Southwest Light Rail Transit
Bicycle Facility Assessment
Technical Memorandum #1
Existing Conditions

April 20, 2015

Toole Design Group

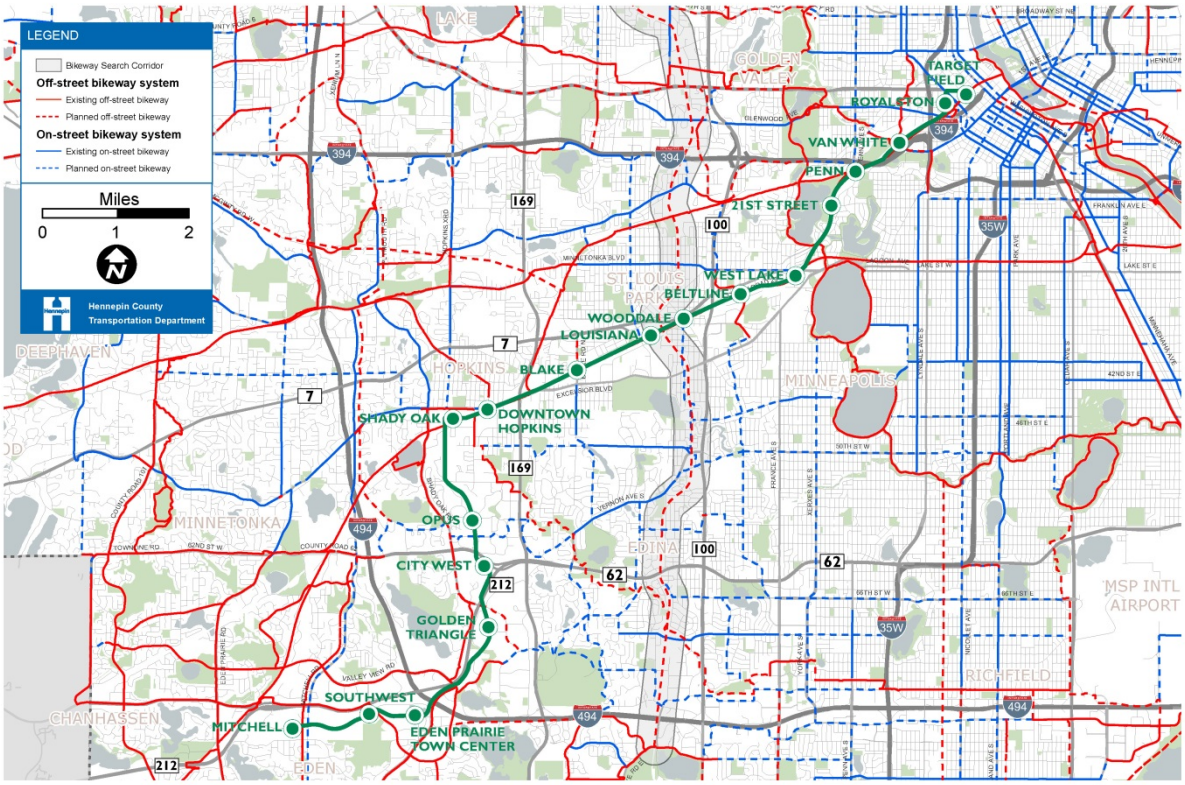
Contents

Introduction

In anticipation of the Southwest LRT project, Hennepin County has requested an assessment of the bike facilities that would be used to access the 17 proposed LRT stations in Minneapolis, St. Louis Park, Hopkins, Minnetonka, and Eden Prairie. This existing conditions assessment is based on roadway network bicyclists would use to access each station. Based on this network a bikeshed was developed for each station. Similar to a walkshed, a bikeshed represents the physical area that can be reached from an LRT station by bicycle assuming a certain level of effort. Understanding the existing network, travel behavior, and determining these bikesheds is the first step in developing recommendations for bicycle parking at the stations, as well as recommendations for bicycle facility improvements near the stations. A later memorandum will present these recommendations.

This memorandum summarizes the bikeshed development process, existing travel behavior in the study area, the existing roadway and bikeway networks, and the characteristics of the anticipated bikesheds for the 17 Southwest LRT stations. A detailed discussion of each of the bikesheds is available in Appendix A. An overview of the project study area is provided in Figure 1.

Figure 1. Project study area



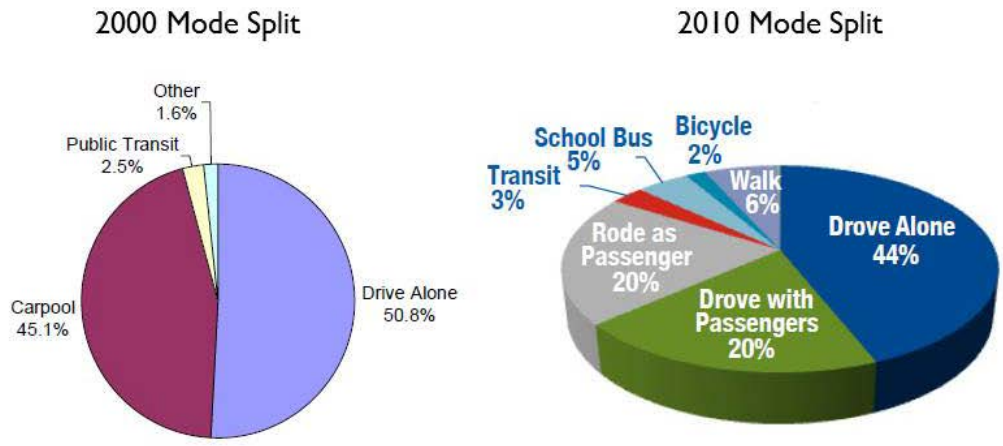
Existing Travel Behavior

Existing travel behavior in the study area was explored based on the Metropolitan Council Travel Behavior Inventory, available bicycle traffic volumes, and the survey responses received as part of this project.

Travel Behavior Inventory

The Metropolitan Council conducts a Travel Behavior Inventory (TBI) every 10 years, which assesses how much people in the Minneapolis-St. Paul metropolitan region travel, which transportation modes they use, and where and when they travel. According to the 2010 TBI, either driving alone or in a carpool is still the primary mode of travel (84%), but it has decreased since 2000. The 2000 TBI marked the first time that non-motorized travel was even included in the survey, and they were combined into an "other" category. As of 2010, non-motorized travel made up 8% of the mode split for the region (Figure 2 and Table 1). Because the TBI is not readily available in GIS format, the 2010 US Census data for the study area was used to determine the anticipated mode share and population of the bikesheds.

Figure 2. 2000 and 2010 mode splits for Minneapolis-St. Paul



Source: Metropolitan Council, 2000 and 2010

Table 1. Commuting to work by mode for Minneapolis/Saint Paul

Mode	2000	2010	Percent Change
Drive	95.9%	84%	-6.9%
Drive Alone	50.8%	44%	-6.8%
Transit	2.5%	3%	+0.5%
School Bus	1.6%	5%	11.4%
Bike		2%	
Walk		6%	

Source: Metropolitan Council, 2000 and 2010

Bicycle Traffic Volumes

A number of local agencies and organizations perform bicycle and pedestrian counts along the trails and roadways in the study area. Data from Transit for Livable Communities, City of Minneapolis, and the Three Rivers Park District are available for many of the trails in the study area. Table 2 illustrates some of the counts, which vary greatly depending on location, day of the week, and weather during the time of the count. In some of the most popular areas, during peak times, bicycle volumes are over 500 for the two hour period which is the equivalent of a bicyclist every 15 seconds.

Table 2. Two hour bicycle counts

Location	2008	2009	2010	2011	2012	2013	2014	Source
Cedar Lake Trail (under I-394)[1]	244	287	147	195	293	534	307	TLC/ Minneapolis[2]
Glenwood Ave W of Royalston Ave[1]	41	40	51	52	49	51	61	TLC
Cedar Lake Trail N of Royalston Ave North[1]					423	580	556	Minneapolis
Cedar Lake Parkway W of Kenilworth Trail[1]					293	388	540	Minneapolis
Southwest LRT Trail, E of Beltline Boulevard[1]	382	364	338	267	507	394		TRPD
Cedar Lake Trail at Wooddale Avenue	264[1]	571	281		571			TRPD
Cedar Lake Trail at Edgebrook Park Connections	557	513	174[1]	459	514			TRPD
Cedar Lake Trail at Depot Coffee House	299	135[1]	194	147				TRPD
Cedar Lake Trail at 11th Ave	362	338	245	357	81[1]			TRPD
Cedar Lake Trail at Blake Rd	508	152[1]		105[1,3]	340			TRPD
MN River Bluffs Trail at Venture Lane	110[1]	96		122	21[3]			TRPD
MN River Bluffs Trail at Valley View Rd Spur	40[1]	86	99		31[1]			TRPD

[1]Weekday count

[2]2008-2012 from Transit for Livable Communities, 2013-2014 from City of Minneapolis

[3]Count impacted by weather

Project Survey

Specific to the study area, respondents to the online survey conducted for this project indicated how frequently and for what purpose they typically rode a bicycle. Survey results are summarized here, and presented in detail in Appendix B. Based on zip codes provided by the respondents, survey responses tended to be clustered around the southwest LRT alignment (Figure 3).

Figure 3. Survey responses: home zip codes

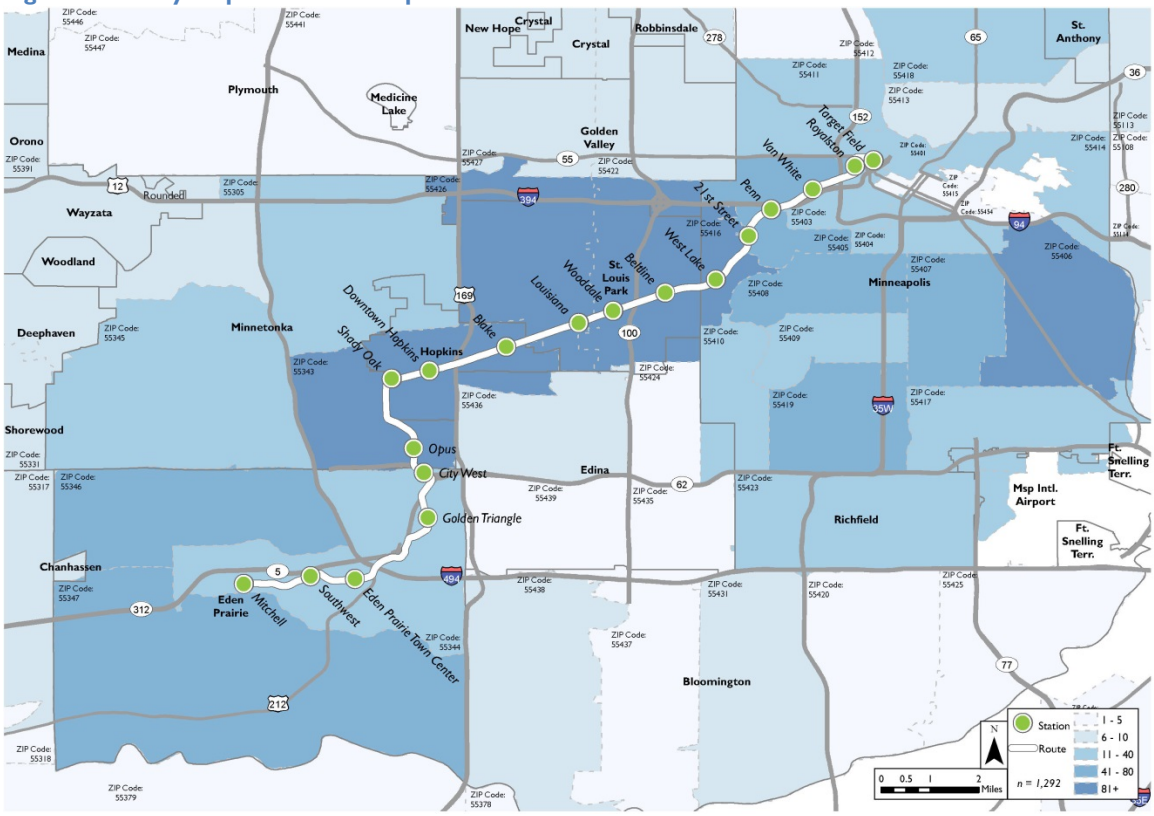
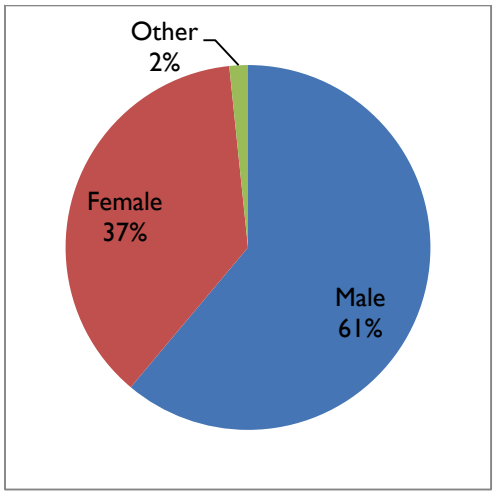


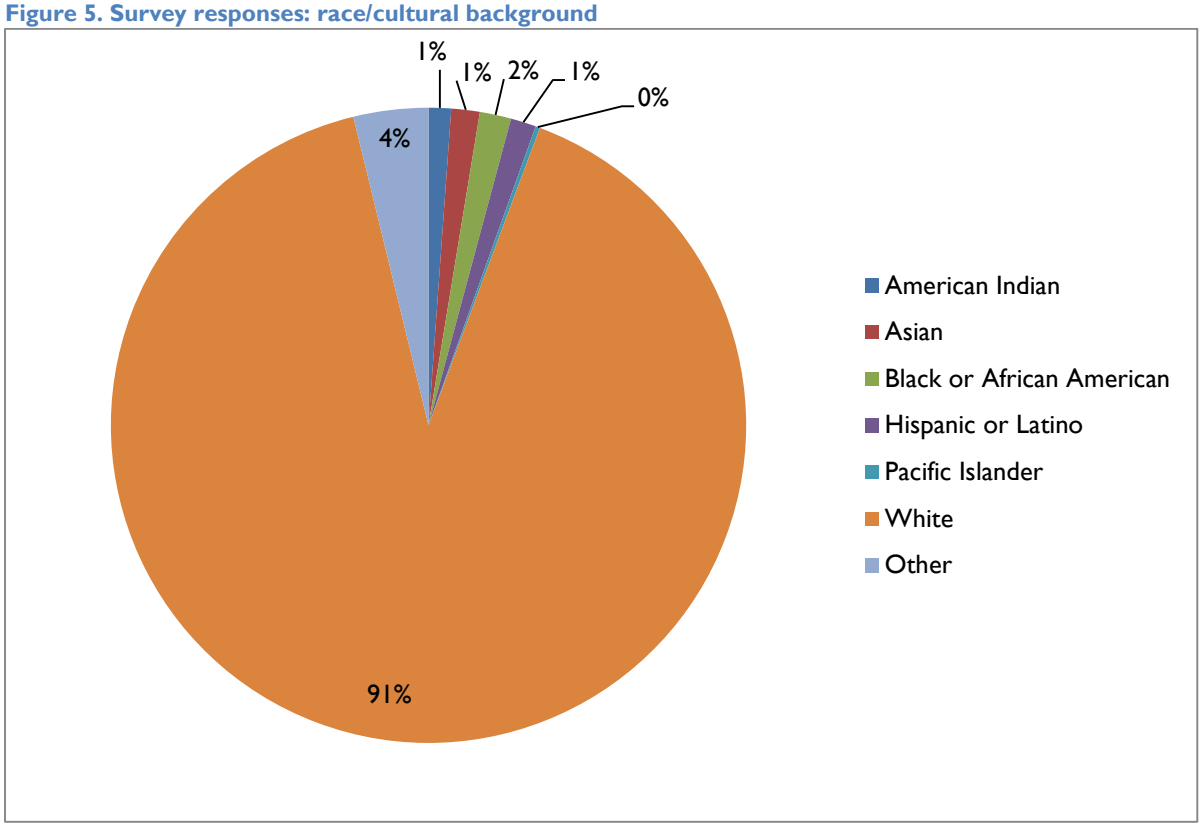
Figure 4. Survey response: Gender



Of the 1,264 people that shared their gender, 61% indicated that they were male (Figure 4). For comparison, the 2010 Census for the zip codes that responded to the survey indicates the population is 49% male, 51% female (other was not an option).

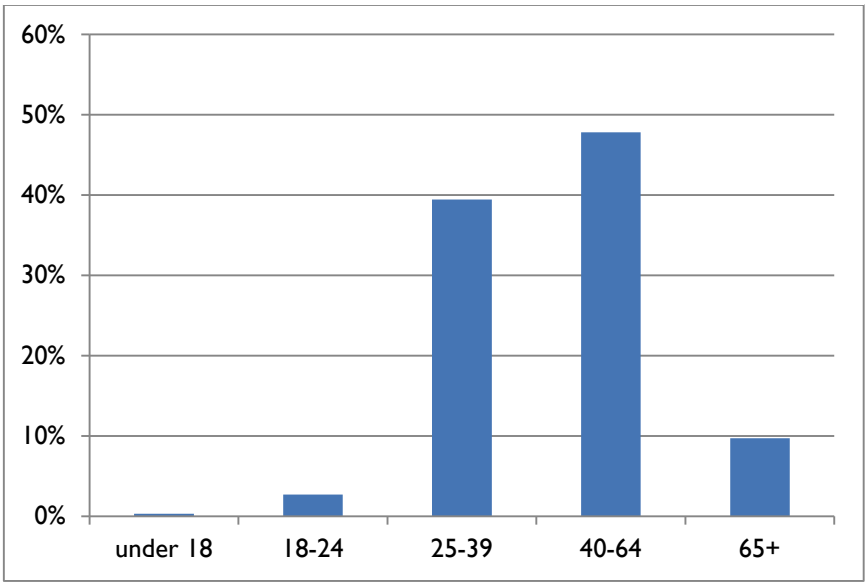
Of the 1,259 people that indicated their race, 91% stated that they were white (Figure 5). For comparison, the 2010 Census for the zip codes that responded to the survey indicates that the population is 77% White, 9% Black, 6% Asian, and 6% Hispanic.

Figure 5. Survey responses: race/cultural background



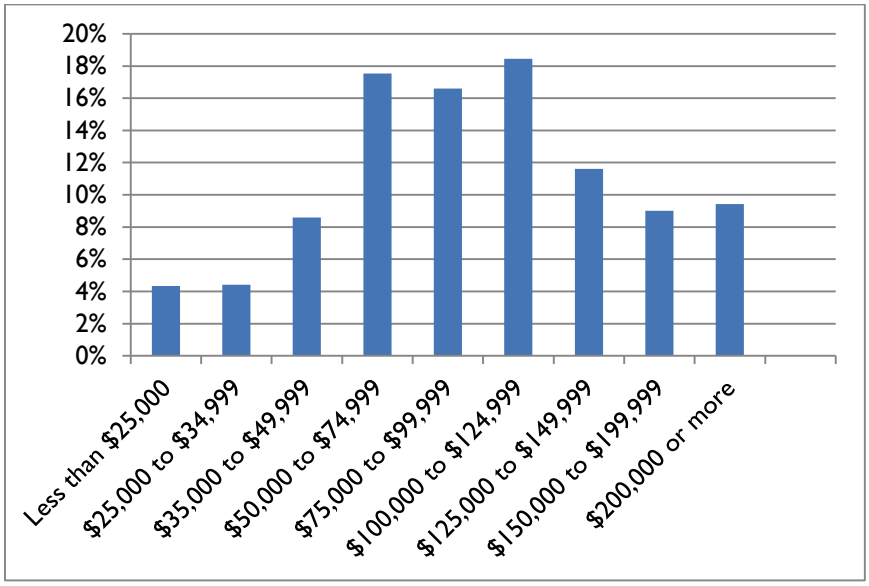
There were 1,265 responses to the question about age. The 2010 Census for zip codes that responded to the survey is 37. By comparison, 48% of the survey respondents were in the 40 to 64-year age bracket, and 40% were in the 25 to 39-year age bracket (Figure 6).

Figure 6. Survey responses: age



For the 1,198 people that responded to the question about income, the median response was $75,000 to $99,999 bracket (Figure 7). By comparison, the median income for the zip codes that responded is $83,775.

Figure 7. Survey responses: approximate gross household income



Overall, out of 1,291 respondents, 52% indicated that they used a bicycle on a weekly basis for part of the year, while 24% were year round bicyclists (Figure 8). The survey reached a large number of occasional bicyclists and those who do not currently bicycle but have interest. These groups represented 19% and 4% of the responses respectively. In addition, out of 1,212 respondents, 55% indicated that they primarily used a bicycle for recreation, followed by 36% who used a bicycle to commute (Figure 9).

Figure 8. Survey responses: frequency of bicycling

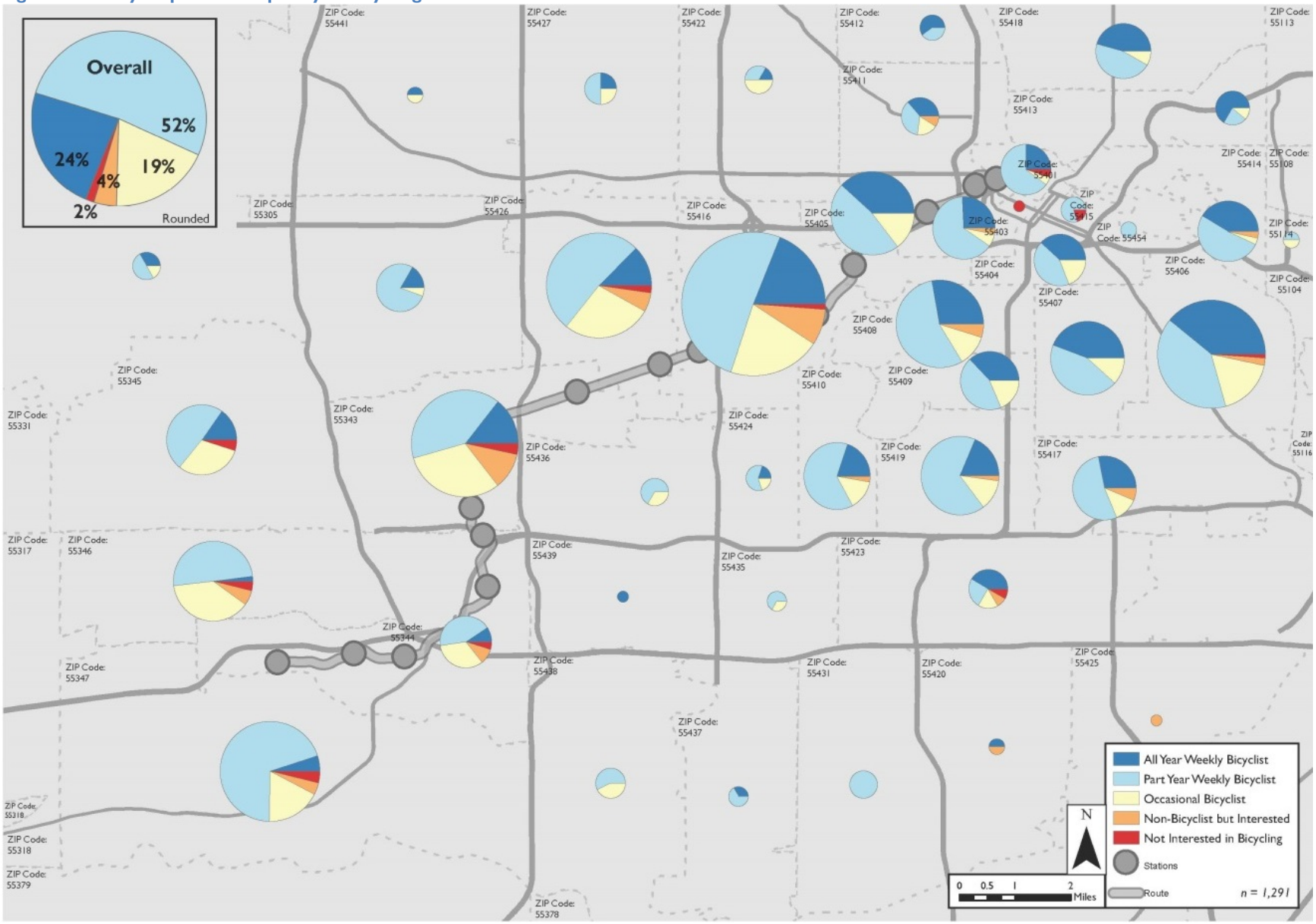
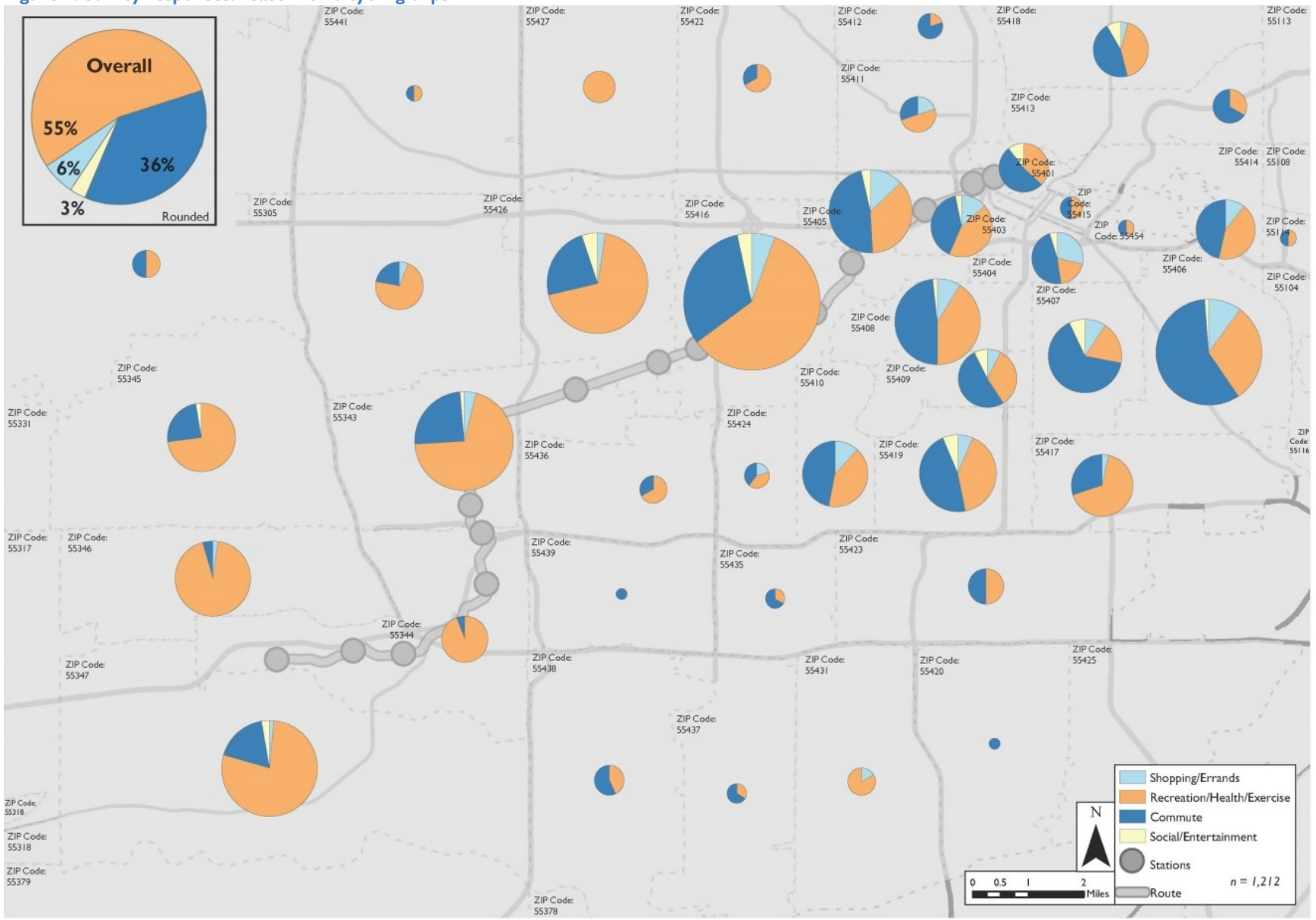


Figure 9. Survey responses: reason for bicycling trips



Existing Network

This section summarizes how the existing roadway and bikeway network was divided into four segments for analysis, the bikeshed development methodology, and results of the analysis.

Network Segments

Within the Southwest LRT corridor, there is a large variance in the roadway network. Land-uses, development density, block lengths, and roadway infrastructure all vary along the corridor. These characteristics can have a substantial impact on the viability of biking as a mode of transportation. For that reason, the existing network has been examined in four different segments along the corridor, which are each defined in Table 3. While each station has its unique characteristics and challenges, the four segments were defined along the Southwest LRT corridor because of their common themes.

Table 3. Corridor Segments

Segment Name	Stations	Description
Urban Minneapolis	• Royalston • Van White	This segment consists primarily of an orthogonal grid road network, mid-high density development, a large amount of commercial businesses and a mix of residential and industrial land uses.
Residential Minneapolis	• Penn • 21st Street • West Lake	This segment consists primarily of an orthogonal grid road network, medium density development, and mainly residential land uses with commercial nodes along arterials and at major intersections.
Saint Louis Park / Hopkins	• Beltline • Wooddale • Louisiana • Blake • Downtown Hopkins • Shady Oak	This segment contains a mix of an orthogonal grid and curvilinear road network, low-mid density development, and a mix of residential and commercial land uses.
Minnetonka / Eden Prairie	• Opus • City West • Golden Triangle • Eden Prairie Town Center • Southwest • Mitchell	This segment consists primarily of a curvilinear road network including cul-de-sacs in residential areas, and low density development that is primarily residential land uses, with a mix of commercial and industrial uses.

Bikeshed Methodology

The Federal Transit Administration defines the area accessible to an LRT station by bicycle as an area within a 3-mile radius of the station. However, drawing a circle of a fixed radius "as the crow flies" around a station is not always accurate. Some areas within the circle may not actually be accessible due to a lack of road connectivity, natural features or other barriers. Others may be accessible, but may require significantly more than 3 miles of travel to reach. This analysis seeks to define a "3-mile" bikeshed for the Southwest LRT stations based on the level of effort required to travel 3 miles by bicycle.

In this analysis, bikesheds were developed using the existing street/trail networks, topography, and typical bicyclist energy expenditure.[1] Roadway network and off-street trail network GIS files were obtained from Hennepin County. Local bicycle network GIS files from each of the five partner cities were also included in the analysis, as well as topographical information for the study area obtained from US Geological Survey's National Map website. The street/trail network was reviewed and adjusted based on local knowledge of existing connections and routes that may not have been included in the GIS layer. Data from the 2010 US Census for commuters age 16 and up was used to determine the mode split for each of the bikesheds.

Service areas were created in ArcGIS Network Analyst using bicyclist energy consumption as the impedance cost. This analysis uses a version of the "steady-state power equation" to estimate the amount of energy a bicyclist consumes in a given street segment when slope and starts/stops are taken into account. The equation assumes default values for the mass of the rider, wind speed, drag, and rolling resistance. The maximum energy expenditure this analysis uses for a one-way trip is approximately 34 kilojoules (kJ) which equates to approximately 3 miles of continuous travel on flat ground.

The energy required to start and stop at intersections is also modeled and takes into account the type of intersection interaction (e.g. left and right turns, as well as straight through). While the functional classification of the roadway the bicyclists is using does not factor into the overall analysis, it is included in the intersection interaction factor. For instance, it is more energy intensive to turn left onto an arterial street from a local street than to turn right from a local street to another local street or to travel straight through an intersection with a local street while bicycling on an arterial. While trails that made connections that roadways do not were included in network, the methodology did not allow for the presence or lack of a bikeway on a roadway to be considered as a factor.

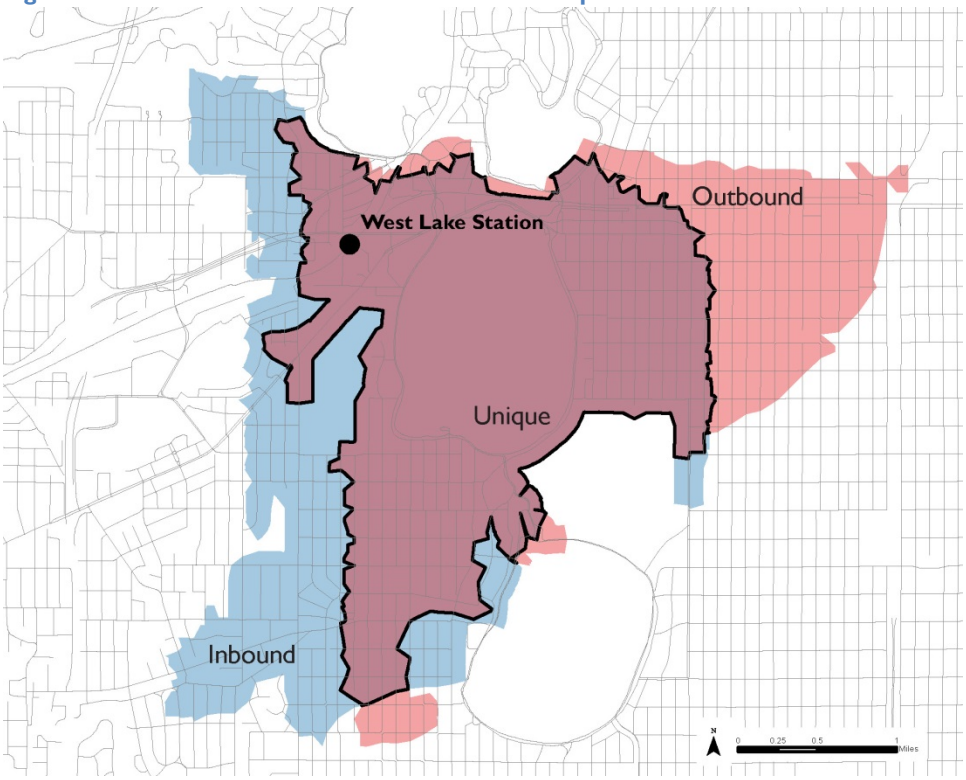
This network analysis resulted in two distinct bikeshed areas for each station – one for a bicycle trip TO the station and one for the trip FROM the station. Figure 10 illustrates the distinction between inbound and outbound bikesheds for a given station. Then, because of the proximity of the stations to one another, many of these bikesheds overlap. A unique bikeshed was then developed for each station assuming that people would access the station that required the least energy to reach and that they would use the same station for both directions of travel. **This unique bikeshed represents the area that can be connected to a single station by bicycle in both directions.**

In some areas with significant grade issues, such as Eden Prairie and Lowry Hill in Minneapolis, large portions of the roadway network are accessible to one station for the inbound trip and accessible to a different station for the outbound trip. These "in-between" areas are shown on the bikeshed maps in Appendix B, but are not included in an individual station's unique bikeshed. Based on the model used, in order to exert 34 kJ of energy or less, a person in this area would access the Southwest LRT by bicycle by riding to one station at the beginning of their trip and away from a different station on their way home. This behavior would require them to carry their bicycle on the train and would therefore not impact bicycle parking estimates. In all likelihood, people in these areas may choose to exert more than

[1] The energy expenditure methodology used draws heavily on the procedure detailed in *A new approach for bikeshed analysis with consideration of topography, street connectivity, and energy consumption (*Iseki and Tingstrom, 2014).

34 kJ of energy in one direction in order to use the same station at both ends of their trip, but there is no way to quantitatively predict this choice.

Figure 10. Inbound versus outbound bikeshed example



After unique bikesheds for each station were developed, the bikesheds were visually inspected and modified based on an understanding of field conditions. The Network Analyst results tend to be overly precise, so the bikeshed areas were often smoothed. For example, a bikeshed that was shown to reach all but one house on a given block was expanded to include that last house. The following statistics were developed for each of the bikesheds and are reported in the bikeshed discussion (Table 4).

Table 4. Bikeshed Statistics definitions

Bikeshed Statistics	Definition	Range
Population	Total census population of the area	59 – 25,433
Projected Population	Estimated population of the area based on 2030 regional forecasts by community	77 – 29,880
Bike Mode Share	Percentage of that population over 16 years old that indicated that they commute by bicycle	0% - 5%
Area	Total square mileage of the bikeshed	0.044 mi^2 – 2.9 mi^2
Intersection Ratio	Ratio between GIS nodes that are connected (intersections) and those that are not (cul-de-sac or dead end streets)	0.66 – 0.92 (on a scale from 0 to 1)
Total Bikeways	Total bikeways miles as indicated by Hennepin county and the five partner cities, including both on- and off-street	0.17 mi – 9.4 mi
Anticipated LRT ridership	2030 weekday ridership estimates for each station provided by the Southwest LRT project	223 – 4,212

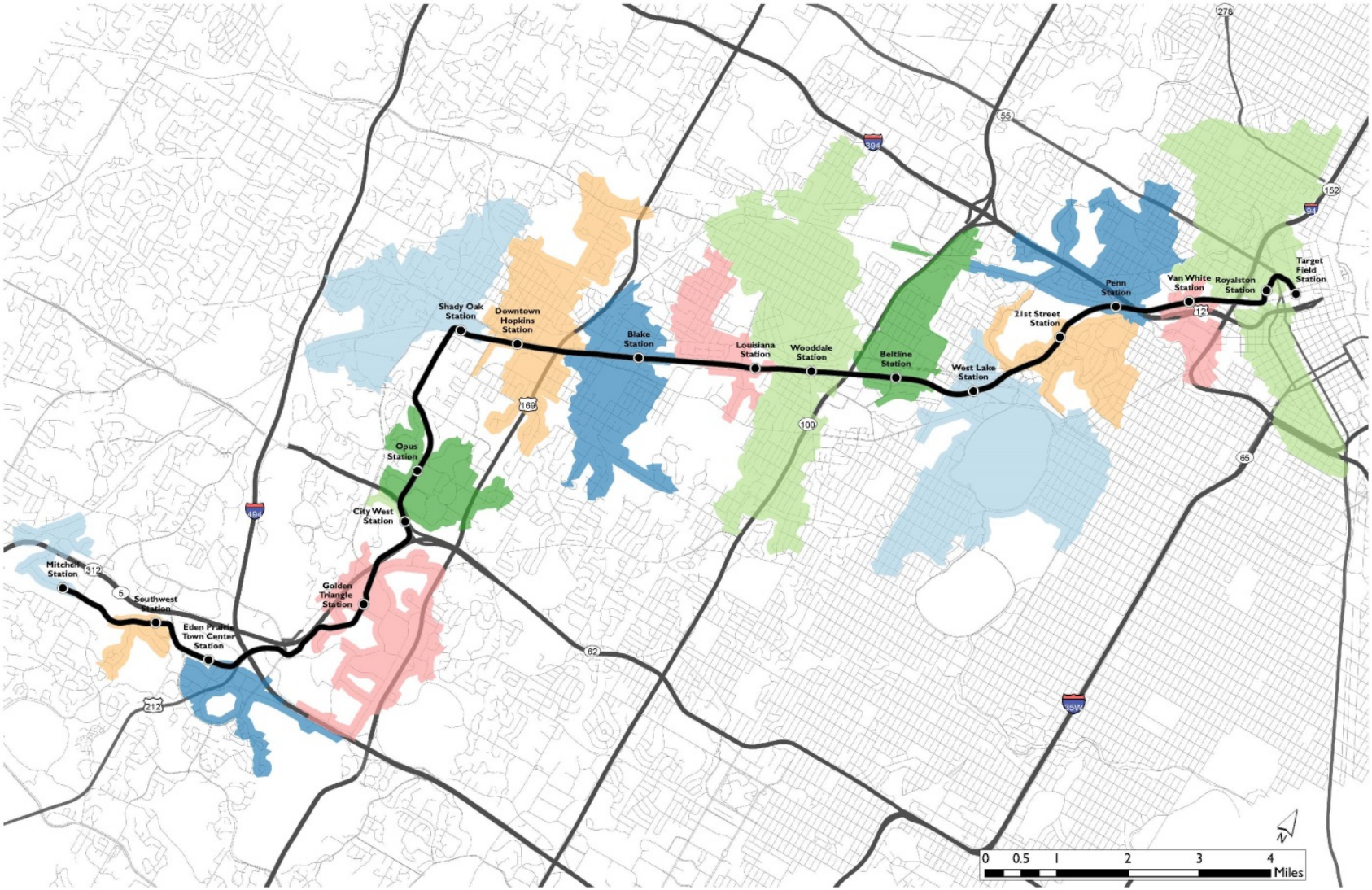
Existing Network Analysis Results

The overall statistics for each of the bikesheds are provided in Table 5. Figure 11 also provides an overview of all 17 bikesheds in the study area. The four segments are discussed below, and the individual bikesheds are discussed in detail in Appendix B.

Table 5. Overall bikeshed statistics

Station	2010 Population	2030 Projected Population	Bike Mode Share	Area	Intersection Ratio	Total Bikeways	Anticipated LRT Ridership
Royalston	25,433	29,880	2.9%	2.9 mi^2	0.90	7.1 mi	223
Van White	1,685	1,980	4.4%	0.39mi^2	0.92	1.4 mi	310
Penn	5,041	5,923	4.6%	1.34 mi^2	0.88	7.4 mi	648
21st Street	3,686	4,331	5.0%	0.89 mi^2	0.90	4.3 mi	1,577
West Lake	16,403	19,272	4.0%	2.1 mi^2	0.92	6.6 mi	2,948
Beltline	4,206	4,899	1.3%	0.95 mi^2	0.85	5.7 mi	3,640
Wooddale	17,139	19,961	1.4%	3.4 mi^2	0.84	8.5 mi	2,015
Louisiana	2,639	3,073	0.2%	0.71 mi^2	0.80	1.2 mi	1,873
Blake	5,603	6,626	0.7%	1.4 mi^2	0.78	6.5 mi	2,191
Downtown Hopkins	6,857	8,109	0.4%	1.8 mi^2	0.75	3.5 mi	3,203
Shady Oak	3,772	4,460	0.4%	1.9 mi^2	0.74	9.4 mi	1,300
Opus	1,061	1,293	0.1%	0.81mi^2	0.72	5.8 mi	2,277
City West	59	77	0%	0.044 mi^2	0.69	0.17 mi	1,105
Golden Triangle	763	1,007	0%	1.3 mi^2	0.71	3.5 mi	2,062
Eden Prairie	699	921	0%	0.54 mi^2	0.75	2.6 mi	1,968
Southwest	736	970	0.1%	0.24 mi^2	0.73	2.9 mi	4,212
Mitchell	111	147	0.3%	0.32 mi^2	0.66	2.6 mi	2,684

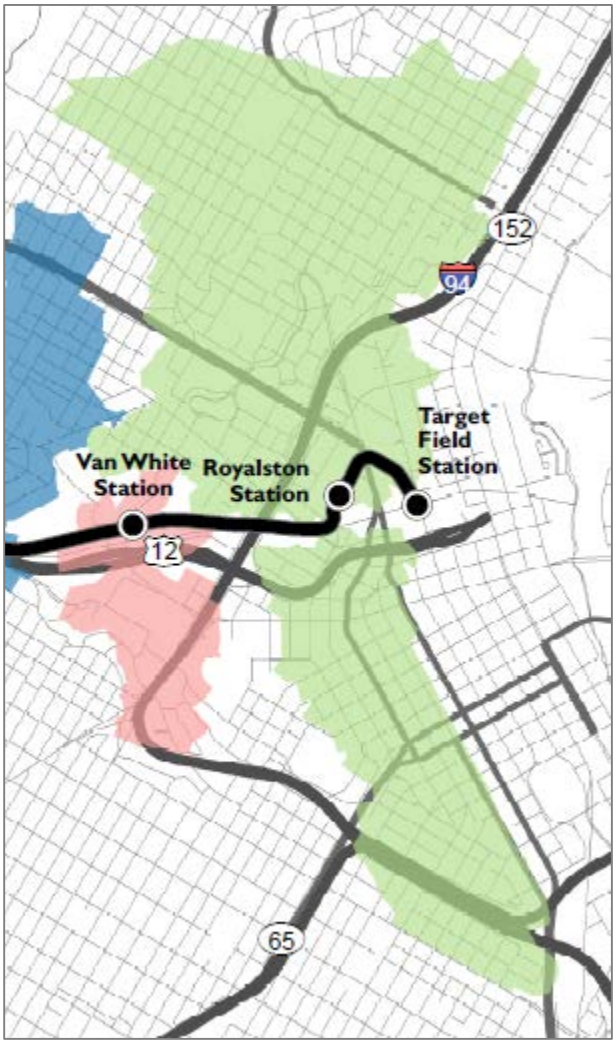
Figure 11. Unique bikesheds by station



Urban Minneapolis Segment

Most of the roadway network near the Southwest LRT alignment within the Urban Minneapolis segment consists of a well-connected grid street pattern (Figure 12). There are many on-street and off-street bikeways within this segment, especially in the dense urban core of Minneapolis. In downtown Minneapolis, there are many on-street bike lanes and the block lengths tend to be short which enhances connectivity. In this area, the LRT alignment would parallel the Cedar Lake Regional Trail provides a non-motorized only east-west connection and connects to the West River Pkwy trail, that is located adjacent to the Mississippi River.

Figure 12. Urban Minneapolis Bikesheds



Other portions of this segment are less dense and include a large amount of industrial land-use. Specifically, the Royalston station area is surrounded by major highways and the block structure is less connected; both of these characteristics create challenges for biking to the station. Interstates 94 and 394 create major barriers for bicyclists, making it difficult to travel to the Royalston and Van White stations from the east and west.

Further away from the Southwest LRT alignment, the mix of land-uses in this segment become more diverse, ranging from the very dense urban core and central business district, to mid-density residential neighborhoods, and low-density industrial areas. The majority of the area was developed with an orthogonal street grid with north-south and east-west orientation. This street network pattern makes it easy for bicyclists to travel in any cardinal direction and provides a multitude of bike route options.

Further to the north and south of the Southwest LRT alignment are primarily residential areas, with some commercial uses located on arterial streets and at major intersections.

Residential Minneapolis Segment

The Southwest LRT alignment runs west of Lake Calhoun and between Cedar Lake and Lake of the Isles (Figure 13). The land uses near the Southwest LRT stations are primarily low to medium density residential with many commercial businesses on arterial roadways, notably West Lake Street and Excelsior Boulevard. Most of the roadway network is an orthogonal grid with some curvilinear streets. The streets around the lakes tend to follow the natural borders of the lakes which limits their connectivity.

Figure 13. Residential Minneapolis Bikesheds

The Chain of Lakes district of Minneapolis comprises the center of this segment, and features a robust bikeway system. The area is actively used by recreational and commuter bicyclists year round, and the bikeways are a popular destination in their own right. The Midtown Greenway is a prominent bikeway, running east from the West Lake station area through the entire eastern portion of the segment, eventually connecting to the Mississippi River and West River Parkway. The Kenilworth trail provides a critical connection between Cedar Lake and Lake of the Isles, and is adjacent to the 21st Street station. The Kenilworth Trail connects to the North Cedar Lake Regional Trail to the north (Penn Station) and to the Cedar Lake Regional Trail to south (West Lake Station).

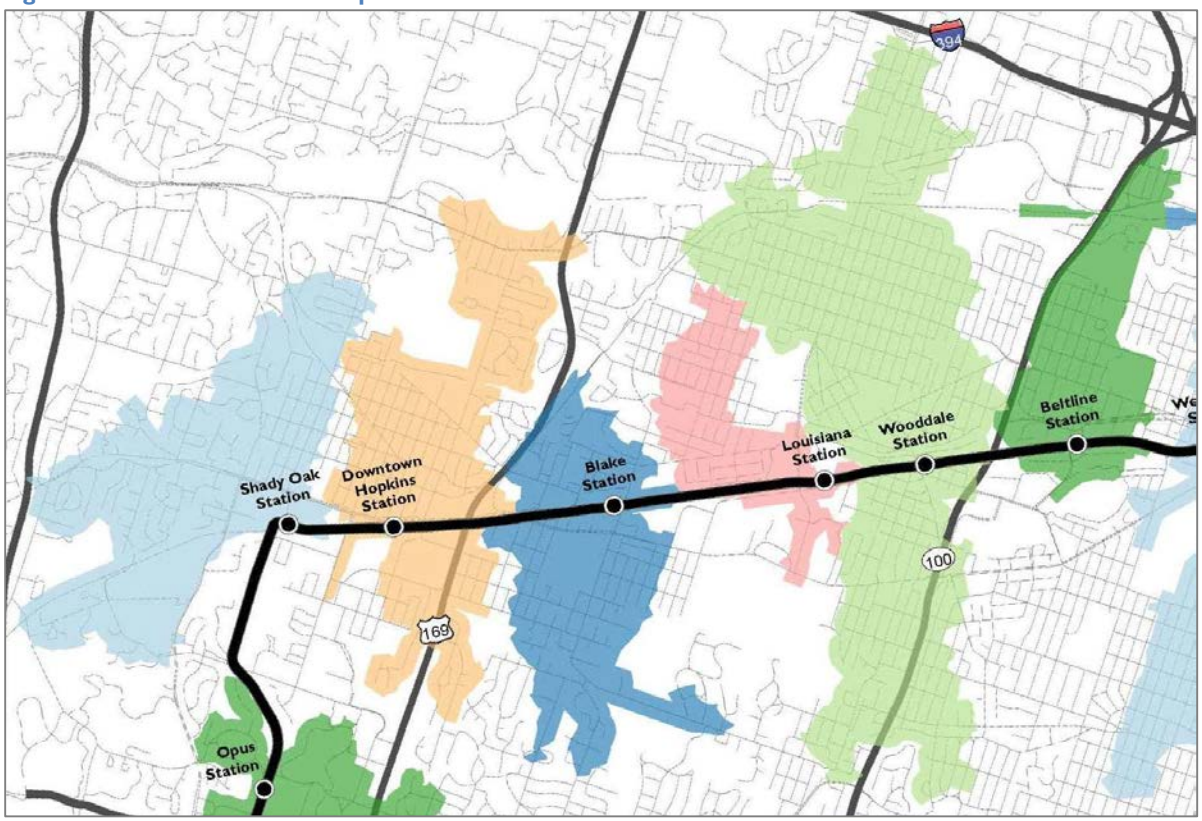
Interstate 394 runs east-west near the Penn station and is a major barrier for bicyclists in the area. Highway 100 runs north and south in the western portion of this segment, creating another significant barrier for bicyclists traveling east and west.

Further away from the Southwest LRT alignment, the majority of the area is composed of residential land-uses with a grid street network. The northern and southern portions of this segment are almost exclusively residential, with commercial uses in select areas along major roadways and intersections.

Saint Louis Park / Hopkins Segment

This segment is approximately 8.5 miles and comprises a large portion of the Southwest LRT corridor (Figure 14). The street network in this segment is mostly a grid, much of which is well connected, although more curvilinear streets can be found further away from the station. This well connected grid contributes positively to the size of the bikesheds in this segment.

Figure 14. St Louis Park and Hopkins Bikesheds



The LRT alignment follows the Cedar Lake Regional Trail in this segment as it passes through the communities of Saint Louis Park and Hopkins. The Minnesota River Bluffs LRT Regional Trail connects to this area from the southwest and the Lake Minnetonka Regional Trail connects from the north west.

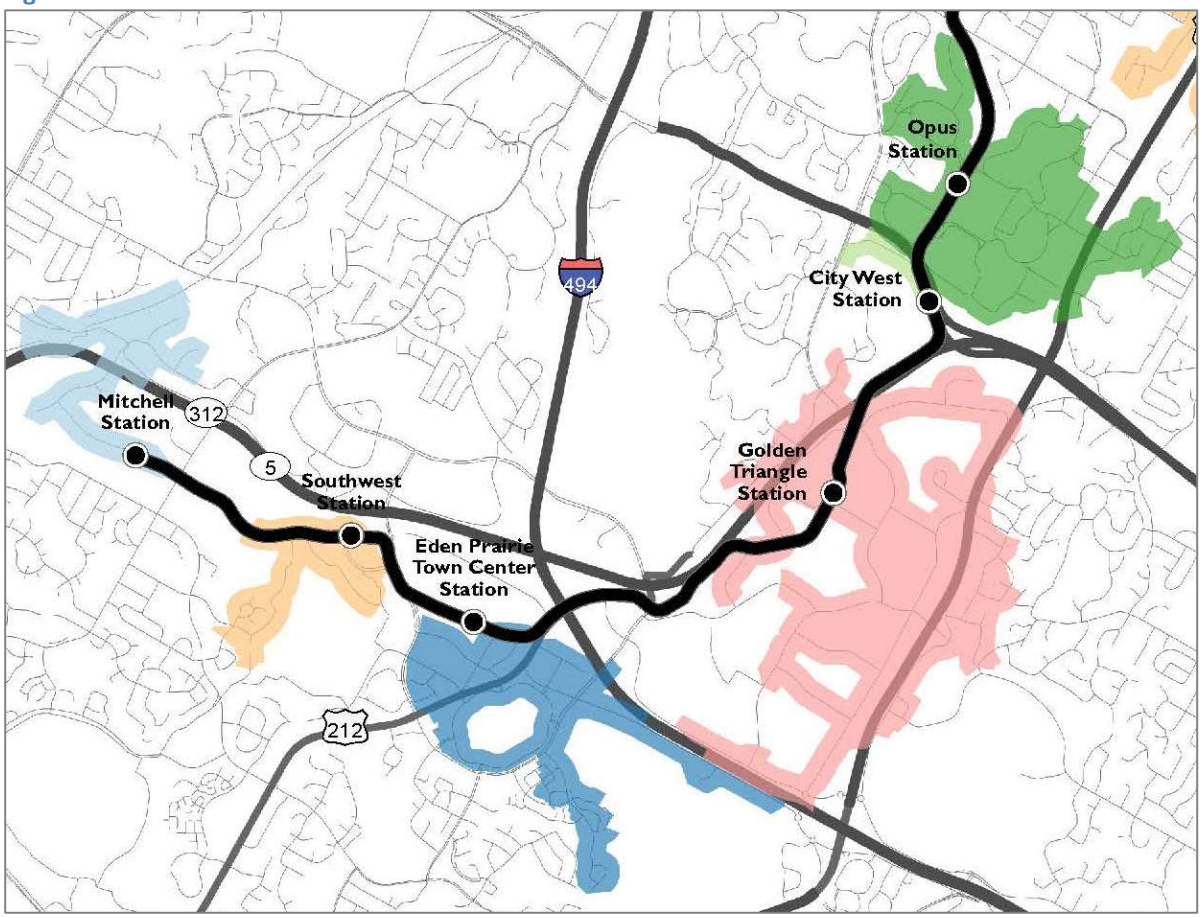
The segment contains a mix of land uses, and development densities, ranging from low-density residential neighborhoods to mid-high density commercial areas. The densest portion of the segment is nearest to the Southwest LRT alignment, which has a large amount of commercial development along roadways such as Excelsior Boulevard as well as a mix of residential and industrial development. Further away from the Southwest LRT corridor, the density of development tends to decline.

There are several major roadways and highways in this segment that run north-south, which creates challenges for bicyclist traveling west and east. Those include Highway 169, Louisiana Ave S, Highway 100, and Shady Oak Road (County Road 61). Other inhibitors to bicycle travel throughout this area are the industrial facilities near the Cedar Lake Trail. These areas have disconnected street networks and large buildings and surface parking lots that obstruct travel by bicycle.

Minnetonka / Eden Prairie Segment

The roadway network in this segment tends to be curvilinear and disconnected, which makes bicycle travel more difficult than any other part of the corridor (Figure 15). While there are a number of shared use paths along major roadways, the routes between destinations tend to be long. The disconnected network, combined with the topography in the area means that the assumed 34 kJ of bicycling effort are expended quickly when traveling by bicycle. Land use in the area tends to be very low density, comprised mainly of single-family homes, commercial areas and some light industrial uses.

Figure 15.Minnetonka and Eden Prairie Bikesheds



In addition to the challenges of navigating a curvilinear and disconnected road network, the segment also has many highways that create barriers for bicyclists. Highways in the area include Interstate 494, US Highway 212, US Highway 169, and Crosstown Highway (62).

There are few roadways that accommodate bicyclists with on-streets bike facilities. However, there are several roadways in the area that have off-street, shared-use facilities for bicyclists and pedestrians that are parallel to the roadways. The Lake Minnetonka and Minnesota River Bluffs Regional trails both pass through this area.

Summary

Understanding the existing network and travel behavior for the 17 Southwest LRT stations is the first step in developing recommendations for bicycle parking at the stations, as well as recommendations for bicycle facility improvements near the stations. Based on the calculated bikesheds for each station it is clear that connectedness of the existing roadway network and area topography are large factors in determining the likelihood that people will access the LRT stations by bicycle. In general, the stations with a better connected roadway network, such as Wooddale and Royalston are easier to access. The limiting impact of barriers such as lakes, golf courses and highways are also apparent when considering the bikesheds for stations such as Opus and City West.

A later memorandum will present the process for developing these recommendations.

Appendix A: Bikeshed Results by Station

This appendix provides a summary of the bikeshed results for each station, including the areas between two stations that may overlap.

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Overall Bikeshed Statistics Summary

Station	2010 Population	2030 Projected Population	Bike Mode Share	Area	Intersection Ratio	Total Bikeways	Anticipated LRT Ridership
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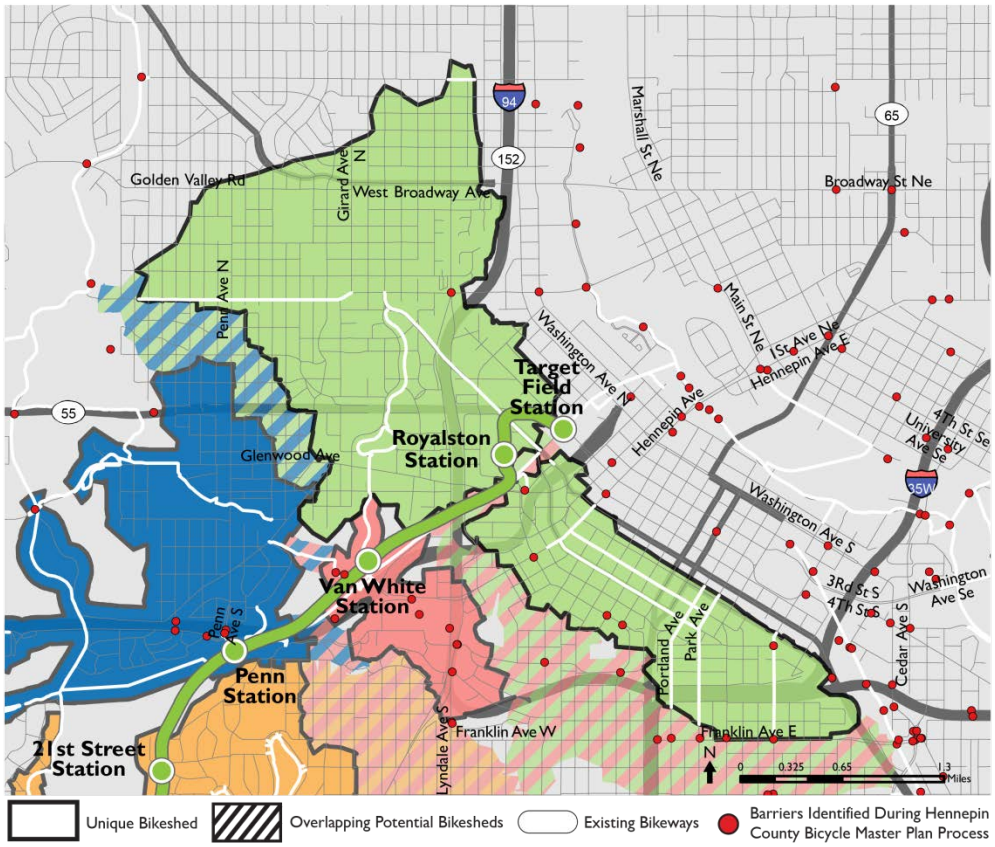
Mitchell	111	147	0.3%	0.32 mi^2	0.66	2.6 mi	2,684

Royalston Station

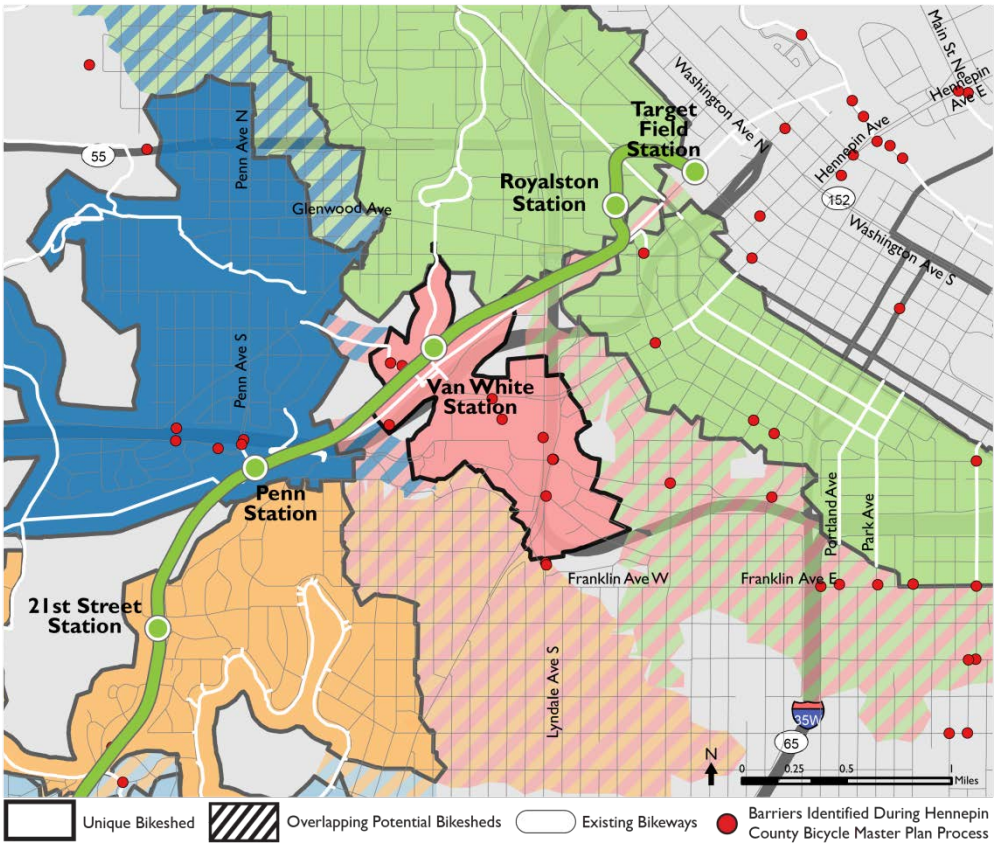


Bikeshed Statistics	
2010 Population	25,433
Bike Mode Share	2.9%
Area	2.9 mi^2
Intersection Ratio	0.90
Total Bikeways	7.1 mi
Anticipated LRT Ridership	223

The Royalston station area is the northeastern most station on the Southwest LRT corridor in the western part of downtown Minneapolis. The Royalston bikeshed has the largest population out of all the stations with 25,433 people, although the anticipated LRT ridership is low.

The bikeshed is also very large, with the second largest area of all the bikesheds at 2.9 square miles, although the anticipated bikesheds for the Target Field station and other Blue Line stations are not included in this analysis. It stretches to the northwest and the southeast along a primarily grid street network. The Cedar Lake Trail runs just south of the station, providing an exclusive non-motorized connection into downtown and to the southwest. The Royalston bikeshed has a total of 7.1 miles of bikeways, one of the highest among all station bikeshed areas. It also has the third highest intersection ratio along the corridor.

Van White Station



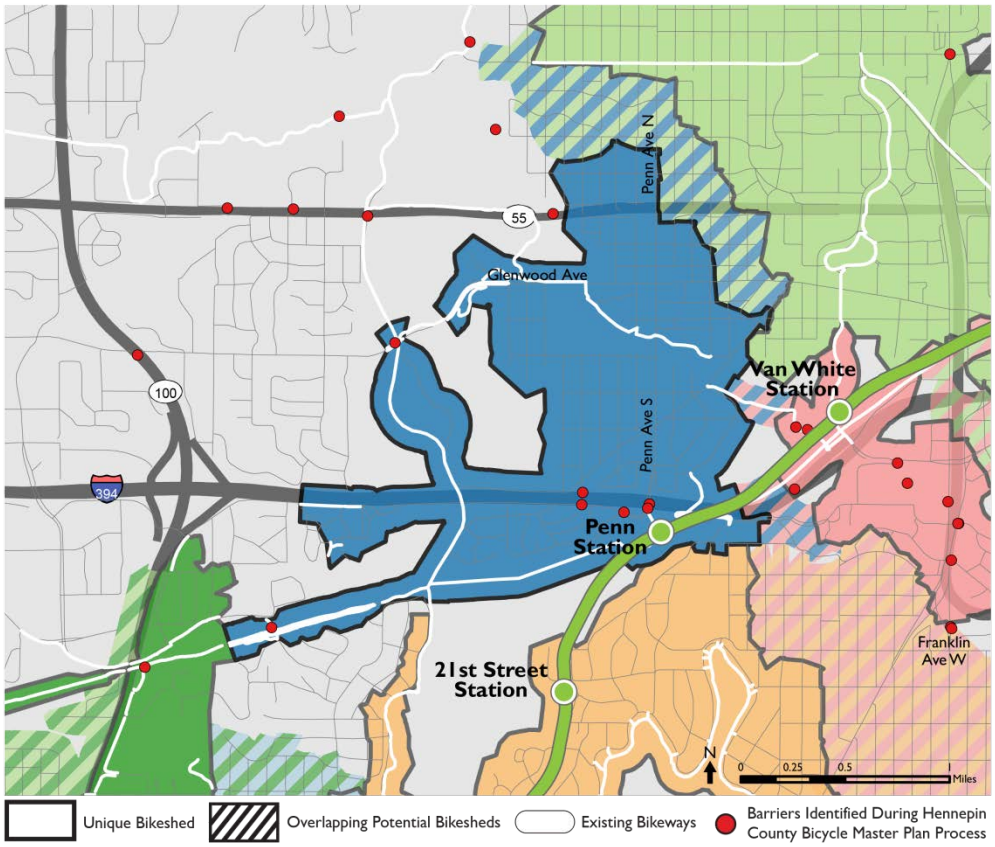
Bikeshed Statistics	
2010 Population	1,685
Bike Mode Share	4.4%
Area	0.39 mi²
Intersection Ratio	0.92
Total Bikeways	1.4 mi
Anticipated LRT Ridership	310

The Van White bikeshed area is one of the smallest along the Southwest LRT corridor at only 0.39 square miles. Interstate 94 runs north-south through the area and Interstate 394 runs east-west, which restrict bicycle travel in the area making other nearby stations easier to reach by bicycle.

The Van White bikeshed has only 1.4 miles of bikeways, one of the lowest in the Southwest LRT corridor. However, this bikeshed has one of the highest bike mode share at 4.4% and the second highest intersection ratio at 0.92.

There are also grade issues in this area that result in an overlap in inbound and outbound bicycle routes between the Van White and 21st Street stations. In order to exert 34 kJ of effort or less to travel to/from the LRT, residents of these areas (shown in stripes on the figure), would have to travel to one station on their way to the LRT and then return from another on their way home.

Penn Station



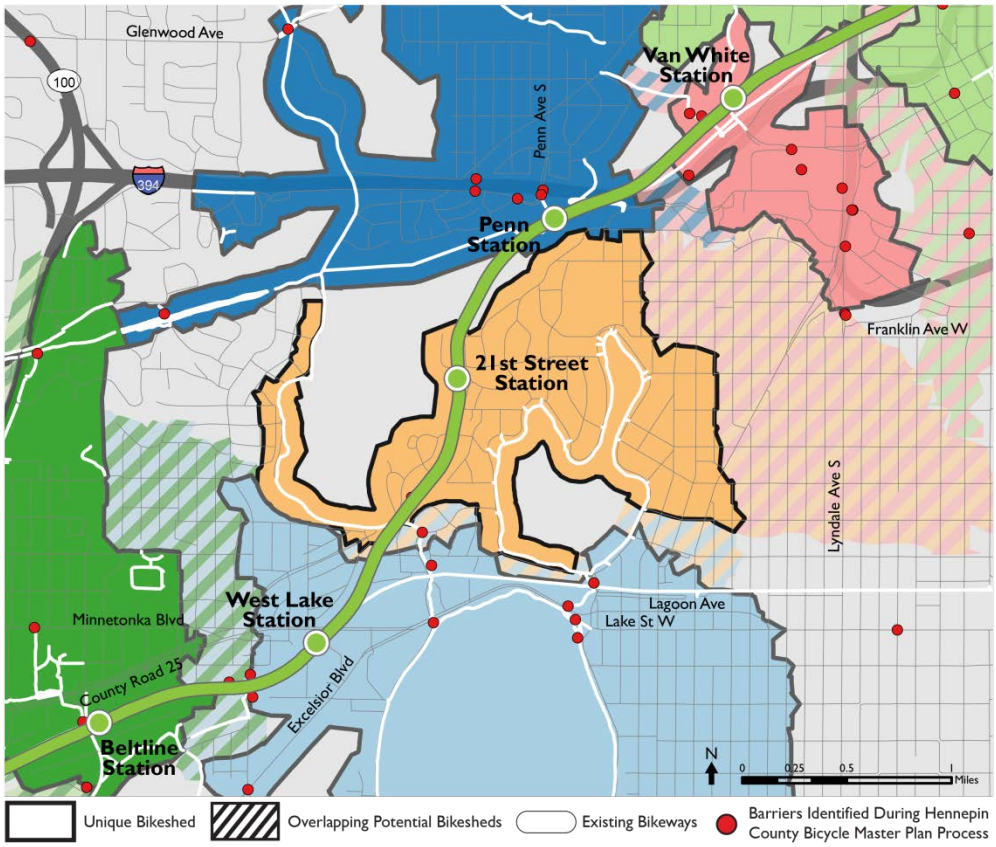
Bikeshed Statistics	
2010 Population	5,041
Bike Mode Share	4.6%
Area	1.34 mi²
Intersection Ratio	0.88
Total Bikeways	7.4 mi
Anticipated LRT Ridership	648

The Penn Station bikeshed is located entirely to the north of the station area due to the significant increase in grade south of the station. This inhibits bicycle travel to or from the neighborhoods on top of the hill. North of the station the streets are in an orthogonal grid pattern and the terrain is relatively flat. Theodore Wirth Park, a dense wooded area, and Theodore Wirth Golf Course are both northwest of the station. This area is only accessible via Theodore Wirth Parkway and as a result, the bikeshed northwest of the station is very limited.

To the west the North Cedar Lake Trail is included in the bikeshed although it provides limited access to surrounding land uses.

Penn Station does have a 4.6% bicycle mode share, one of the highest among all stations, although anticipated ridership is low. It has the third highest amount of bikeway mileage with 7.4 miles.

21st Street Station



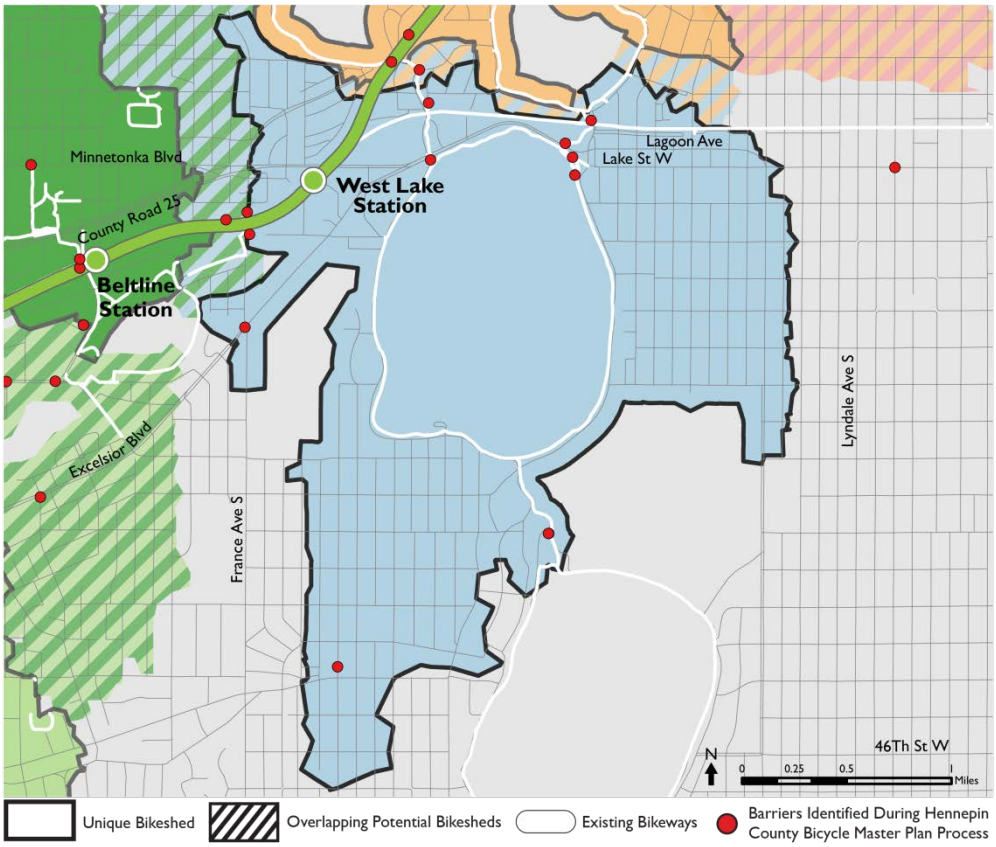
Bikeshed Statistics	
2010 Population	3,686
Bike Mode Share	5.0%
Area	0.89 mi²
Intersection Ratio	0.90
Total Bikeways	4.3 mi
Anticipated LRT Ridership	1,577

The 21st street station is situated along the Cedar Lake trail, and is surrounded by lakes on each side of the station - Cedar Lake to the west, and Lake of the Isles to the east. The lakes impact mobility in the area, which is one reason why the bikeshed area is relatively small at only 0.89 square miles.

There are also grade issues in this area that result in an overlap in inbound and outbound bicycle routes between the Van White and 21st Street stations. In order to exert 34 kJ of effort or less to travel to/from the LRT, bicyclists in these areas (shown in stripes on the figure), would have to travel to one station on their way to the LRT and then return from another on their way home.

The majority of the bikeshed is to the east of the station, stretching around Lake of the Isles. The streets in this bikeshed are typically curvilinear, often following the natural borders of the nearby lakes. Besides the Cedar Lake Trail, the bikeshed has few bikeways, with a total of 4.3 miles. Despite the small amount of bikeway mileage, the area has the highest bike mode share percentage with 5%.

West Lake Station

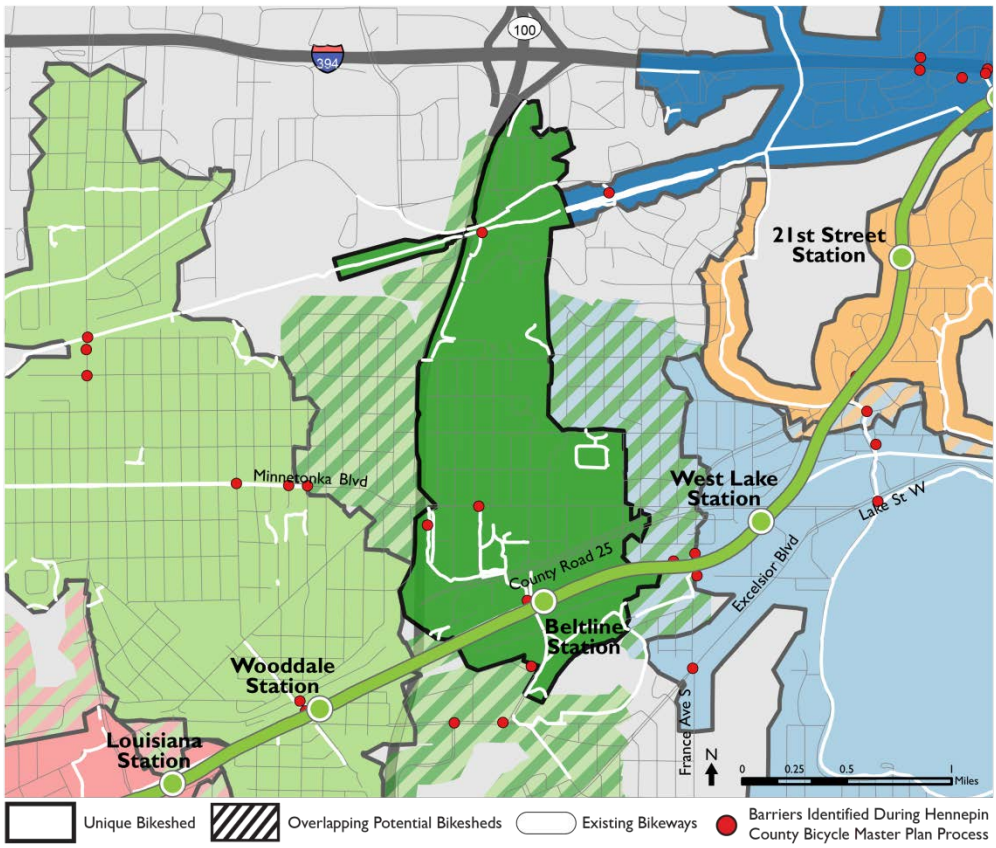


Bikeshed Statistics	
2010 Population	16,403
Bike Mode Share	4.0%
Area	2.7 mi^2
Intersection Ratio	0.92
Total Bikeways	6.6 mi
Anticipated LRT Ridership	2,948

The West Lake station is located just south of W Lake Street and west of Lake Calhoun along the Cedar Lake Trail. The bikeshed area is very large at 2.1square miles (not including the surface area of the lake), which is the third highest amongst all bikesheds. The bikeshed area completely surrounds Lake Calhoun, which is a popular recreational destination for bicyclists in the area.

The West Lake station bikeshed also has the third highest population out of all the Southwest LRT station bikesheds. The neighborhoods surrounding Lake Calhoun are primarily residential and have a grid street pattern. Major barriers in the bikeshed include Lake Calhoun and the Minikhada Club golf course.

Beltline Station

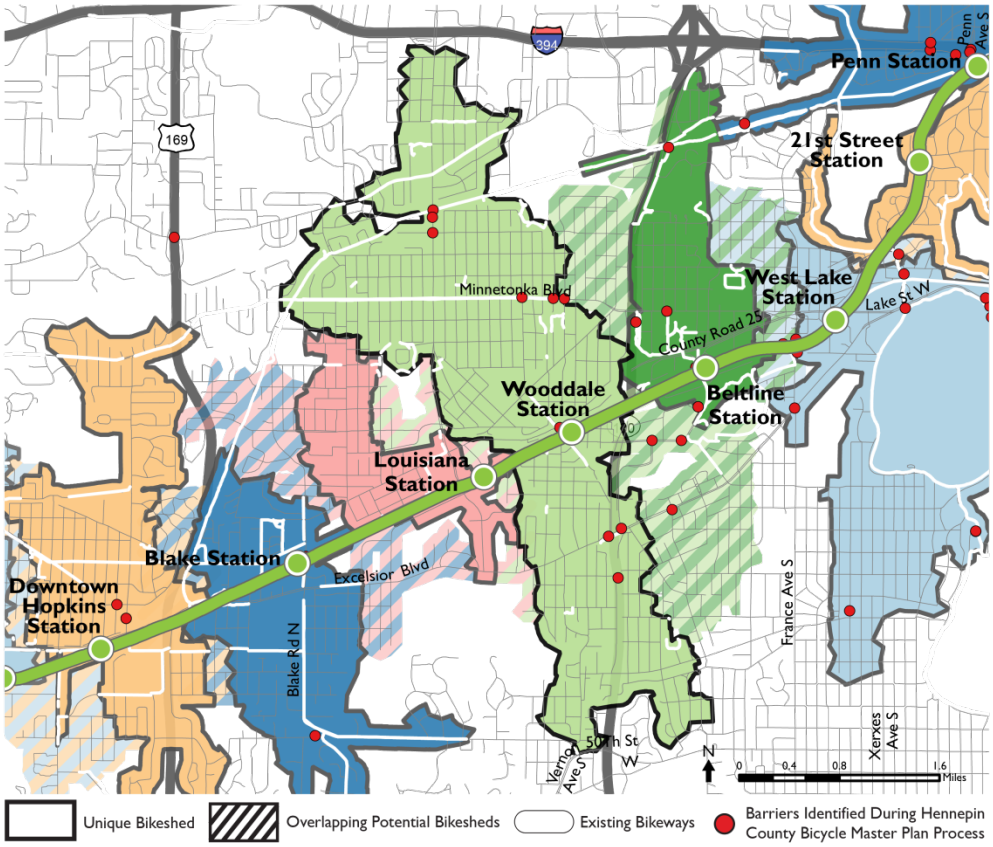


Bikeshed Statistics	
2010 Population	4,206
Bike Mode Share	1.3%
Area	0.95 mi²
Intersection Ratio	0.85
Total Bikeways	5.7 mi
Anticipated LRT Ridership	3,640

The Beltline station bikeshed is long and narrow and extends to the north and south of the station. There is some overlap of potential bikesheds between this station and the Wooddale and West Lake stations. The majority of the bikeshed is located north of the Beltline station, due to the curvilinear and disconnected road network to the south.

The entire bikeshed is located east of Highway 100, which runs north-south and is a major barrier for bicyclists in the area. The bikeshed reaches the North Cedar Lake Trail, but does not extend very far down the trail in either direction before the assumed level of effort is expended. To the east the North Cedar Lake Trail is included in the Penn Station bikeshed.

Wooddale Station

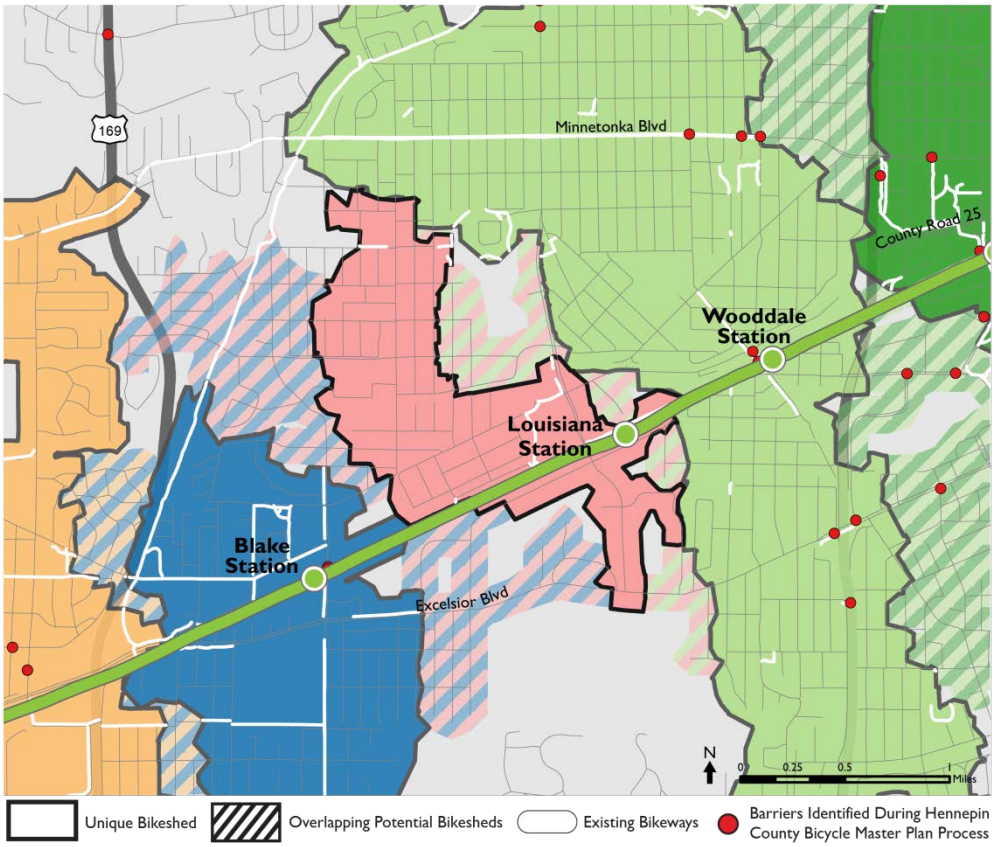


Bikeshed Statistics	
2010 Population	17,139
Bike Mode Share	1.4%
Area	3.4 mi^2
Intersection Ratio	0.84
Total Bikeways	8.5 mi
Anticipated LRT Ridership	2,015

With a total area over 3.4 square miles, the Wooddale station is the largest bikeshed in the corridor (note the larger scale on the above figure). The bikeshed extends primarily to the north and south and is densely populated with 17,139 residents. It has the second highest population among Southwest LRT station bikesheds, although the current bike mode share is only 1.4%.

The Wooddale bikeshed also has the second highest amount of bikeways, with over 8.5 miles. This bikeshed is so large primarily due to the orthogonal street grid with small blocks that makes bike connections easy.

Louisiana Station



Bikeshed Statistics	
2010 Population	2,639
Bike Mode Share	0.2%
Area	0.71mi²
Intersection Ratio	0.80
Miles of Bikeways	1.2
Anticipated LRT Ridership	1,873

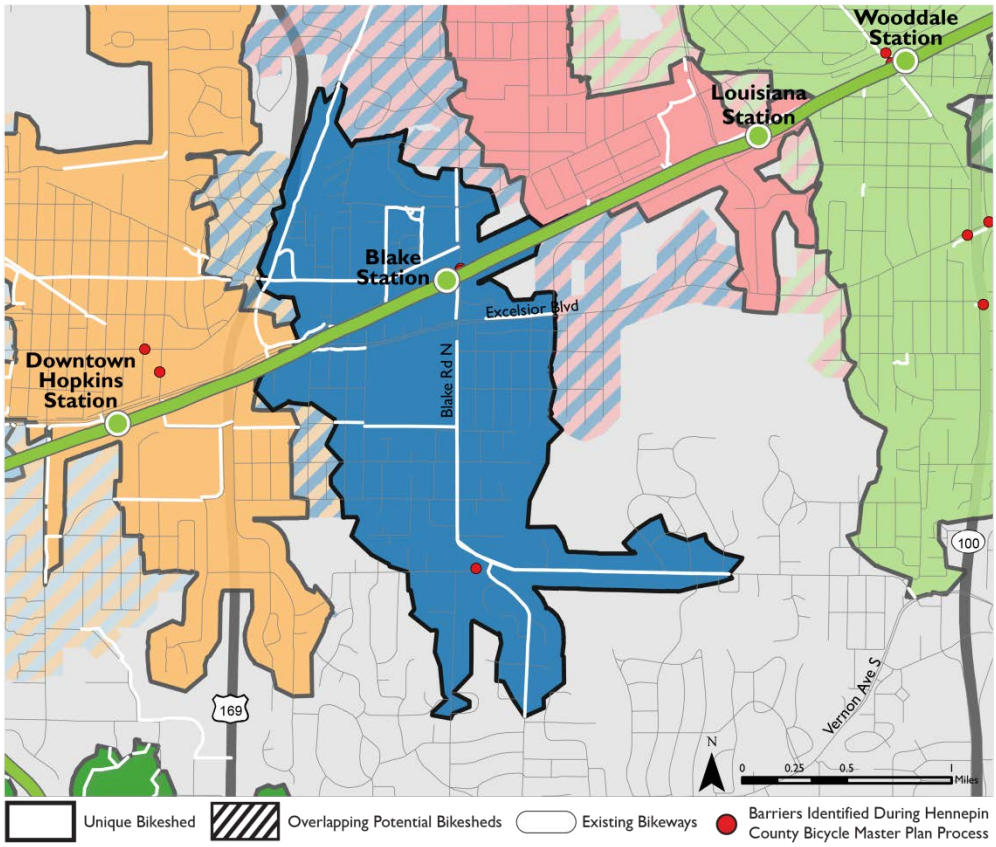
The Louisiana bikeshed has a very small area, at only 0.71 square miles. As a result, there are only 1.2 miles of bikeways – one of the lowest amongst all Southwest LRT station bikesheds. The bicycle mode share in this area is also very low.

There is quite a bit of overlap of potential bikesheds between this station and the Blake station. In order to exert 34 kJ of effort or less to travel to/from the LRT, residents of these areas (shown in stripes on the figure), would have to travel to one station on their way to the LRT and then return from another on their way home.

The station does not connect to the North Cedar Lake Regional Trail, whereas the stations on either side of it do.

The majority of the bikeshed is to the north of the station, where there is a mix of residential and commercial land uses. The Meadowbrook Golf Course is south of the station, and the roadway network to the south is less connected, both of which limit bicycle access. Highway 7, which runs east-west, is also difficult to cross by bike and limits the size of the bikeshed.

Blake Station



Bikeshed Statistics	
2010 Population	5,603
Bike Mode Share	0.7%
Area	1.4 mi^2
Intersection Ratio	0.78
Total Bikeways	6.5 mi
Anticipated LRT Ridership	2,191

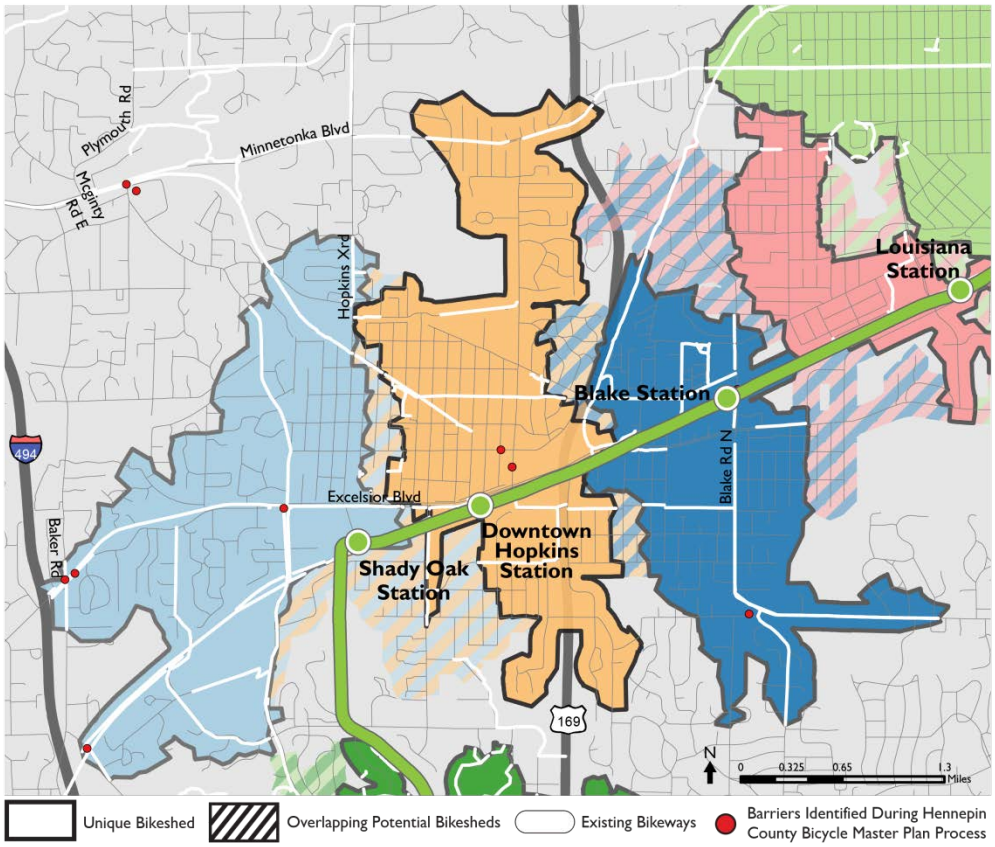
The Blake station has the one of the highest populations among all station areas at 5,603. The bikeshed area is above average at 1.4 square miles.

There is some overlap of potential bikesheds between this station and the Louisiana station. In order exert 34 kJ of effort or less to travel to/from the LRT, residents of these areas (shown in stripes on the figure), would have to travel to one station on their way to the LRT and then return from another on their way home.

The station connects to the North Cedar Lake Regional Trail.

The Blake station bikeshed area is limited by highways to the north and two golf courses – the Meadowbrook Golf Course and the Interlachen Country Club. Highway 7 runs east to west and US Highway 169 runs north to south in this area. Both are barriers that make bicycle travel through this area difficult. The Blake station bikeshed has 6.5 miles of bikeways; however, bicycle mode share is only 0.7%.

Downtown Hopkins Station

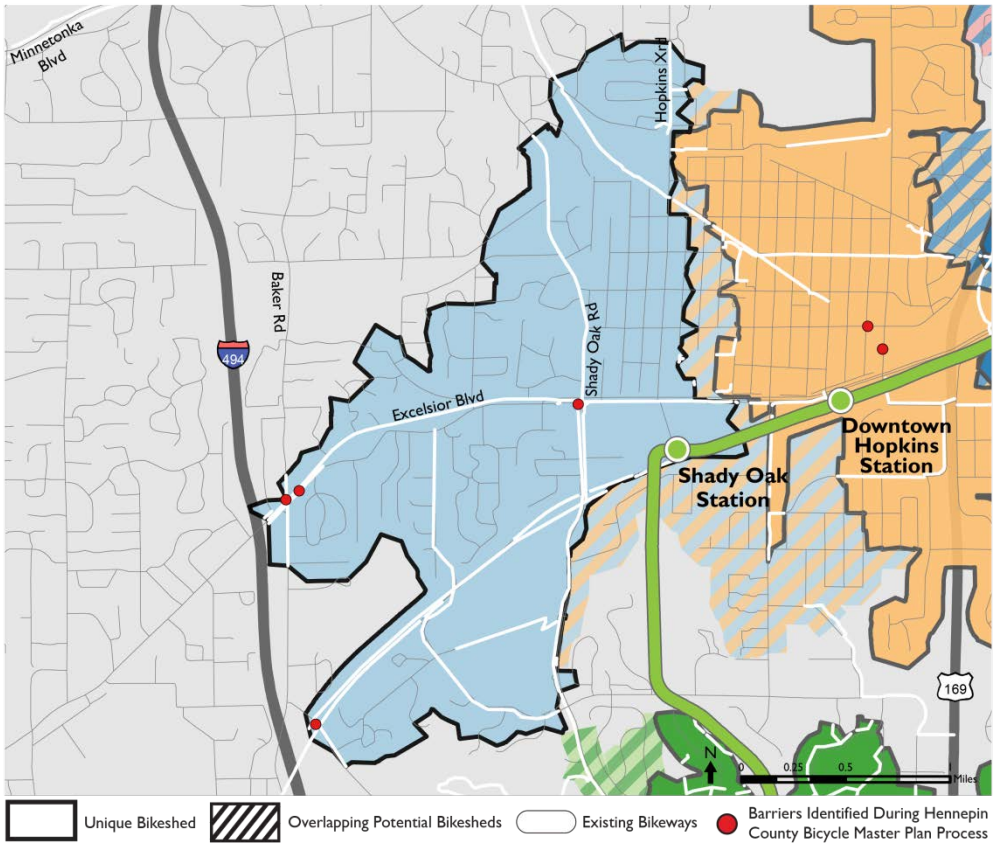


Bikeshed Statistics	
2010 Population	6,857
Bike Mode Share	0.4%
Area	1.8 mi^2
Intersection Ratio	0.75
Total Bikeways	3.5 mi
Anticipated LRT Ridership	3,203

The Downtown Hopkins station bikeshed is 1.8 square miles, and one of the largest among Southwest LRT station bikesheds. However, the bikeshed area only has 3.5 miles of bikeways. Southwest of the station there is an overlap in potential bikeshed between the Downtown Hopkins station and the Shady Oak station.

The street network north of the station is a grid pattern that includes the central business district of the City of Hopkins. However, the Oak Ridge Country Club obstructs bicycle travel northwest of the station. To the south of the station, large industrial land uses and a disconnected roadway network inhibit bicycle travel. The bicycle mode share there is only 0.4%.

Shady Oak Station



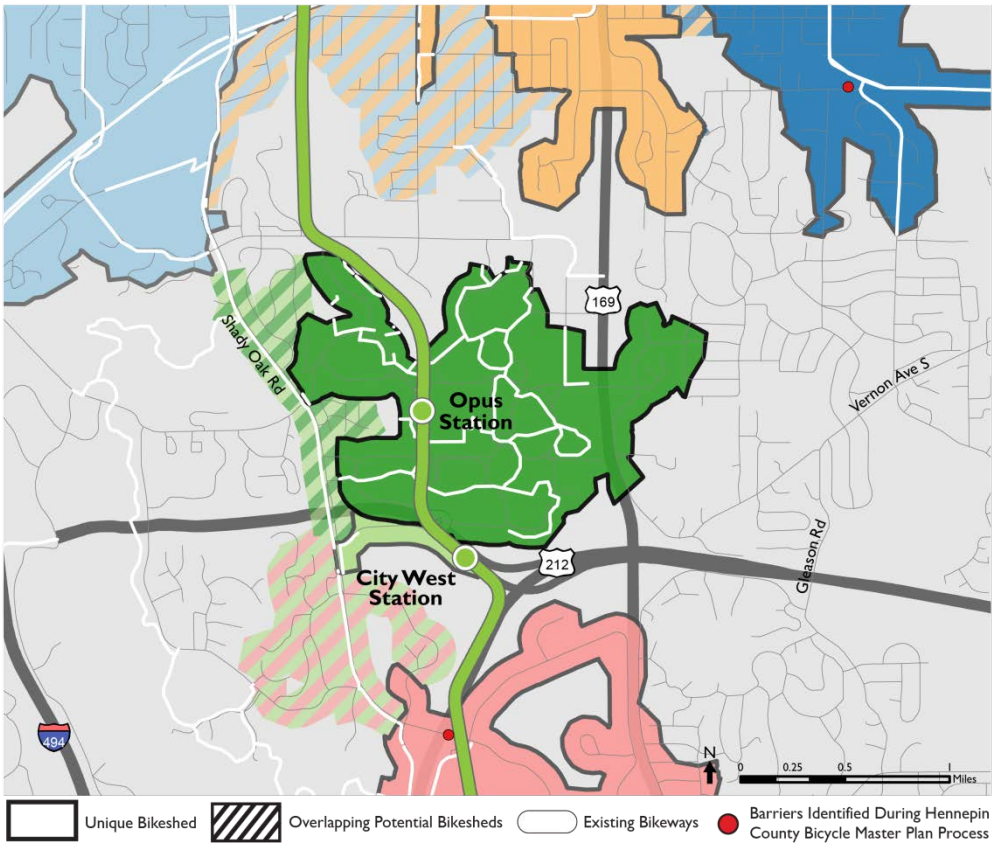
Bikeshed Statistics	
2010 Population	3,772
Bike Mode Share	0.4%
Area	1.9 mi^2
Intersection Ratio	0.74
Total Bikeways	9.4 mi
Anticipated LRT Ridership	1,300

The Shady Oak station bikeshed has more bikeway mileage than any other bikeshed, with 9.4 miles including the Lake Minnetonka Regional Trail and the Minnesota River Bluffs Regional Trail.

The Shady Oak station also has one of the largest bikeshed areas among all stations, covering an area of 1.9 square miles. The station is located on a curve in the Southwest LRT alignment, and the entire bikeshed is to the north and to the west of the station where there is little potential for overlap with other station bikesheds. As a result, The Shady Oak station is the "closest" station for a large area of the network.

The roads in this bikeshed are very curvilinear and often disconnected, as shown by the low intersection ratio of 0.74.

Opus Station



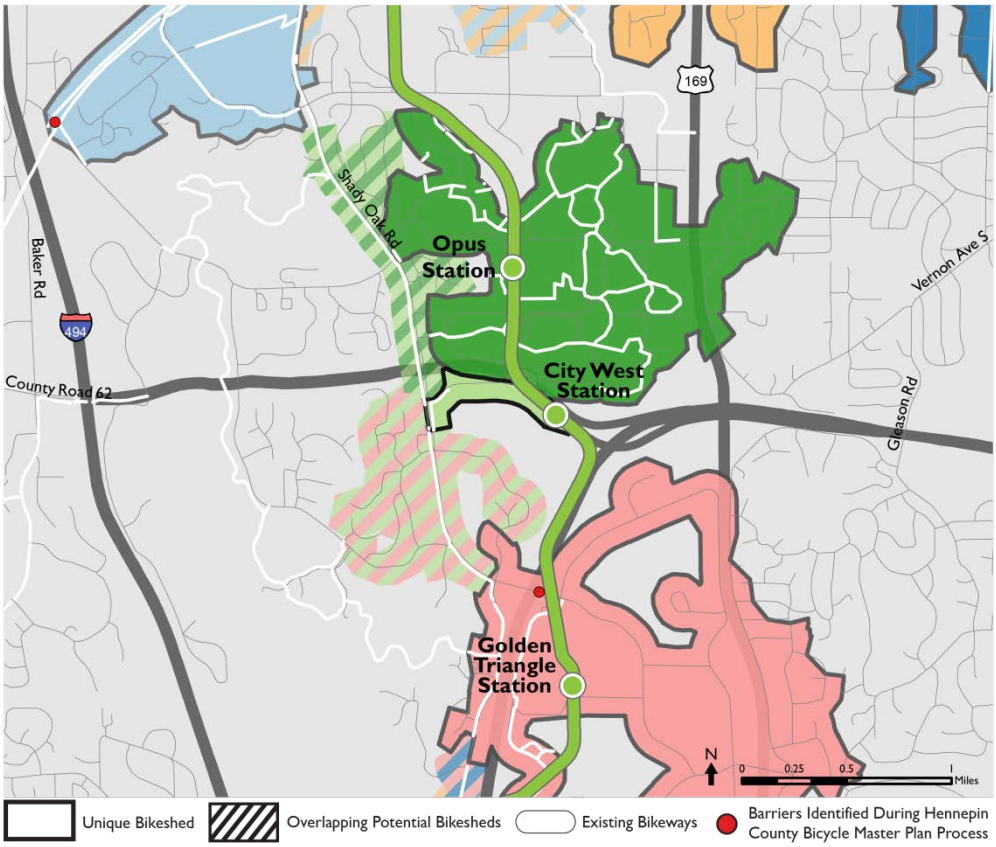
Bikeshed Statistics	
2010 Population	1,061
Bike Mode Share	0.1%
Area	0.81 mi²
Intersection Ratio	0.72
Total Bikeways	5.8 mi
Anticipated LRT Ridership	2,277

The Opus station bikeshed is contained primarily within the Opus industrial park. The circuitous recreational trails in the area provide connectivity within the park, but do not connect the park to adjacent land uses. As a result, the bikeshed does not extend much past US Highway 169 or US Highway 212. Bren Road E is the only way across US Highway 169, and there is no apparent crossing of US Highway 212.

The population in the bikeshed is only 1,061, given that the land use is primarily commercial.

The Opus bikeshed does have 5.8 miles of bikeways, but most of them are indirect recreational trails through the industrial park and not particularly practical for bicyclists traveling to the station. Like all stations in this segment, the bicycle mode share in the Opus bikeshed is 0.1%.

City West Station



Bikeshed Statistics	
2010 Population	59
Bike Mode Share	0%
Area	0.044 mi^2
Intersection Ratio	0.69
Total Bikeways	0.17 mi
Anticipated LRT Ridership	1,105

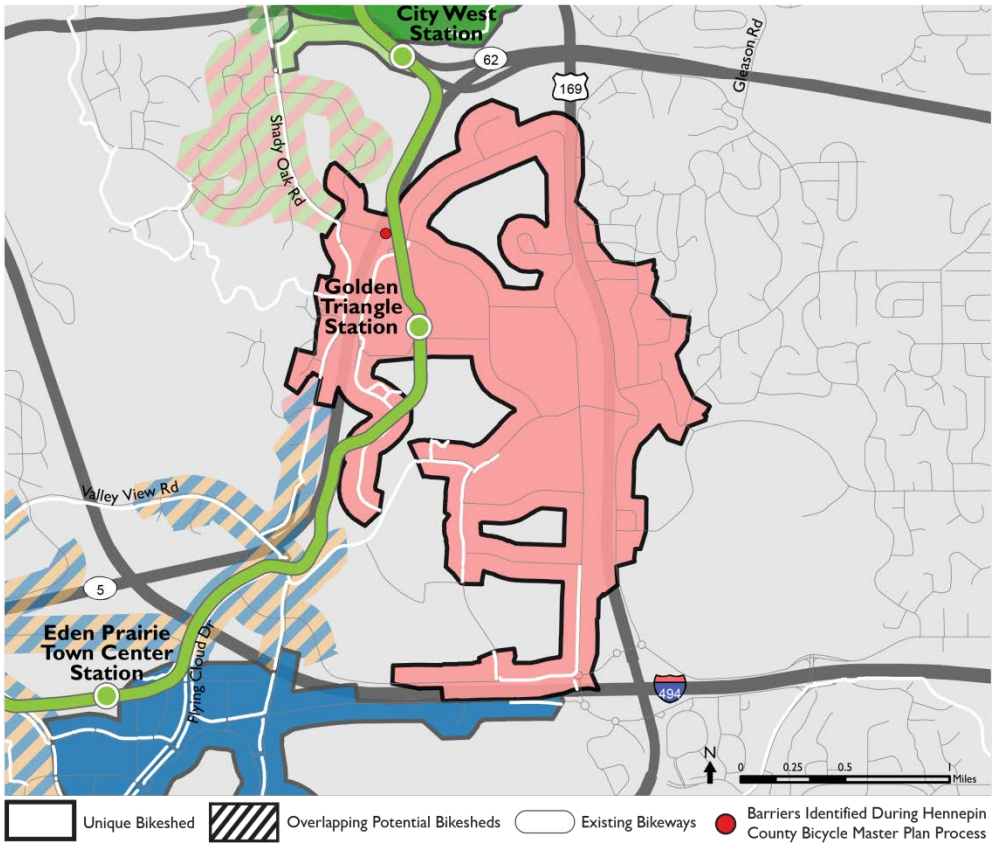
The City West station is tucked in the southwest corner of the Trunk Highway 62 and US Highway 212 interchange with very little connection to the roadway network. As a result of its location, this bikeshed is by far the smallest area, it has the least amount of bikeway miles, and has the smallest population.

The bikeshed extends from the station out to Shady Oak Road and slightly south along Shady Oak Road.

There is a steep grade on Shady Oak road, which works in favor of bicycle travel in one direction and against it in the other. As a result, there is some overlap of potential bikesheds between the City West, Opus, and Golden Triangle stations. In order to exert 34 kJ of effort or less to travel to/from the LRT, bicyclists in these areas (shown in stripes on the figure), would have to travel to one station on their way to the LRT and then return from another on their way home.

Like all stations in this segment, the bicycle mode share in the City West bikeshed is 0%.

Golden Triangle Station



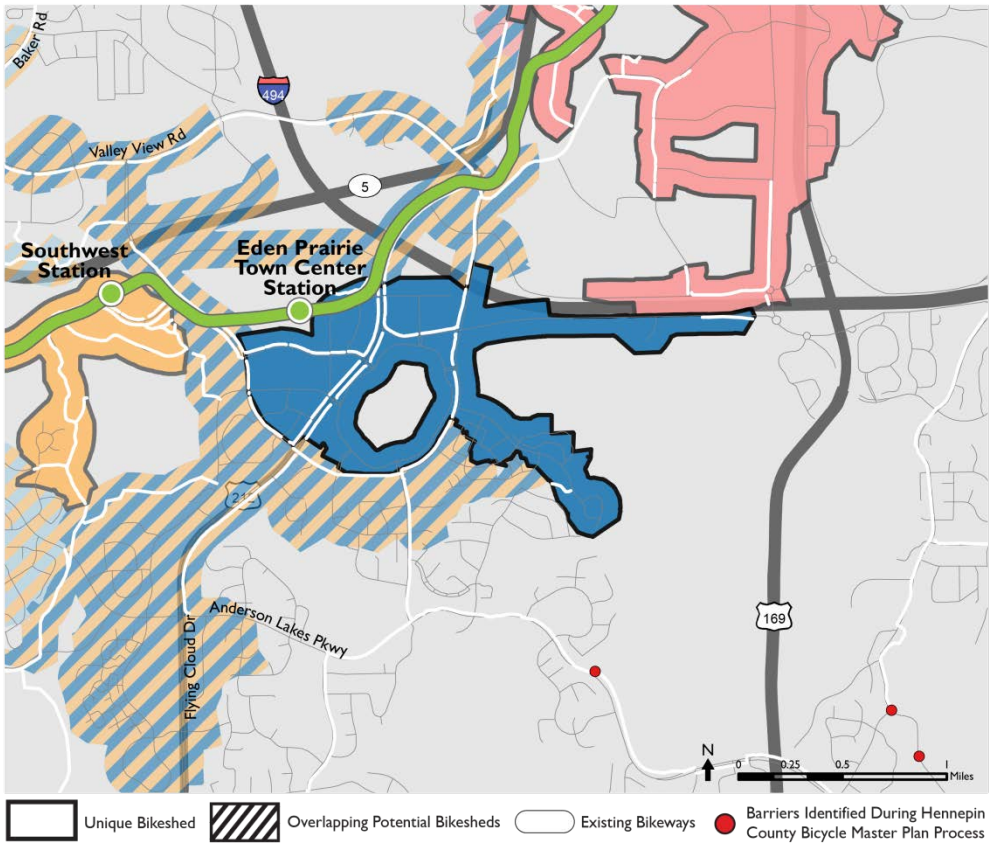
Bikeshed Statistics	
2010 Population	763
Bike Mode Share	0%
Area	1.3 mi^2
Intersection Ratio	0.71
Total Bikeways	3.5 mi
Anticipated LRT Ridership	2,062

The Golden Triangle station is situated in an area with a very curvilinear and disconnected roadway network. This is apparent, given the intersection ratio of 0.71, one of the lowest amongst all bikesheds. The Golden Triangle bikeshed does not cross Interstate 494 to the south, and has limited connectivity across US Highway 169 to the east. The Shady Oak Road crossing of Trunk Highway 62 provides the only access across the freeway to the west.

There is some overlap of potential bikesheds between this station and the two on either side of it, primarily along Shady Oak Road. In order to exert 34 kJ of effort or less to travel to/from the LRT, bicyclists in these areas (shown in stripes on the figure), would have to travel to one station on their way to the LRT and then return from another on their way home.

Like all stations in this segment, the bicycle mode share in the Golden Triangle bikeshed is 0%.

Eden Prairie Town Center



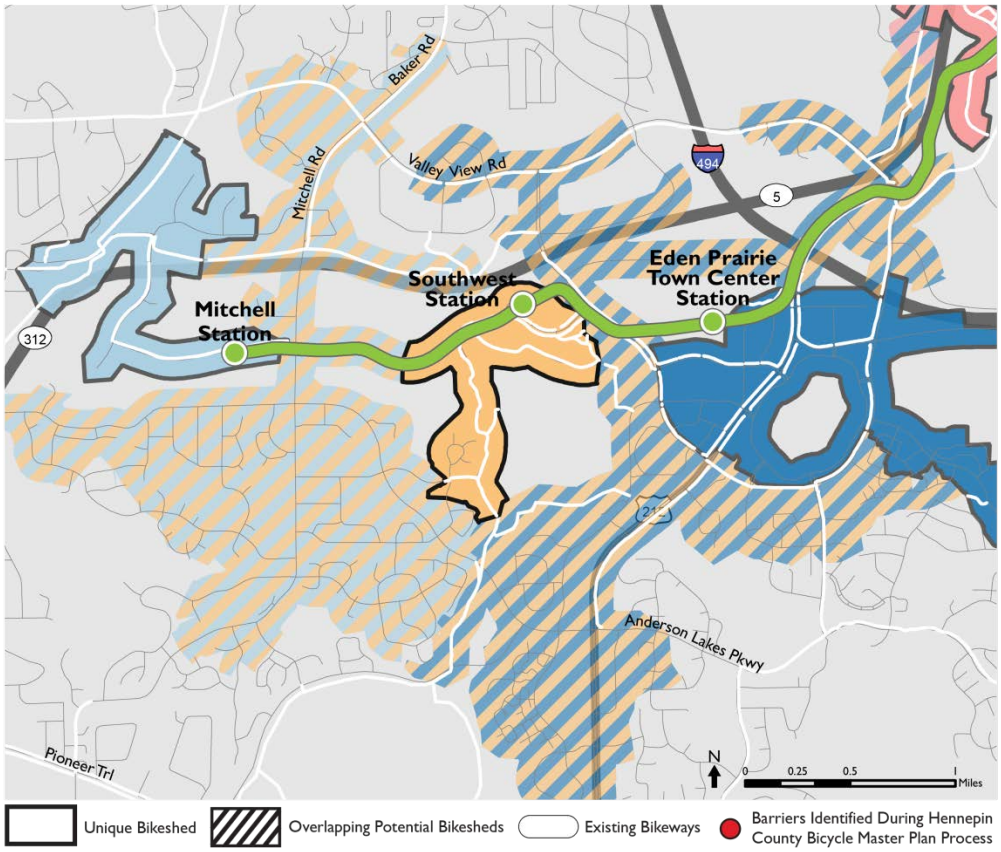
Bikeshed Statistics	
2010 Population	699
Bike Mode Share	0%
Area	0.54 mi²
Intersection Ratio	0.75
Total Bikeways	2.6 mi
Anticipated LRT Ridership	1,968

The Eden Prairie Town Center station bikeshed is entirely south of the station and tends to follow the curvilinear roadway network. The disconnection of the network in the area is apparent. The mall for which the station is named is a major barrier to bicycle travel, and only some of the residential areas behind it are accessible by bike.

The bikeshed area is small, at only 0.54 square miles. The grade in this area is a significant factor in the size of this bikeshed. The trip to the station is uphill from most of its surroundings, so the overlap in potential bikeshed between this station and the Southwest station is large. In order exert 34 kJ of effort or less to travel to/from the LRT, bicyclists in this area would likely to travel to the Eden Prairie Town Center station on their way to the LRT and then return home from the Southwest station.

Within that area, there are 2.6 miles of bikeway. The population in the bikeshed is only 352, and like all stations in this segment, the bicycle mode share in the Eden Prairie Town Center bikeshed is 0%.

Southwest Station



Bikeshed Statistics	
2010 Population	731
Bike Mode Share	0.1%
Area	0.24 mi²
Intersection Ratio	0.73
Total Bikeways	2.9 mi
Anticipated LRT Ridership	4,212

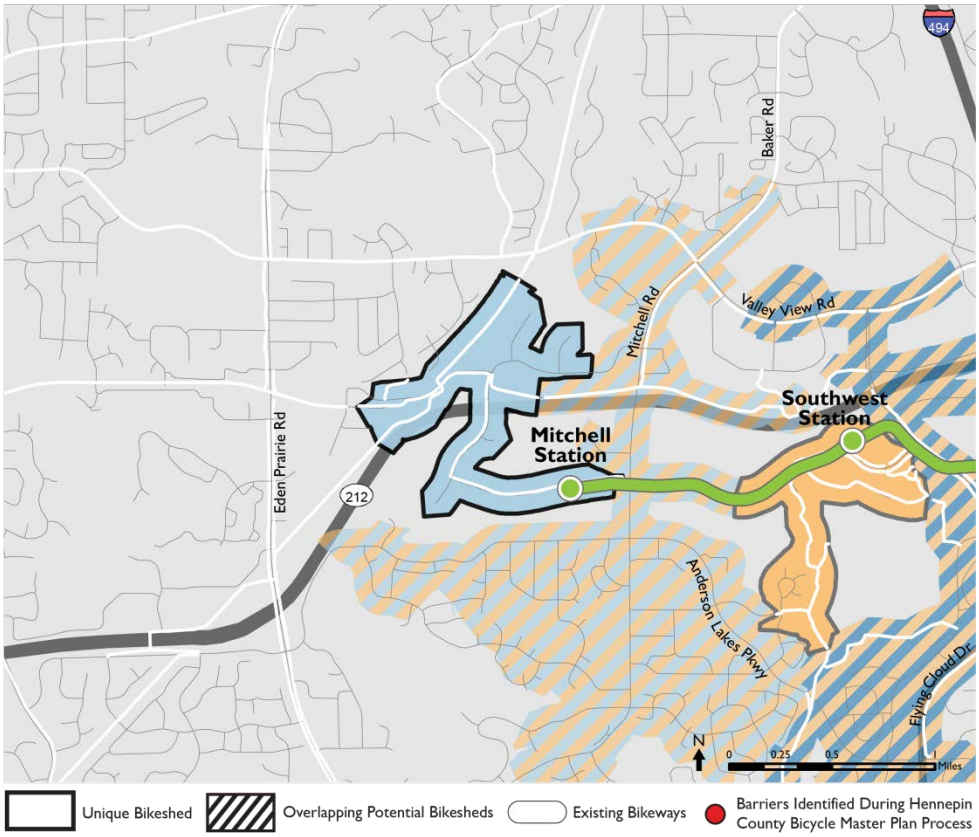
The Southwest station is the second smallest bikeshed, at 0.24 square miles. The population within the bikeshed is only 731.

Due to the grades in the area, this station has a large overlap in potential bikesheds with the two stations on either side of it. This overlap includes a number of residential areas. In order to exert 34 kJ of effort or less to travel to/from the LRT, bicyclists in this area would likely to travel to the Eden Prairie Town Center station on their way to the LRT and then return home from the Southwest station.

There are some major barriers to bicycling in the area, namely US Highway 212 directly north of the station, Purgatory Creek to the south, as well as several other wetland areas. The only major roadway in the bikeshed is Technology Drive, which the LRT alignment also follows.

Like all stations in this segment, the bicycle mode share in the Southwest bikeshed is 0%. However, due to the availability of a motor vehicle park and ride, this station is expected to have the highest LRT ridership.

Mitchell Station



Bikeshed Statistics	
2010 Population	111
Bike Mode Share	0.3%
Area	0.32 mi^2
Intersection Ratio	0.66
Bikeways	2.6 mi
Anticipated Weekday LRT Ridership	2,684

The Mitchell station is the terminal station of the Southwest LRT. As such, bicycle access to this station from the north, south, or west has the potential to increase overall ridership for the LRT.

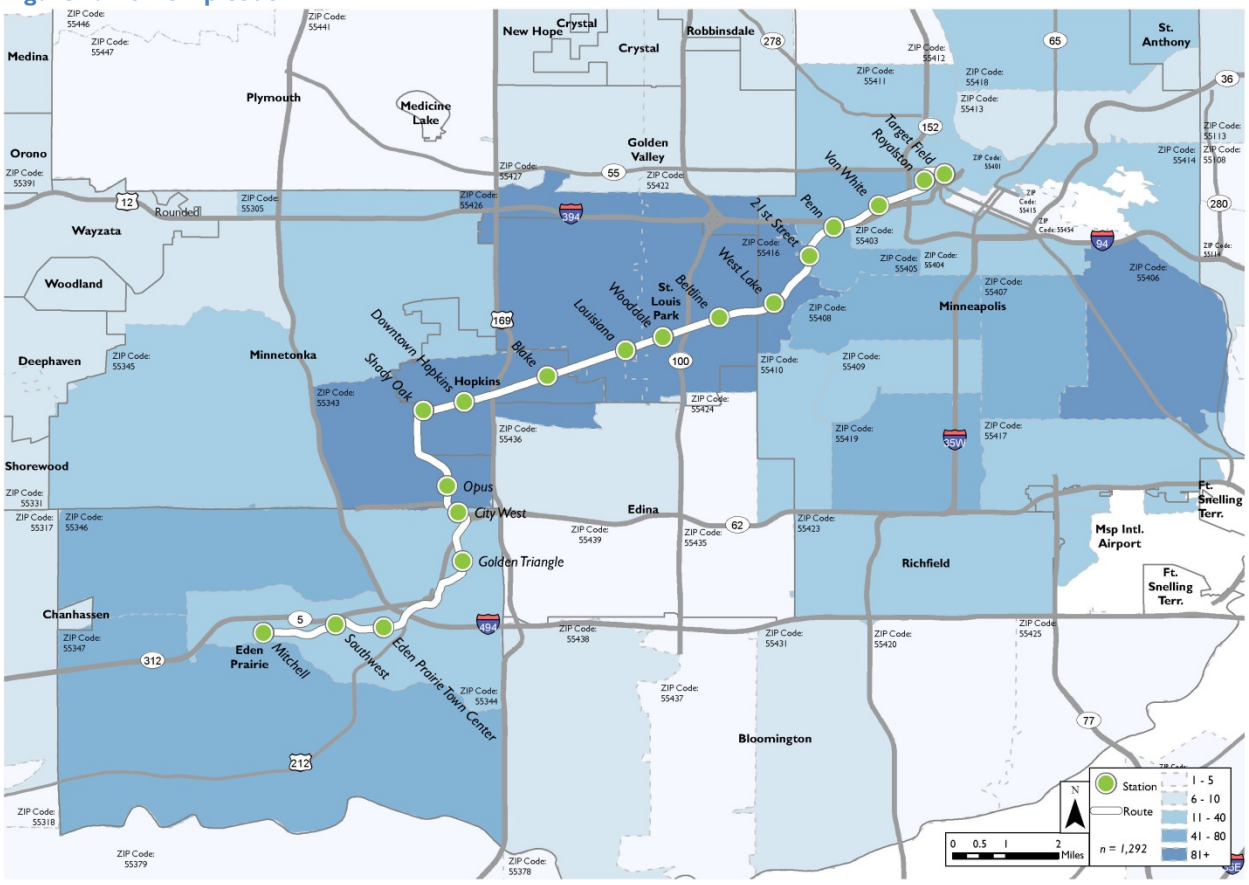
However, the bikeshed has an area of only 0.32 square miles, one of the lowest among all bikesheds. Mitchell Road provides connectivity to the south, but only for one direction of travel due to grades. Wallace Road is the only viable path across US Highway 212 to the north. There is no direct route across US Highway 212 to the west, regardless of topography.

Unsurprisingly, the bikeshed only has a population of 56, one of the lowest. The bikeshed area has 2.6 miles of bikeways, which includes the Minnesota River Bluffs Regional Trail which runs north-south thought the bikeshed area. Like all stations in this segment, the bicycle mode share in the Mitchell bikeshed is 0%.

Appendix A: Bikeshed Results by Station

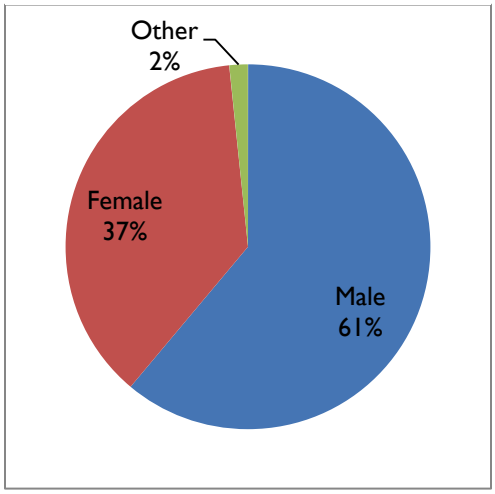
A total of 1,443 surveys were started and 1,292 were completed, a 90% response rate. Responses tended to cluster around the Southwest LRT line (Figure 1). The following summarizes the overall survey demographics, bicyclist profiles, and Southwest LRT specific responses received. Bike parking related responses will be summarized as part of the recommendations memorandum to follow.

Figure 1. Home zip code



Overall survey demographics

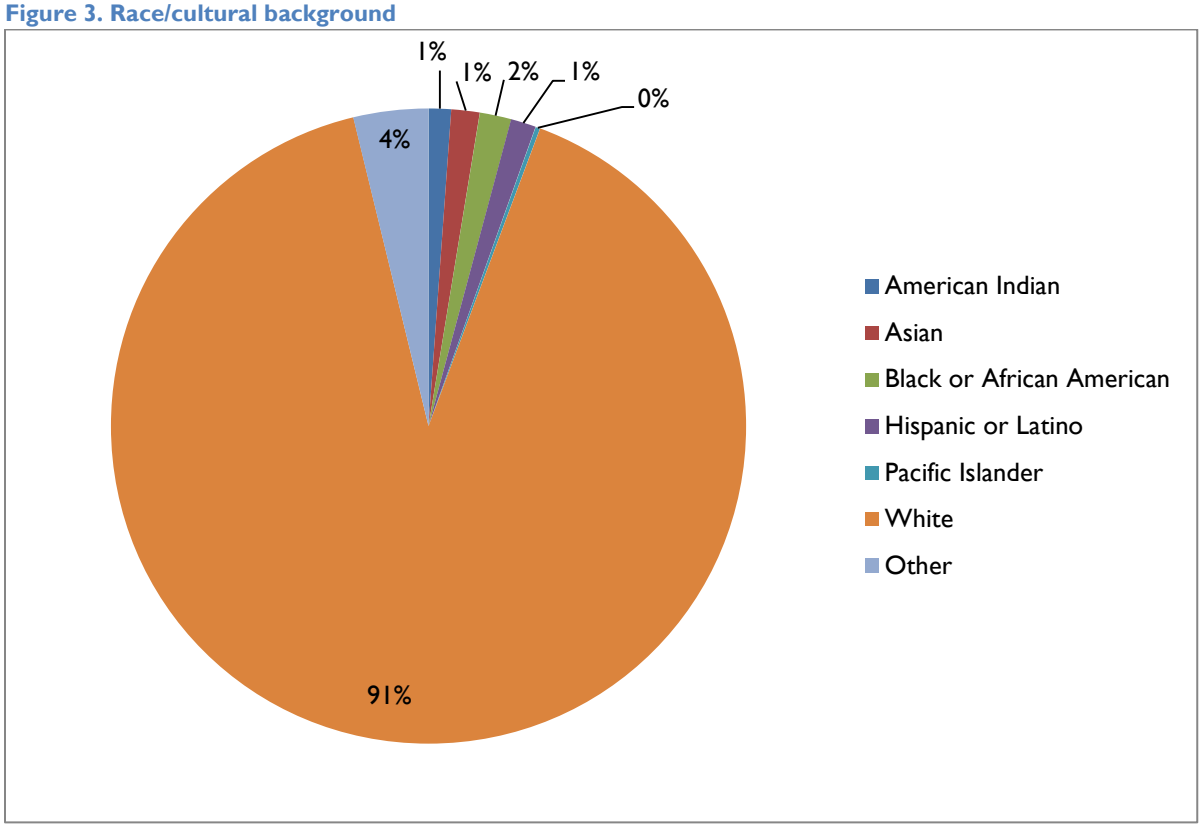
Figure 2. Gender



Of the 1,264 people that shared their gender, 61% indicated that they were male (Figure 2). For comparison, the 2010 Census for the zip codes that responded to the survey indicates the population is 49% male, 51% female (other was not an option).

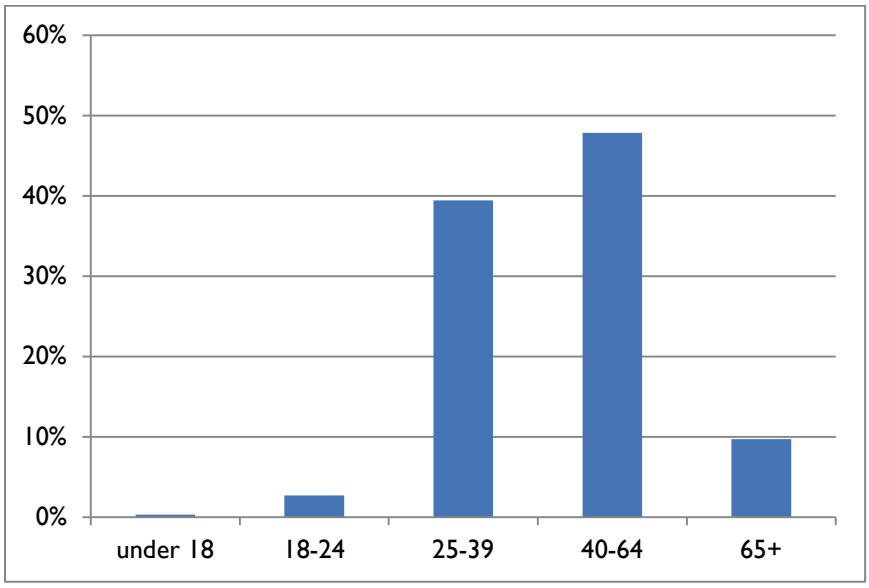
Of the 1,259 people that indicated their race, 91% stated that they were white (Figure 3). For comparison, the 2010 Census for the zip codes that responded to the survey indicates that the population is 77% White, 9% Black, 6% Asian, and 6% Hispanic.

Figure 3. Race/cultural background



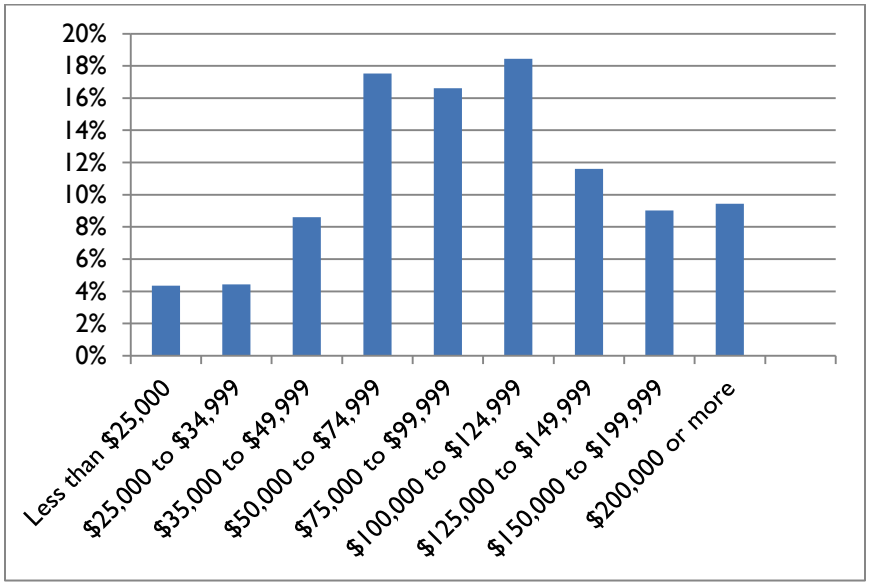
There were 1,265 responses to the question about age (Figure 4). The 2010 Census for zip codes that responded to the survey is 37. By comparison, 48% of the survey respondents were in the 40 to 64-year age bracket, and 40$ were in the 25 to 39-year age bracket.

Figure 4. Age



For the 1,198 people that responded to the question about income, the median response was $75,000 to $99,999 bracket (Figure 5). By comparison, the median income for the zip codes that responded is $83,775.

Figure 5. Approximate gross household income



Bicyclist profiles

Of 1,291 respondents, 76% indicated that they rode a bike weekly, 24% rode year round. Those that rode a bike occasionally, or would be interested in doing so in the future represented 19% and 4% of the responses respectively (Figure 6). The majority of the responses were from individuals who stated that they rode a bike for recreation, health or exercise (55%), while 36% use a bike to commute to school or work (Figure 7).

Figure 6. Type of bicyclist

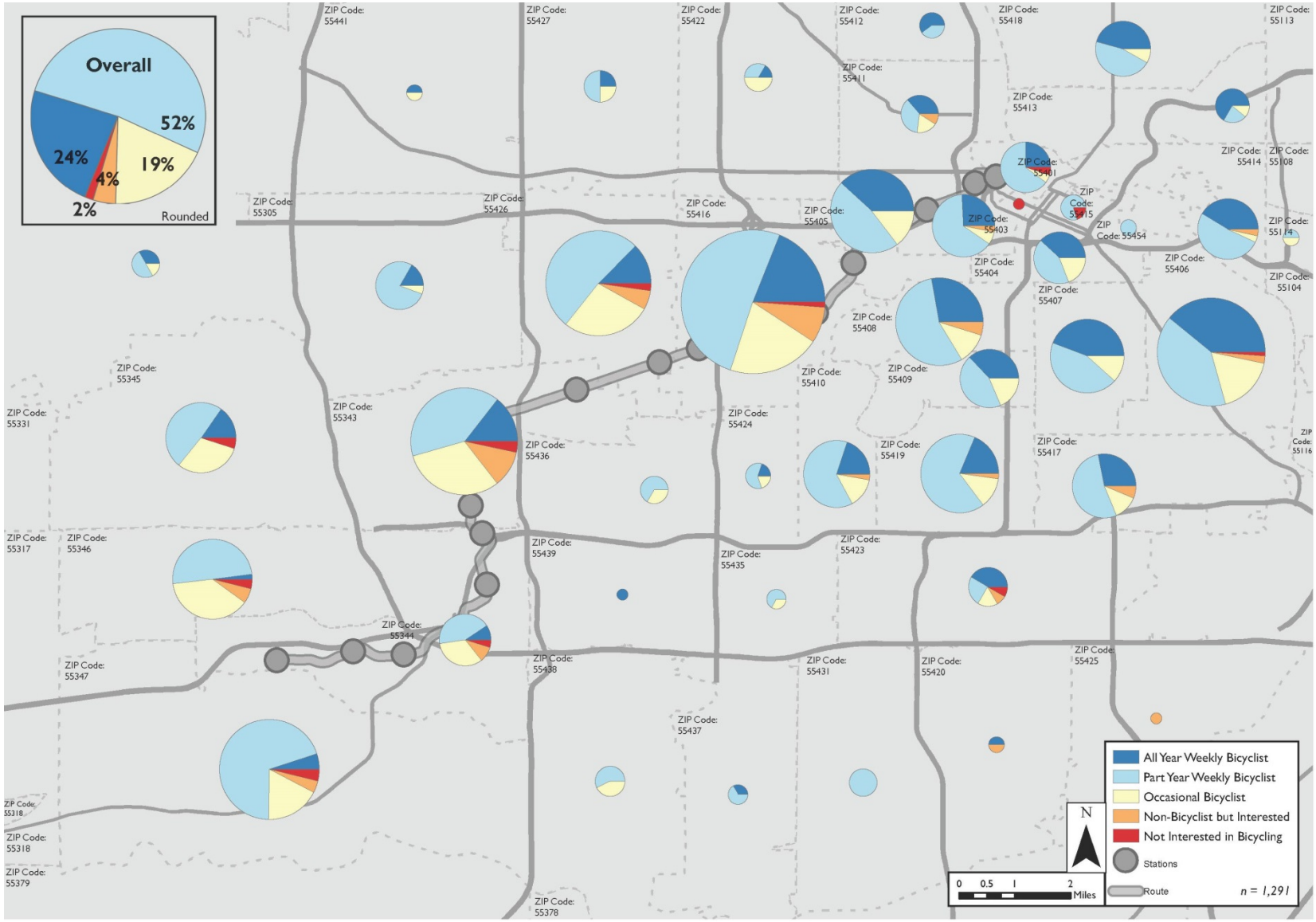
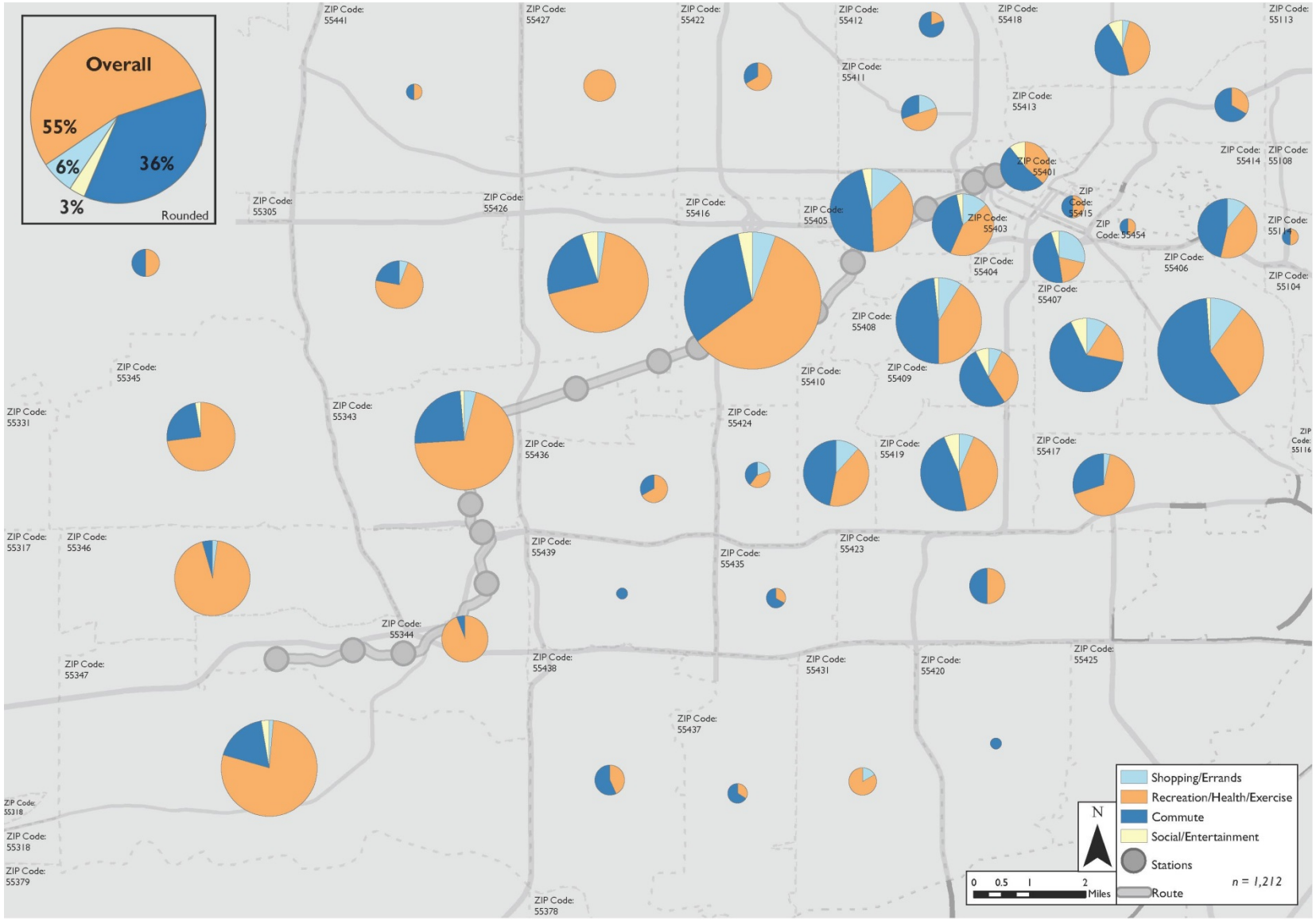


Figure 7. Most frequent type of trip



Southwest Light Rail specific questions

63% of respondents (N = 1,289) indicated that they planned to use the light rail when it opened, while 30% were not sure (Figure 8). More specifically, respondents indicated between which two communities they were most likely to travel using the Southwest LRT. The question did not indicate which community was their destination and which was their origin. Eighty-five percent indicated they would travel to or within Minneapolis, with 26% to St Louis Park and 23% to Eden Prairie (Figure 9). A number of responses checked only one location, which was assumed to mean their trip would stay entirely within that community.

Figure 8. Likelihood of LRT use

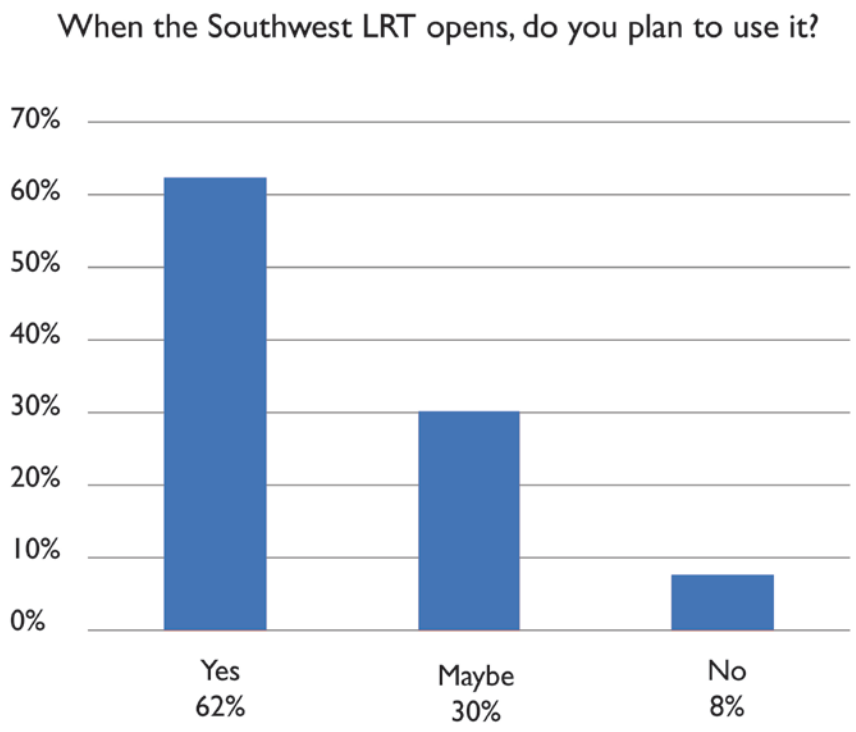
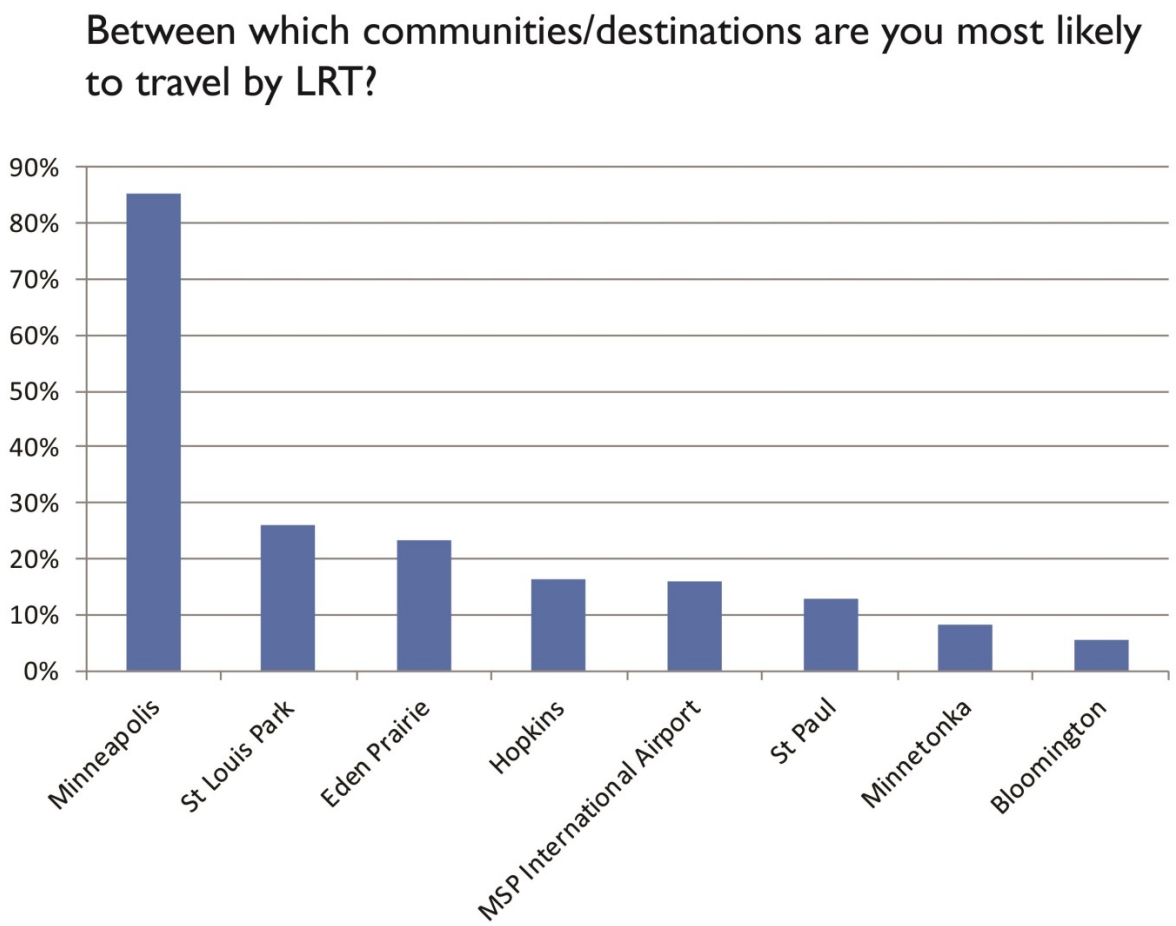
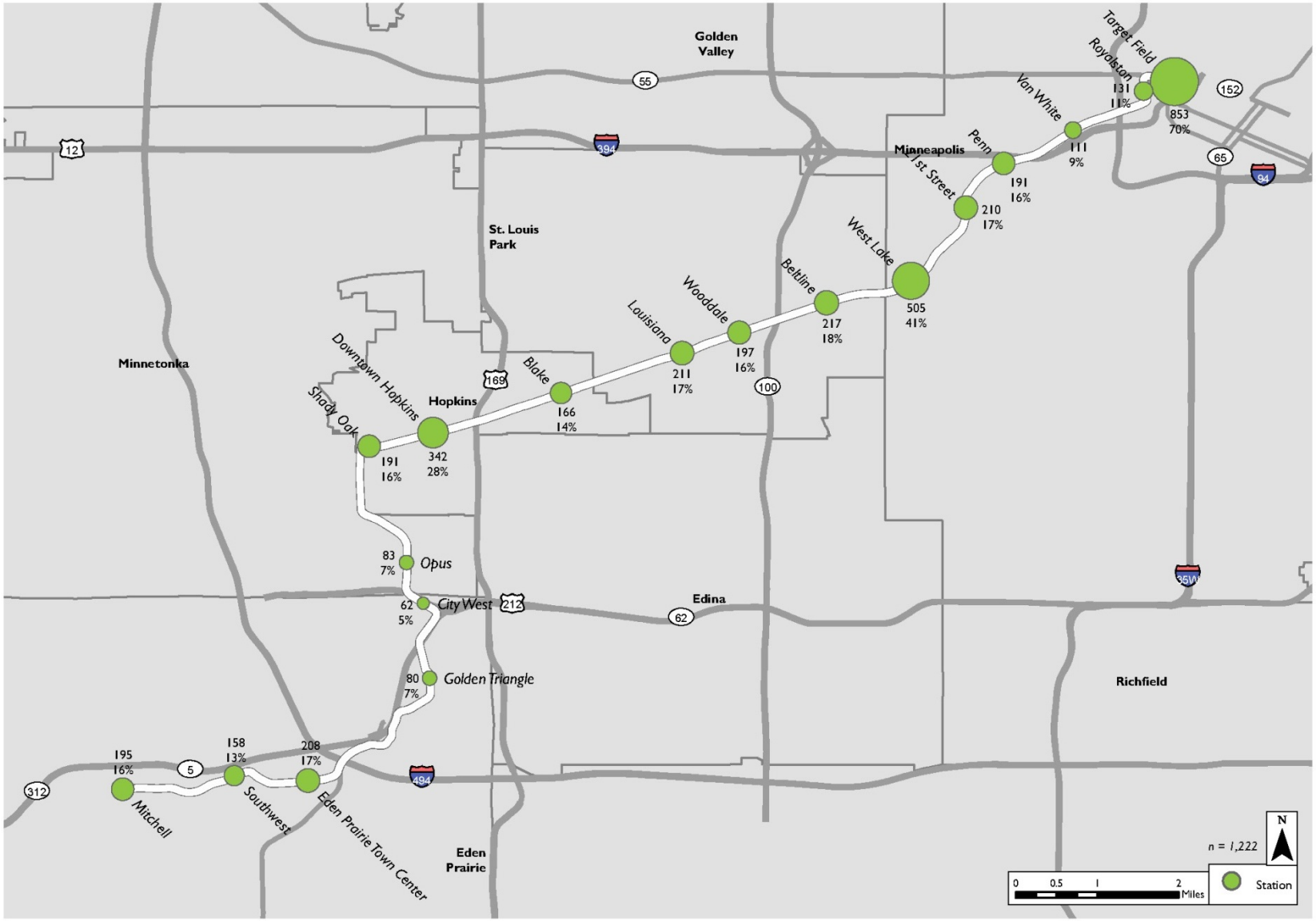


Figure 9. Communities/destinations traveled between



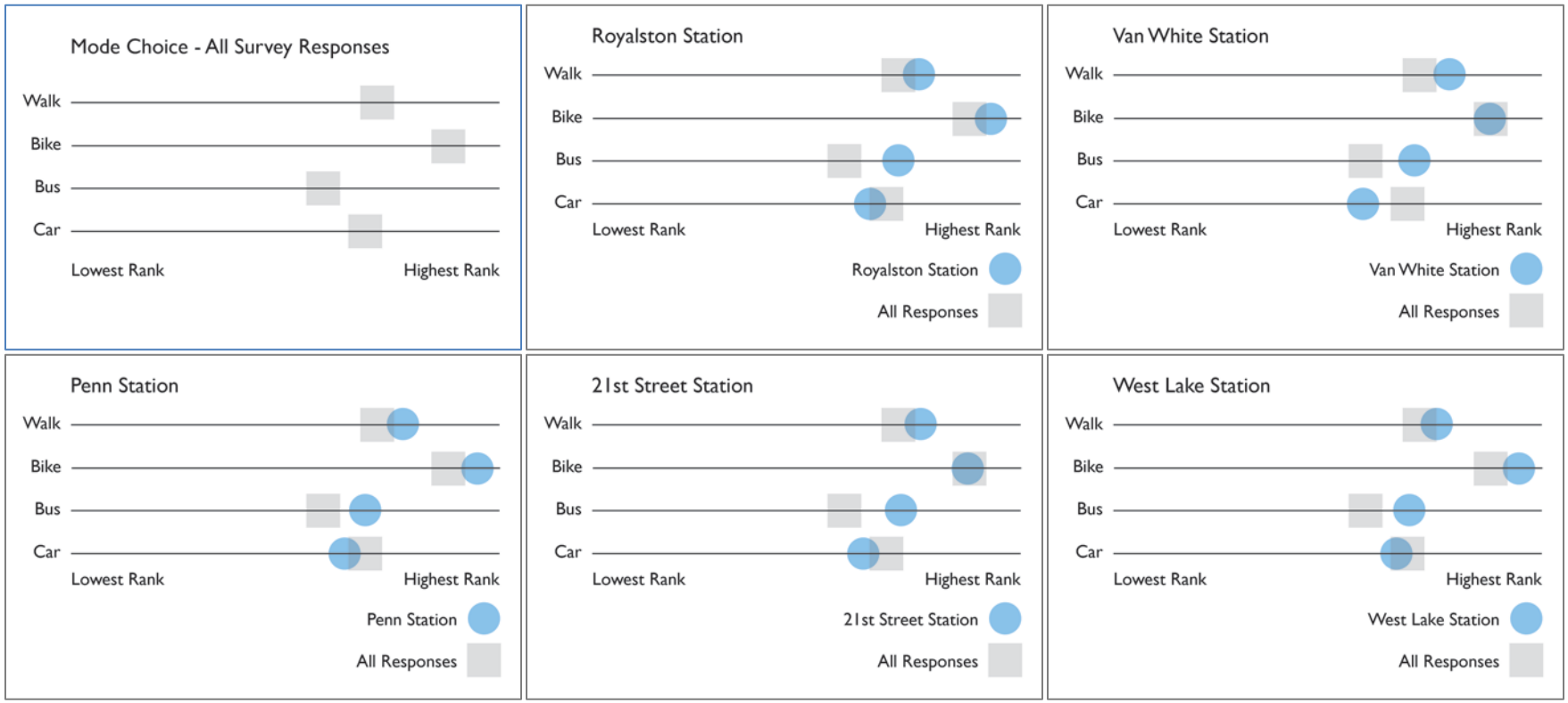
Furthermore, respondents were allowed to pick an unlimited amount of stations that they might utilize as part of their trip. The stations most likely to be utilized were Target Field (70%), West Lake (41%), and Downtown Hopkins (28%). The least commonly selected station was City West, although 5% of respondents indicated they may use it (Figure 10).

Figure 10. Station most likely used

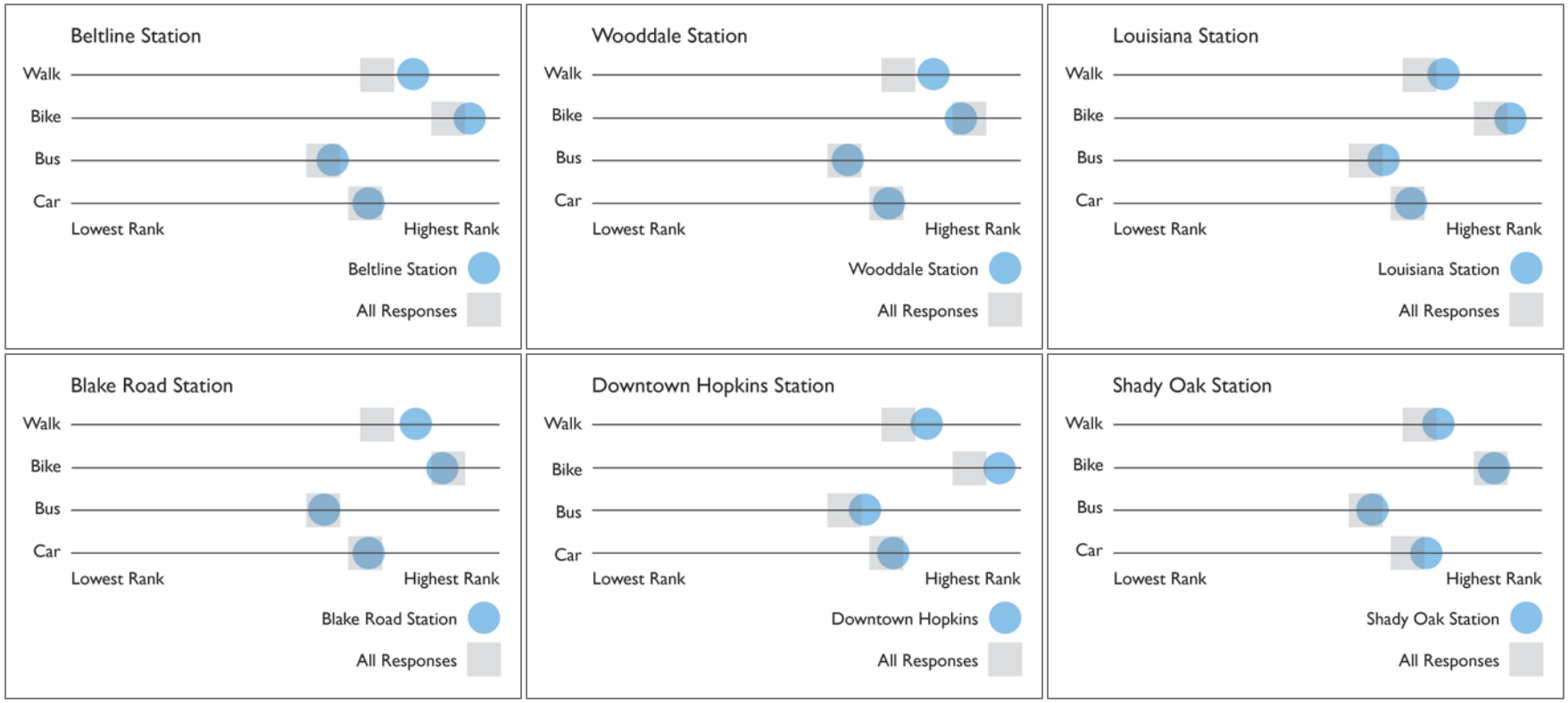


Finally, respondents ranked their mode of choice to access the LRT overall. These choices were then summarized for each of the stations, although respondents could pick multiple stations (Figure 11). This does not, therefore, imply a specific mode preference for a specific station. In addition, people who may be interested in biking to the Southwest LRT would have self-selected to participate in the survey. Overall, biking to the station was the preferred mode, followed by walking, then by car, then by bus. For those who indicated they may use the stations further to the west, driving to the station was a more popular choice, while the stations closer to Minneapolis would be used by those who would choose to bike.

Figure 11. Station access mode choice



Appendix B: Survey Results



Appendix B: Survey Results