considerations

Portions of White Avenue have parking on one or both sides of the road. In order to accommodate the contra flow lane, areas where parking exists on both sides of the road will need to be eliminated. For consistency, parking should be located on a single side of the street, assumed here to be the north side. The north side of White Avenue has fewer driveways for a large part of this corridor section, so consolidating or retaining the parking on this side will result in a smaller net loss of spaces. The contra flow design will need to be reemphasized through the placement of “Do Not Enter – Except Bikes” signs and westbound bicycle signals at the intersection of White Avenue and 17<sup>th</sup> Street. Additional study is needed to determine the final placement and engineering details of the contra flow lanes. It is recommended that both conventional and separated contra flow bicycle lanes be considered in this analysis.

### Visualization – White Avenue at 19<sup>th</sup> Street



## M – Woodland Avenue (#13)

### Conditions and Observations

Woodland Avenue is a key connection between Broadway and Central Street. It directly abuts Fulton High School and serves Physicians Regional Medical Center, grocery and retail uses, and residential areas. It will also link to the future First Creek Greenway near the intersection with Broadway, slated to begin construction in 2015. A striped bicycle lane currently exists on Woodland Avenue between Glenwood Avenue and Central Street. This section of Woodland Avenue is four lanes between Broadway and Physicians Regional Medical Center, and then two lanes between Huron Street and Glenwood Avenue. 2013 traffic counts in this section indicate a volume of approximately 10,800 vehicles per day. The 2-lane section varies between 26 and 28 feet wide, while the 4-lane section is approximately 45 feet wide.

<b>PROJECT EXTENTS</b>	Glenwood Avenue to Broadway
<b>PROJECT LENGTH</b>	0.52 miles
<b>FACILITY TYPE</b>	Striped Bicycle Lanes with Road Diet
<b>ESTIMATED COST</b>	\$85,000

### Recommended Improvements

Restripe Woodland Avenue to accommodate striped bicycle lanes. Within the current 4-lane section, this improvement will entail completing a road diet that takes this to a 2-lane facility. Within this section, bicycle lanes are recommended to be 6 feet wide. For the 2-lane section, travel lanes should be reduced to 10 feet wide, which will allow for 4-foot striped bicycle lanes.

### Implementation Considerations

Special treatments will be needed around the intersections. The bicycle lanes will end around the crosswalk to Fulton High School in advance of the intersection with Broadway. If signal modifications are a possibility at this intersection, a bike box could be marked by moving back the stop bar. The right-of-way width between Saint Mary Street and Huron Street is sufficient that additional pavement may be added in this block to accommodate both striped bicycle lanes and the existing turn lanes.

### Visualization – Woodland Avenue at St. Mary Street

