Technical Memo 2: Existing Conditions and Market Analysis

Highway 169 Mobility Study

Version 2.0

Minnesota Department of Transportation

SRF Consulting Group, Inc. | Engineers Planners Designers

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Introduction

Project Background

The purpose of the Highway 169 Mobility Study is to develop and evaluate potential options for improving transit and reducing congestion on Highway 169 between Shakopee and Golden Valley. The study will focus on a constrained set of alternatives that includes elements of highway bus rapid transit (BRT), MnPASS Express Lanes, and spot mobility improvements such as the addition of auxiliary lanes or interchange modifications. These improvements are intended to increase mobility, reliability, and safety through the study area. See Figure 1 for a map of the study area.

Within the broader study effort, the purpose of this existing conditions and market analysis is to gain an understanding of how Highway 169 is currently used and how well it functions for various users. The information documented in this memo will inform development of highway BRT and MnPASS Express Lane elements, as well as spot mobility improvements for analysis in this study.

The existing conditions and market analysis is divided into four parts: study area location and demographics, transit conditions, highway operations conditions, and a market analysis.

Study Area Location and Demographics

The Highway 169 Corridor Study Area is a 23-mile segment from Highway 41 in Shakopee to Highway 55 in Golden Valley. Located in the southwest quadrant of the Twin Cities region, in the study area Highway 169 passes through Plymouth, Golden Valley, St. Louis Park, Minnetonka, Hopkins, Edina, Eden Prairie, and Bloomington in Hennepin County, and Savage and Shakopee in Scott County. The study area is composed of areas within two miles of the corridor, and also includes part of the City of Prior Lake. The location and demographics sections describe the land uses in the corridor, other major transportation facilities, and demographics such as race, age, poverty status, education levels, median household income, and zero-vehicle households.

Transit Existing Conditions

Highway BRT is being considered on Highway 169. The transit section of this existing conditions memo describes transit service, performance, and facilities on Highway 169, as well as on I-394 and Highway 55, which are the two BRT route options under consideration from Highway 169 to downtown Minneapolis.

Highway Operations Conditions

MnPASS Express Lanes are also being considered on Highway 169, which if implemented could be directly or indirectly connected to the existing MnPASS lane on I-394 or to

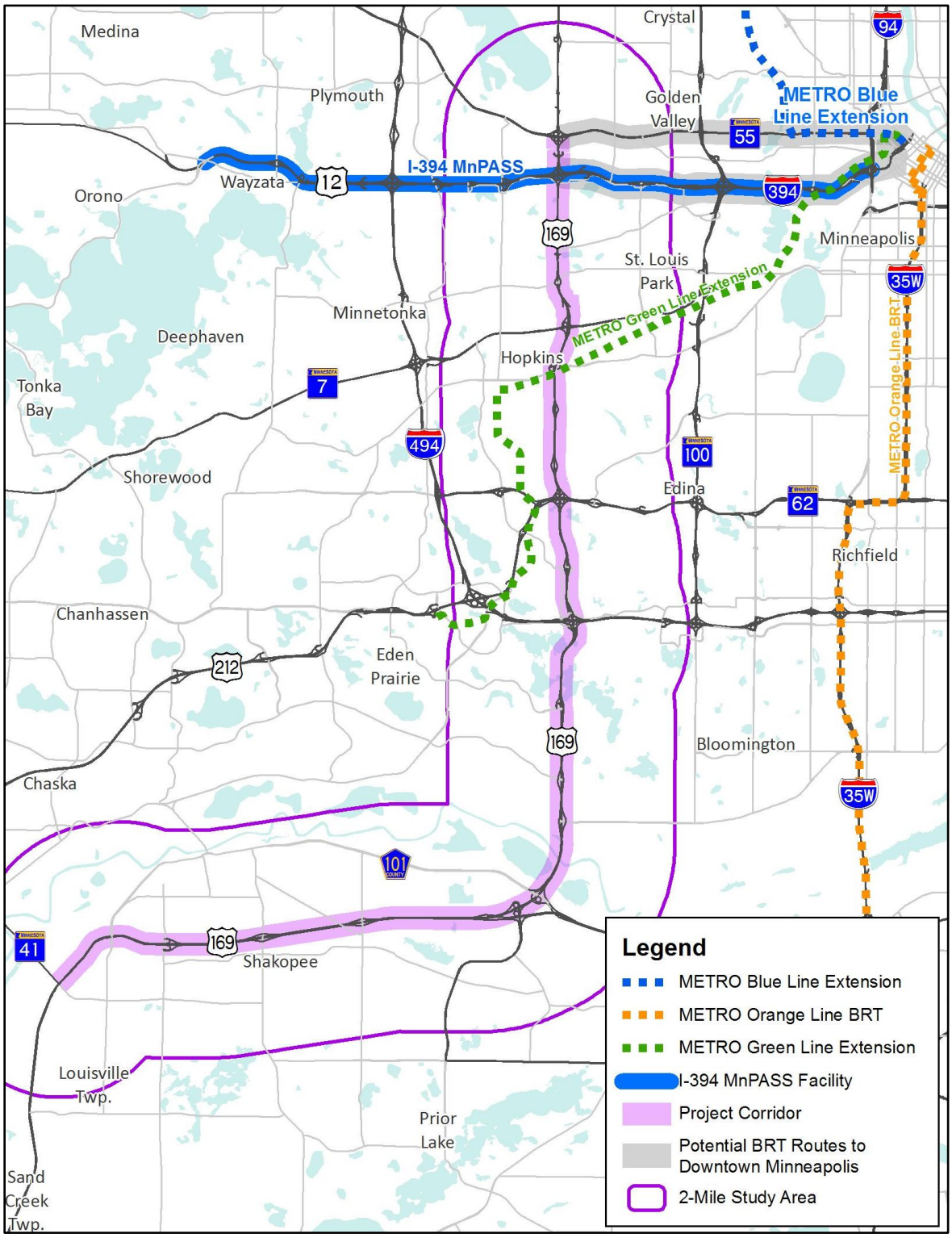
possible future MnPASS lanes on I-494 or Highway 62. However, this memo focuses solely on the existing highway conditions on Highway 169. Traffic characteristics, congestion levels and bottleneck locations, as well as travel time reliability and high crash locations are discussed in the highway operations existing conditions analysis.

Market Analysis

The market analysis uses origin-destination data to describe travel patterns on Highway 169 and includes an analysis of trip clusters, ramp-to-ramp movements, and use of alternate routes.

While this memo provides some general descriptions of the physical nature of the corridor, physical components and constraints in the corridor will be described and analyzed fully in a separate memo developed as part of the initial set of alternatives.

Figure 1: Highway 169 Mobility Study Area



Study Area Location and Demographics

Location

The Highway 169 Corridor Study Area runs from Highway 41 in Shakopee to Highway 55 in Golden Valley. This 23-mile stretch of Highway 169 is located in the southwest quadrant of the Twin Cities region and passes through Plymouth, Golden Valley, St. Louis Park, Minnetonka, Hopkins, Edina, Eden Prairie, and Bloomington in Hennepin County, and Savage and Shakopee in Scott County. The study area is composed of areas within two miles of the corridor, and also includes part of the City of Prior Lake. Highway 169 runs north-south in Hennepin County and connects with Highways 55, 7, 62, 212, and Interstates 394 and 494 in the study area. Highway 169 runs east-west in Scott County where it connects with Highways 13 and 41. Highway 169 crosses a range of landscapes and land uses that include employment-rich corporate campuses, industrial and warehouse facilities, retail centers, single-family residential neighborhoods, clusters of apartment buildings, and several prominent natural features. The highway crosses Bassett Creek, Minnehaha Creek, Nine Mile Creek, Anderson Lakes Parks Reserve, and the Minnesota River in the study area.

Please see Figure 1 for a map of the study area and Figure 2 for a map of land use in the corridor. Figure 3 shows the locations of major employers near Highway 169.

In the study area Highway 169 is mostly four lanes wide (two lanes in each direction), though there are multiple locations where the corridor is wider to accommodate auxiliary lanes near interchanges. The Bloomington Ferry Bridge, one of the main connections between Scott County and the rest of the metropolitan area, is six lanes wide. Space available for transportation infrastructure varies throughout the corridor. The areas that are most constrained have narrow shoulders (less than six feet wide) and retaining walls to allow for frontage roads and interchange ramps.

Corridor Cities

Plymouth

The City of Plymouth is located in the northwest corner of the study area; Highway 169 is the city's eastern border. Highway 55 is a major highway that runs diagonally through the city. There is a mix of land uses in the area around Highway 169 and Highway 55, including retail, services, office, and multifamily residential, as well as open space surrounding Basset Creek.

Golden Valley

Golden Valley is located in the northeastern corner of the study area. It is bound by Highway 169 to the west and mostly by I-394 to the south. Highway 55 runs east-west through the southern half of the city. The area along the corridor is dominated by industrial, office, single-family residential, and institutional uses. One of the largest employers in the region, General Mills global headquarters is located in the northeast quadrant of I-394 and Highway 169.

St. Louis Park

Highway 169 forms most of the western border of St. Louis Park. Typical land uses along Highway 169 are single- family residential, parks and recreational uses, as well as some institutional uses. Exceptions to this are several office towers in the northwest quadrant of I-394 and Highway 169, and Knollwood Mall, a regional shopping center in the northeast corner of Highway 169 and Highway 7. The Park Nicolet Methodist Hospital is also located near the corridor and draws thousands of employees and visitors each day. St. Louis Park will be served by the proposed Green Line Extension LRT line, with stations just south of Highway 7 at Beltline Boulevard, Wooddale Avenue, and Louisiana Avenue.

Minnetonka

The City of Minnetonka is located on the west side of Highway 169. Land use in the corridor is a mix of single-family and multifamily residential. I-394 runs along the northern part of the city and is surrounded by commercial and office uses. Opus Business Park northwest of the Highway 169 and Highway 62 interchange hosts the United Health Group corporate headquarters and a mix industrial, mixed use industrial, recreational, office, and residential uses. Opus Business Park will be served by a station on the proposed Green Line Extension LRT line; a second station in Minnetonka will be located near its border with Hopkins near Shady Oak Road and Excelsior Boulevard.

Hopkins

Highway 169 runs through the middle of the City of Hopkins and the entire city is located within two miles of the highway. Hopkins has a traditional downtown with an historic Main Street, a grid network of streets, and fairly dense single- and multi-family residential neighborhoods. There is a wide range of land uses present along the corridor including institutional, office, and industrial. Cargill is a major employer in the region and is located at the intersection of Highway 169 and Excelsior Boulevard. Hopkins will be served by the Green Line Extensions LRT line at Blake Road, 8th Avenue in downtown Hopkins, and at Shady Oak Road near its border with Minnetonka.

Edina

Highway 169 forms most of the western border of the City of Edina and Highway 62 runs east-west through the city and connects with Highway 169. North of Highway 62 there is a mix of land uses along the corridor including office, single-family residential, and multifamily residential. Nine Mile Creek runs under Highway 169 from Minnetonka to Edina. Adjacent is greenspace and wetland. Land uses south of Highway 62 along the corridor are dominated by residential neighborhoods and institutional and recreational uses.

Eden Prairie

The City of Eden Prairie is mostly bound by Highway 169 on its eastern edge.. I-494 and Highway 212 both intersect with Highway 169 near the Eden Prairie border. Highway 212 runs diagonally from Highway 169 until it intersects with Interstate 494 creating an area called the Golden Triangle. This area is a mix of industrial uses, office, and open space and is a regional jobs center because of its excellent freeway access. Emerson Electronics, and Supervalu have corporate offices in the Golden Triangle. The Golden Triangle, the United Health Group corporate campus at Highway 62 and Shady Oak Road, and SouthWest Station will all be served by the proposed Green Line Extension LRT line. South of I-494 and Golden Triangle land use in Eden Prairie is mostly single-family residential, park land, and water, with some small retail areas.

Bloomington

The City of Bloomington's western edge is mostly bound by Highway 169. Land use along the corridor is mostly single-family residential, with some green space and water bodies. Along I-494 to the north is a mix of greenspace and industrial and office uses, and industrial and multifamily uses line Old Shakopee Road near the corridor.

Savage

The City of Savage is located southeast of Highway 169 and connects to the corridor via Highway 13 which runs east and west. Land uses near the corridor in Savage include greenspace and industrial uses along the Minnesota River including machinery salvage and repair businesses, as well as single family residential, and undeveloped land.

Shakopee

The City of Shakopee is located on the far southern portion of the corridor. Highway 169 runs through the middle of the city from the Bloomington Ferry Bridge over the Minnesota River to Highway 41. Because the highway runs the length of the city, there is a wide range of land uses adjacent to the corridor including greenspace, single- and multi- family residential, retail, industrial, mixed-use industrial, undeveloped land, and some areas classified as farm land. Major employers include Amazon, Seagate Technologies, Shutterfly, Saint Francis Medical and Cancer Centers, and Saint Gertrude's Health Center. Other

seasonal regional draws include Valley Fair Amusement Park, Canterbury Park, and the Renaissance Festival.

Figure 2: Land Use in the Highway 169 Corridor

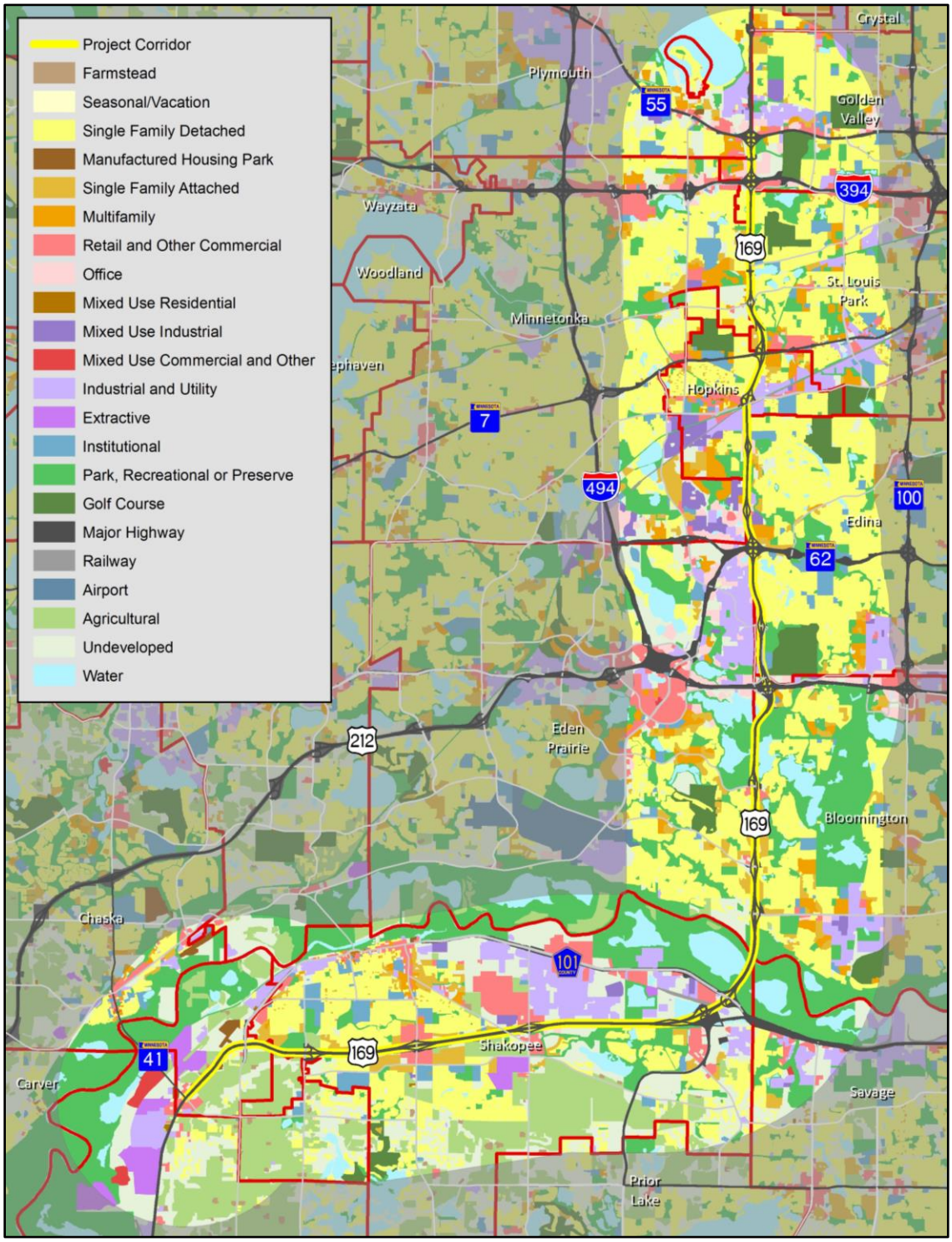
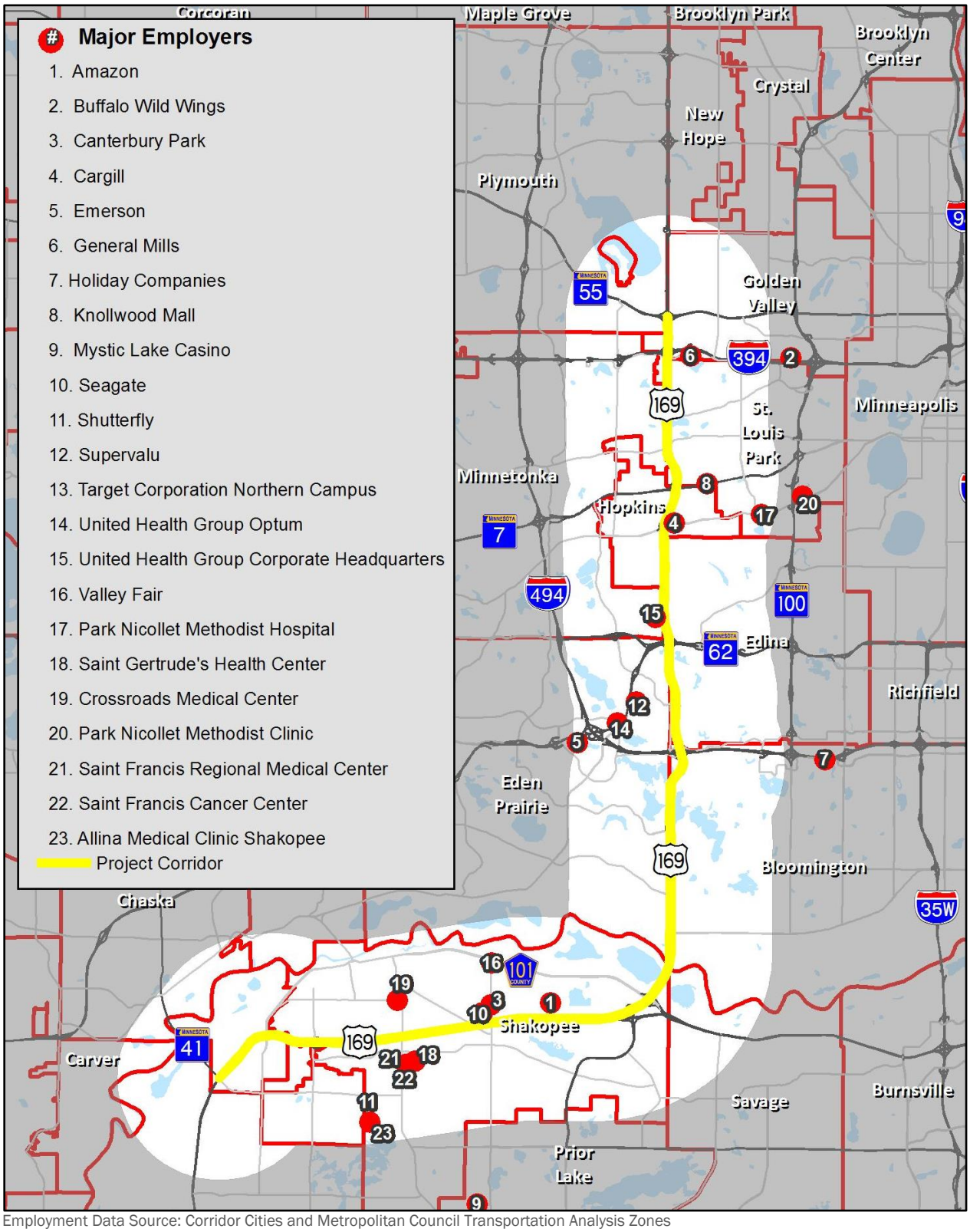


Figure 3: Major Employers in the Highway 169 Corridor



Employment Data Source: Corridor Cities and Metropolitan Council Transportation Analysis Zones

Demographics

A two-mile buffer around Highway 169 was drawn to summarize demographic trends in the populations living closest to the highway. The corridor is populous; more than 215,000 people live within two miles of the corridor in 10 cities. The municipalities range in size from Bloomington with approximately 85,000 residents, to just under 18,000 residents in Hopkins. Overall, the corridor population is fairly wealthy, well educated, and somewhat racially diverse.

Table 1 shows a range of demographic indicators by municipality. Note that the values in the table reflect the populations in the study area, not the municipality as a whole, with the exception of Hopkins, which is entirely within the study area. The Scott County cities in the study area, Prior Lake, Savage and Shakopee, have high percentages of young people under age 18 in the study area. Hopkins stands out in the corridor with the most racial diversity and limited English proficiency among its population, and also has the highest percentage of zero-vehicle households.

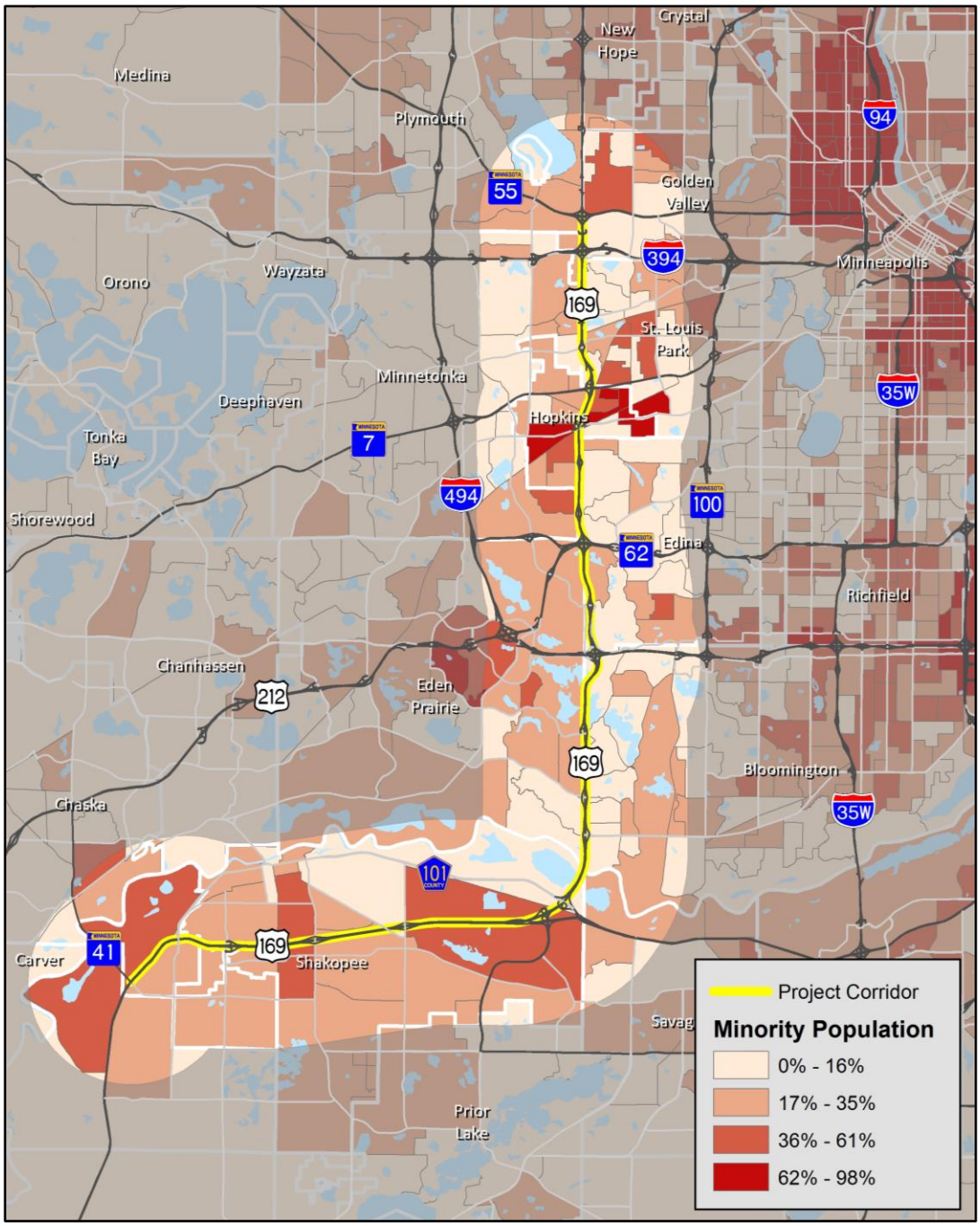
See Table 1 and Figure 4 through Figure 9 for details and maps.

Table 1: Study Area Demographic Indicators

City	Population in the Study Area	Percent Minority	Percent Foreign Born	Percent Limited English Proficiency	Percent Zero-Vehicle Households	Percent Under Age 18	Percent in Poverty	Percent without High School Education	Average of Median Household Income
Bloomington	20,652	15.4%	7.9%	3.5%	3.4%	17.8%	4.4%	3.8%	$88,477
Eden Prairie	27,488	27.4%	18.5%	6.5%	4.9%	25.6%	5.7%	4.3%	$94,338
Edina	22,478	12.6%	9.5%	1.8%	3.0%	25.1%	4.3%	1.3%	$118,572
Golden Valley	12,307	20.4%	8.3%	3.6%	5.7%	20.7%	9.0%	4.8%	$78,736
Hopkins	17,909	42.2%	21.9%	10.3%	14.5%	23.8%	16.1%	8.8%	$54,582
Minnetonka	25,423	17.9%	10.9%	4.4%	4.5%	17.5%	5.6%	2.9%	$80,231
Plymouth	9,794	16.9%	10.9%	5.2%	5.4%	19.8%	12.1%	4.2%	$75,935
Prior Lake	7,598	15.3%	4.8%	2.4%	5.1%	31.7%	4.3%	2.3%	$110,903
Savage	5,486	18.8%	10.5%	6.8%	0.5%	34.6%	1.8%	3.5%	$121,267
Shakopee	37,381	29.4%	16.0%	8.0%	4.1%	29.6%	7.3%	7.6%	$72,360
St. Louis Park	29,578	22.2%	9.9%	3.8%	8.0%	19.3%	9.4%	5.4%	$66,256
Corridor	216,094	22.9	12.1	5.3%	5.7%	23.4%	7.4%	4.7%	83,015
Seven-County Metro Area	2,920,637	24.8%	11.0%	6.3%	8.2%	24.1%	11.1%	7.0%	$68,183

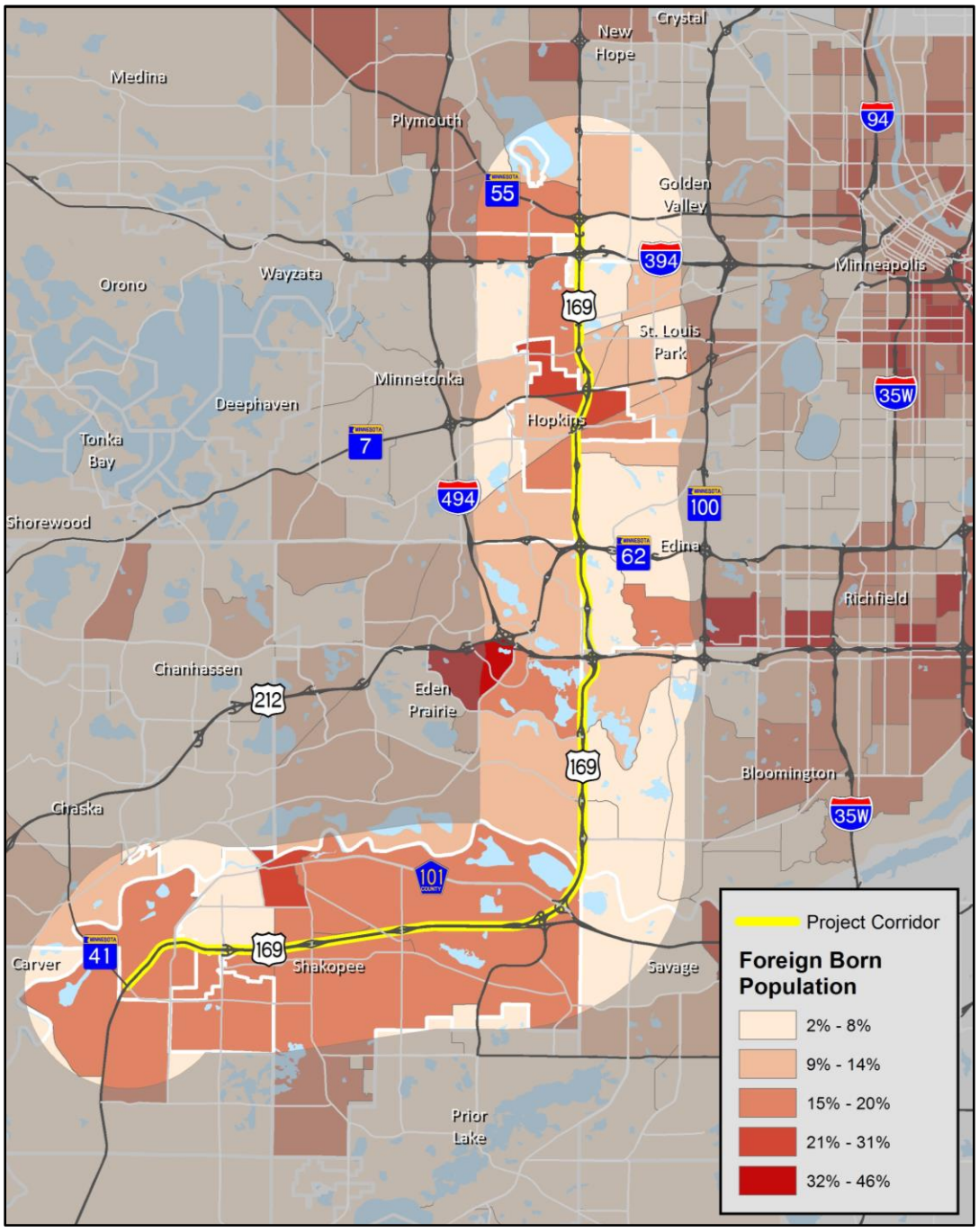
Source: American Community Survey 2009-2014

Figure 4: Minority Populations in the Highway 169 Corridor



In the northern part of the corridor, including Hopkins and St. Louis Park, there is a higher concentration of African-American populations. Asian populations are more prevalent in the southern part of the corridor in Shakopee, Savage, and Eden Prairie. Hispanic populations are fairly evenly distributed in the corridor with a few areas of high concentration in Hopkins. American Indian populations make up a small percentage of the corridor population and are fairly evenly distributed throughout the corridor.

Figure 5: Foreign-Born Populations in the Highway 169 Corridor



Each city located along the corridor has foreign-born populations, however, they tend to be concentrated in certain census tracts within each city. As a whole, the City of Hopkins has the largest foreign born population (21.9 percent) and people with Limited English Proficiency (10.3 percent) in the study area, followed by the City of Shakopee (16.0 percent and 8.0 percent respectively). Languages spoken at home vary by each city: Spanish is prevalent throughout the corridor as are other Indo-European languages. Asian and Pacific

Island speaking populations are clustered on the south end of the corridor in Bloomington and Shakopee and on the north end in St. Louis Park, Golden Valley, and Plymouth.

Figure 6: Languages Spoken in the Highway 169 Corridor

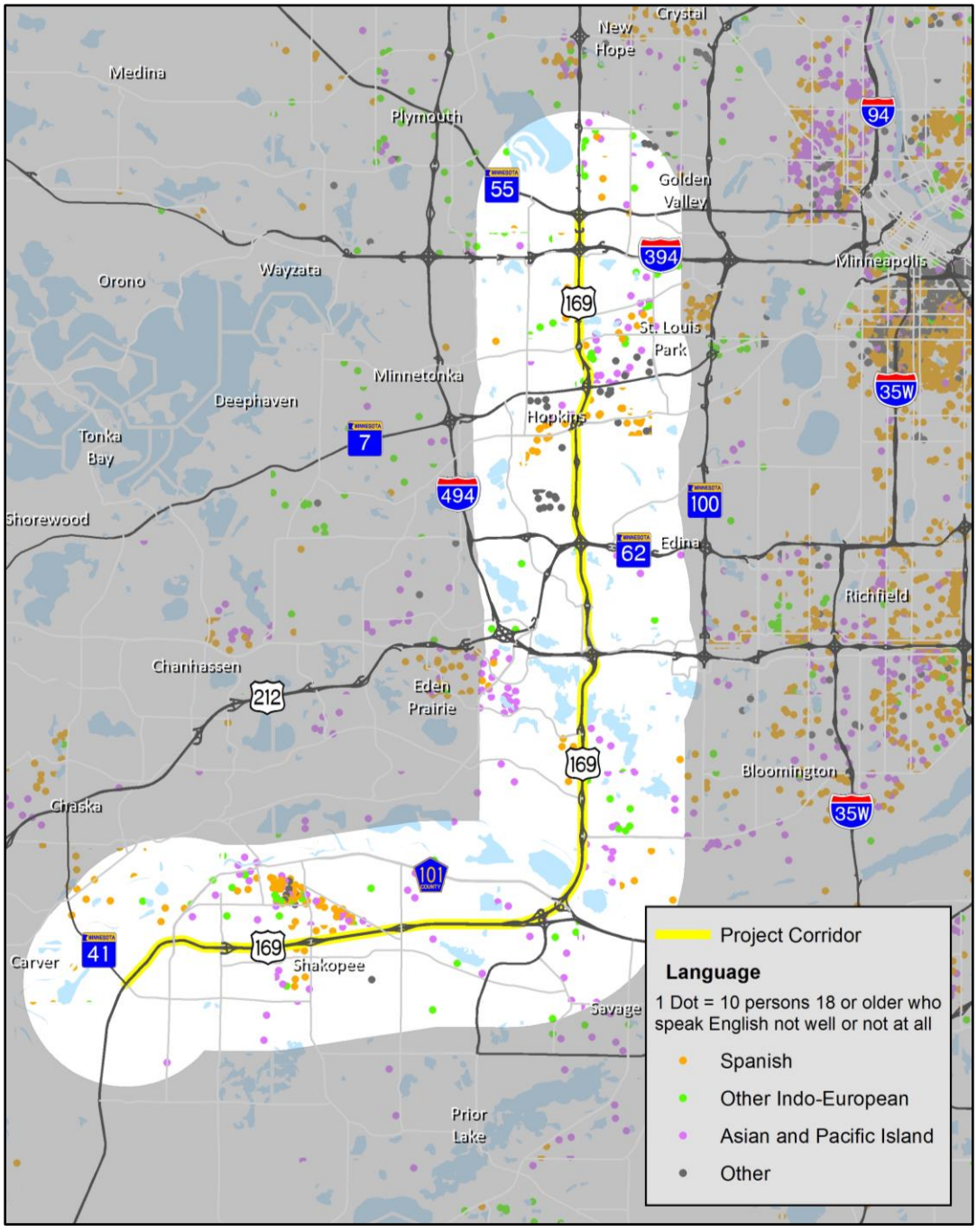
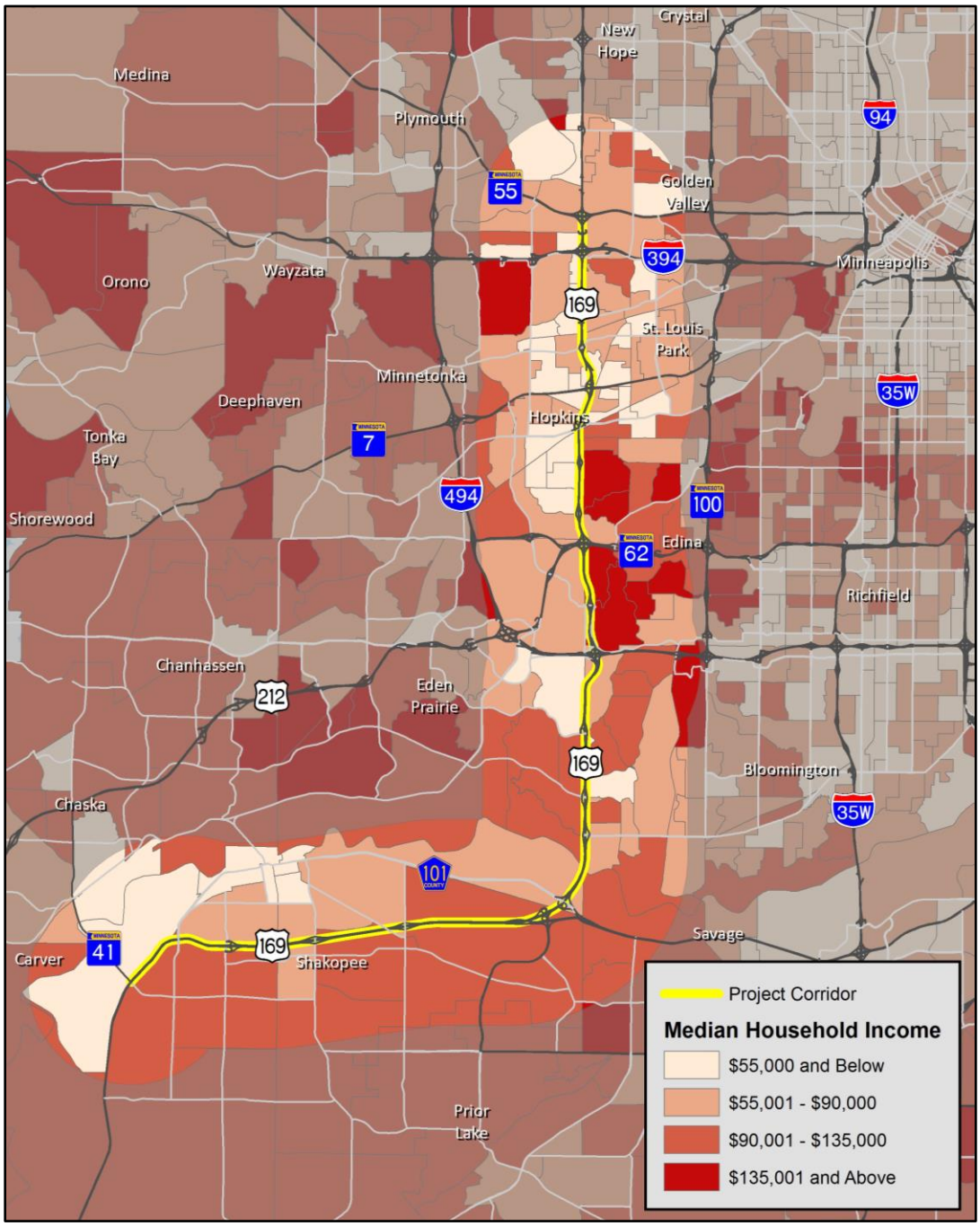
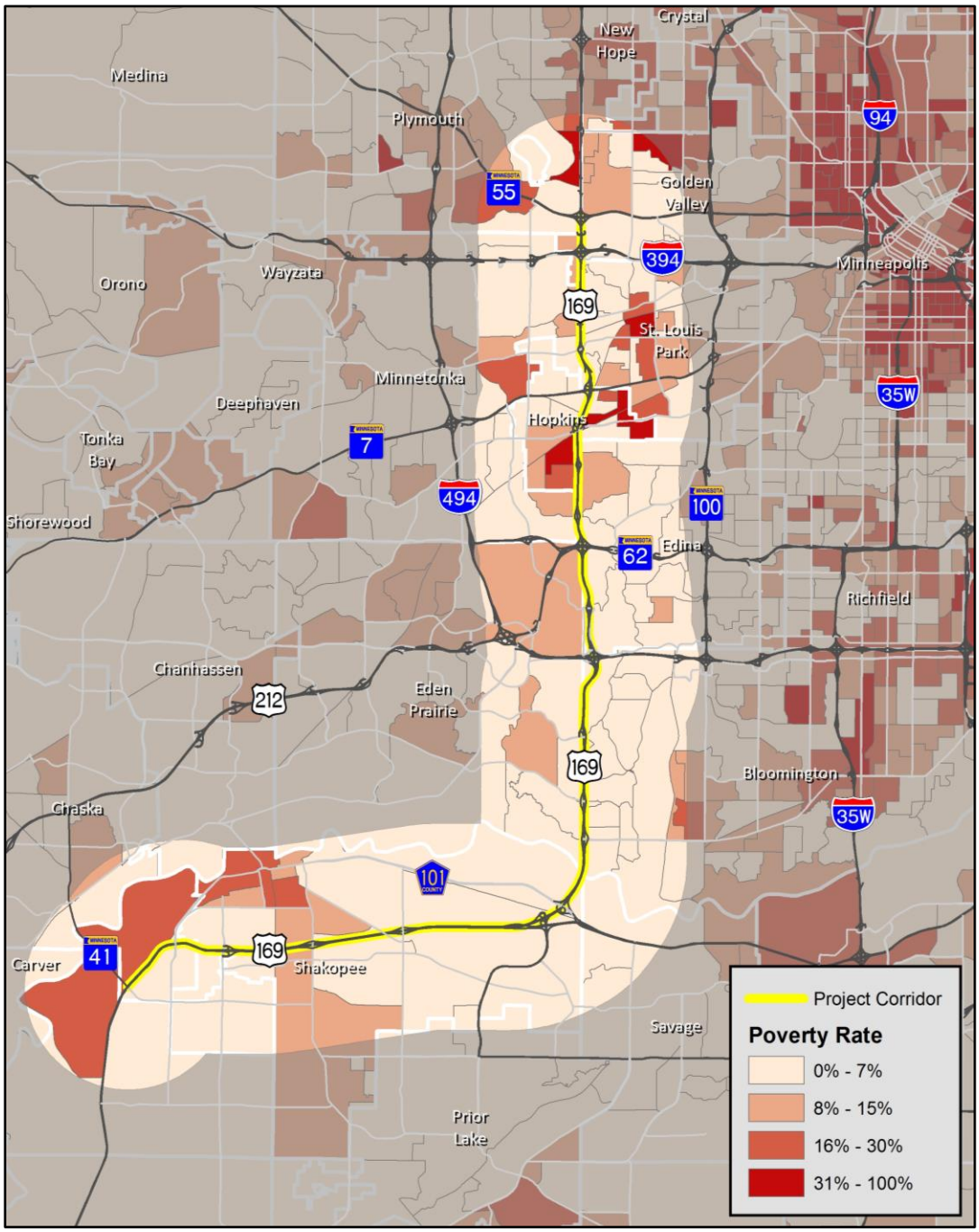


Figure 7: Median Household Incomes in the Highway 169 Corridor



The corridor is economically diverse. Median household income by block group in the Corridor ranges from over $135,000 to below $30,000. The City of Savage and City of Edina have some of the highest median incomes where Hopkins, Plymouth, and St. Louis Park have some of the lowest median incomes. This coincides with the poverty rate where the City of Hopkins is the highest at 16.1 percent followed by the City of Plymouth at 12.1 percent. The City of Savage has the lowest poverty rate at less than two percent.

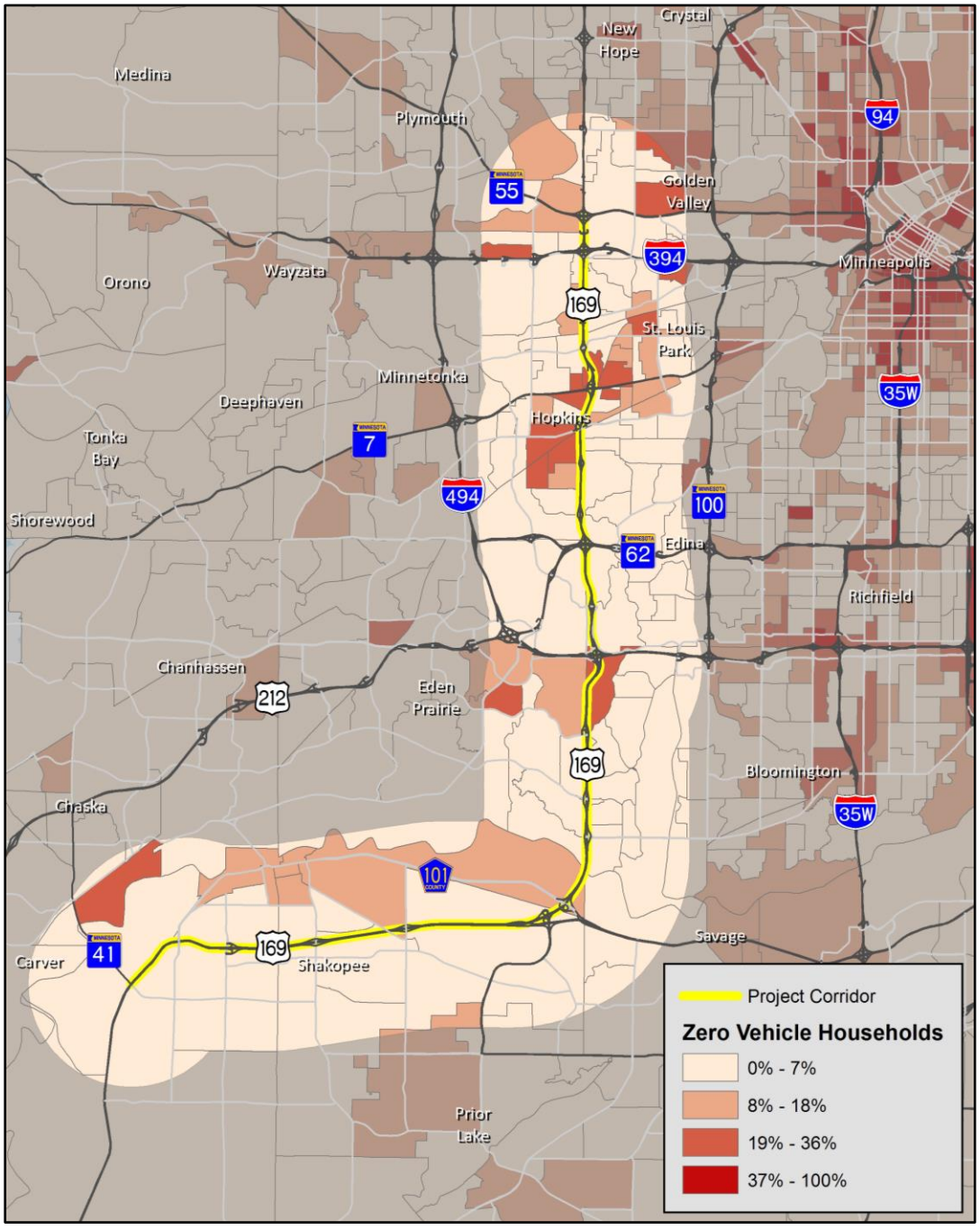
Figure 8: Poverty Rates in the Highway 169 Corridor



Most households in the corridor have at least one vehicle per household. In the corridor 5.7 percent of households do not have access to a vehicle (zero-vehicle households). Hopkins has the highest percentage of zero-vehicle households at 14.5 percent, whereas less than one percent of Savage's households have no cars. Zero-vehicle households are concentrated in areas of poverty and correlate to areas with more transit options. Block groups with higher than the corridor average for zero-vehicle households are found in St. Louis Park, Hopkins, Golden Valley, Bloomington, and Eden Prairie. However, among the corridor cities only

Hopkins has a higher percentage of zero vehicle households than the regional average of 8.2 percent.

Figure 9: Zero-Vehicle Households in the Highway 169 Corridor



Existing Conditions

Transit

Transit Infrastructure

Existing transit infrastructure along the Highway 169, I-394, and Highway 55 corridors is shown in Figure 10. This infrastructure includes facilities which provide a travel time advantage to transit vehicles, as well as park-and-ride surface parking lots and ramps. Each of these infrastructure components in the study area is described in additional detail below.

Transit Advantages

There are multiple types of transit advantages throughout the Highway 169 study area, as well as on Highway 55 and I-394 between Highway 169 and downtown Minneapolis. This infrastructure includes the MnPASS Express Lanes on I-394, bus-only shoulder lanes, and ramp meter bypasses.

MnPASS

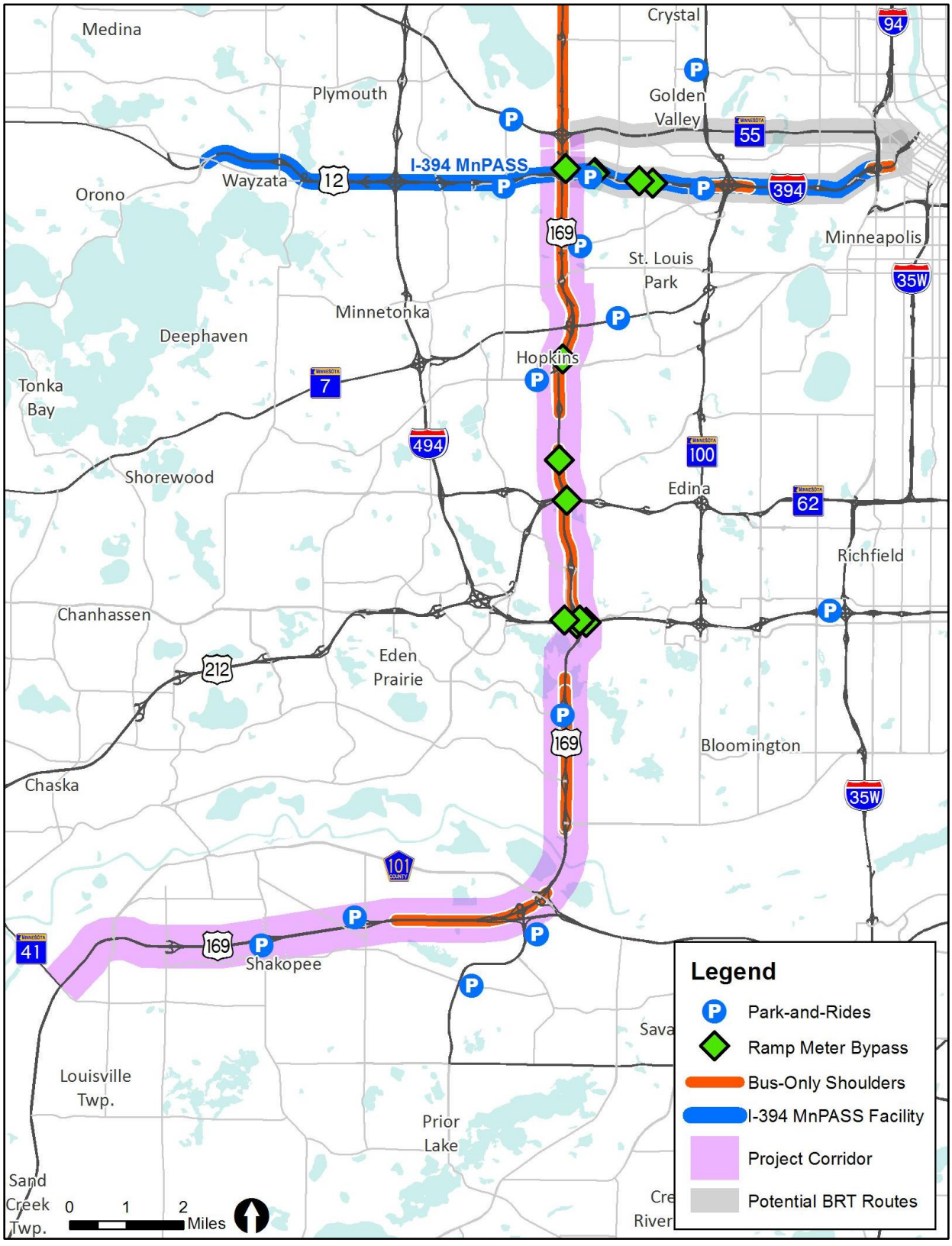
The I-394 MnPASS lane extends from I-494 to downtown Minneapolis and has two distinct segments. The segment between Highway 169 and Highway 100 is an at-grade center lane in each direction intended for use by transit vehicles, high-occupancy vehicles (HOVs) with two or more passengers, and single-occupancy vehicles choosing to pay the posted fee via an electronic fee system. East of Highway 100 to downtown Minneapolis, the MnPASS facility transitions to two reversible lanes that are separated by jersey barriers and grade differences from the general purpose lanes. There is currently no connection from Highway 169 directly into the I-394 MnPASS lane.

Ramp Meter Bypasses

Throughout the corridors, there are 12 ramp meter bypasses where HOVs and transit vehicles can bypass other vehicles waiting at ramp meters to efficiently enter the highway. Ramp meter bypasses are operational at the following locations:

Entering Northbound Highway 169	Entering Eastbound I-394	Entering Westbound I-394	Entering Eastbound I-494	Entering Westbound I-494
Bren Road Excelsior Boulevard Eastbound Highway 62/Highway 212 Westbound I-394	Northbound Highway 169 General Mills Boulevard Louisiana Avenue	Louisiana Avenue	Northbound Highway 169 Southbound Highway 169	Northbound Highway 169 Southbound Highway 169

Figure 10: Existing Transit Infrastructure



Bus-Only Shoulders

As shown in Figure 10 Bus-only shoulders are located on both sides of Highway 169 throughout most of the corridor, with the exception of four segments: Londonderry Road/Bren Road to 5th Street/Lincoln Drive, I-494 to Anderson Lakes Parkway, the Minnesota River to Highway 101, and southwest of Old Brick Yard Road (County Highway 69) in Shakopee. A bus-only shoulder is also located on eastbound I-394 between Xenia Avenue and Highway 100 where the standard MnPASS lane terminates and the reversible MnPASS lane begins.

Park-and-Rides

The park-and-ride usage and home location data used in this report is from Metro Transit's *2015 Annual Regional Park-and-Ride System Report*. Park-and-ride usage is tracked through a collaborative effort between the state, county, and other regional agencies. Together these agencies counted and recorded license plate data for vehicles parked at every park-and-ride and park-and-pool serving the Twin Cities metropolitan area. Usage data was collected one time for each facility within the following dates:

- Tuesday, September 29–Thursday, October 1, 2014
- Tuesday, October 6–Thursday, October 8, 2014

Metro Transit then obtained user origin data from the Minnesota Driver and Vehicle Services (DVS) and the Wisconsin Department of Transportation databases to acquire vehicle registrants' street address, city/township, and zip code. Upon completion of address acquisition, Metro Transit staff geocoded the home origins of approximately 16,100 system users. Geocoding allows for a visual display of user origin distribution while protecting individual privacy throughout the system.

There are eight park-and-ride facilities adjacent to Highway 169. Additionally, there are three facilities on I-394 between Highway 169 and downtown Minneapolis and two facilities on Highway 55 between the same endpoints. An inventory of these 11 park-and-ride facilities including the number of parking spaces (capacity), usage, and adjacent highway, is listed in Table 2. Also included is an inventory of park-and-rides that, while not located on the Highway 169 corridor, are served by routes that travel on Highway 169.

Table 2: Highway 169, Highway 55, and I-394 Park-and-Ride 2015 Usage

Park-and-Ride Facility	Park-and-Ride Usage		
	Usage	Capacity	% Used
Highway 169			
Marschall Road	50	442	11%
Seagate Technology	4	82	5%
Southbridge Crossing	206	513	40%
Eagle Creek Transit Center	72	563	13%
Preserve Village Mall	17	50	34%
Hopkins Transit Center	37	52	71%
Cub Foods – Plymouth (Nathan Lane)	31	120	26%
Westwood Lutheran Church	9	40	23%
I-394			
General Mills	105	123	85%
Louisiana Avenue Transit Center	328	330	99%
Park Place	35	55	64%
Highway 55			
Highway 100 and Duluth Street	70	50	140%
Station 73 (Highway 55 and County Road 73)	150	288	52%
Other Park-and-Rides with Routes that Travel on Highway 169			
Highway 7 and Texas Avenue	4	10	40%
Excelsior City Hall	11	20	55%
Highway 7 and Vine Hill Road	3	27	11%
Minnetonka Boulevard and Steele Street	6	25	24%
Minnetonka Boulevard and Baker Road	13	16	81%

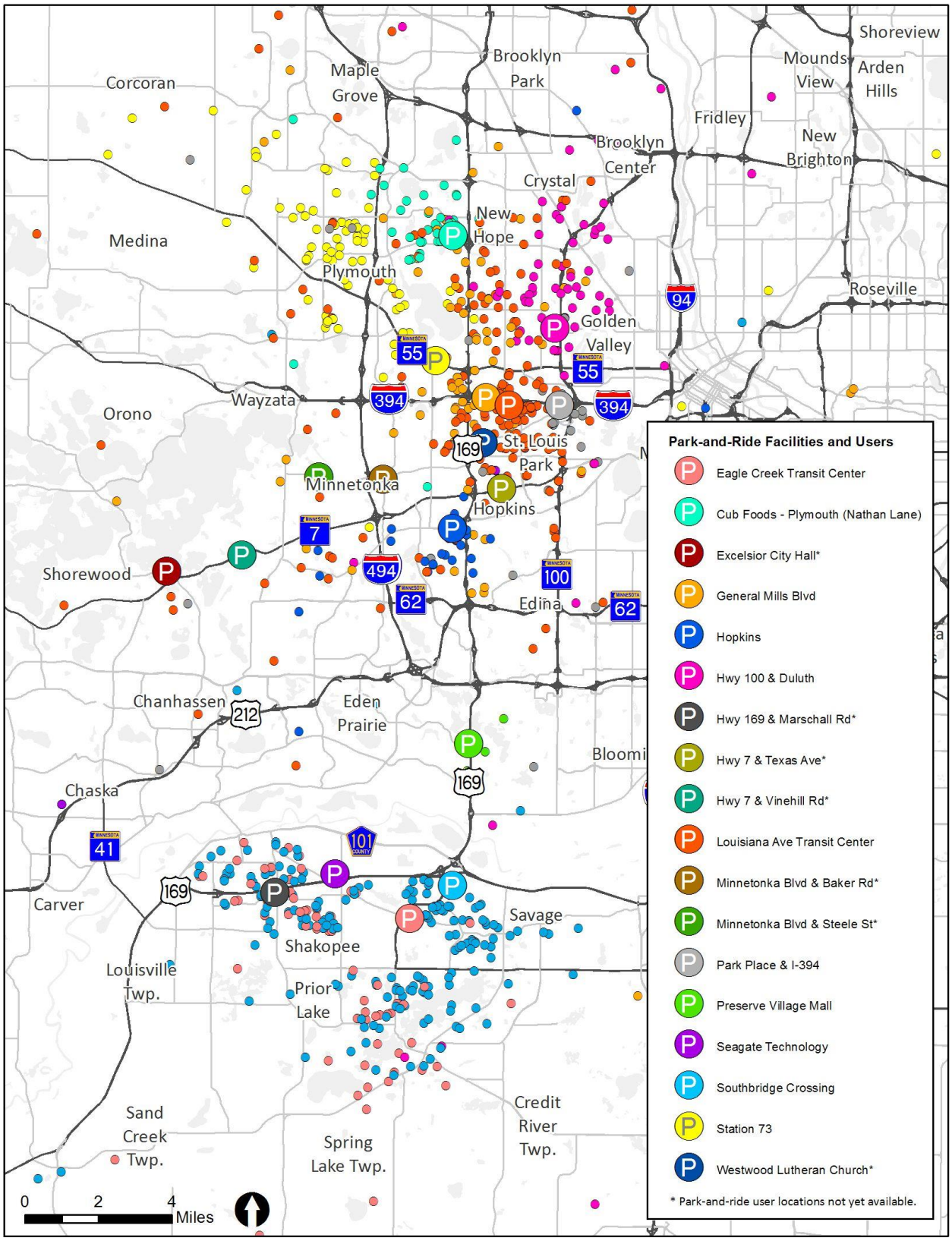
Source: Metropolitan Council 2015 Annual Regional Park-and-Ride System Report

The Southbridge Crossing facility and the Eagle Creek Transit Center on Highway 169 in Shakopee have the largest capacity of all of the facilities along the corridors with 513 and 563 parking spaces, respectively. The Louisiana Avenue Transit Center on I-394 in Saint Louis Park has the largest draw of users and operates at 99 percent of capacity.

The park-and-ride facility at Highway 100 and Duluth Street on Highway 55 in Golden Valley is one of the smallest park and rides but has the greatest utilization rate of all facilities on the corridors. Users regularly fill and exceed the capacity of this lot, which was at 140 percent capacity in 2015. This can occur if users park on a street near a facility with no other apparent nearby destinations, use an overflow lot, use a shared parking lot where available park-and-ride spaces are not clearly marked, or use any other non-traditional parking arrangement.

Figure 11 shows the home locations for the park-and-ride users in the service area. This map demonstrates that the park-and-ride users are dispersed throughout the adjacent and nearby communities of the park-and-ride facility, including Plymouth, Golden Valley, Saint Louis Park, Shakopee, Savage, and Prior Lake. Few users travel distances over ten miles to reach a park-and-ride in the study area.

Figure 11: Park-and-Ride User Home Locations



Transit-Supportive Development Patterns

There are some conditions in the corridor cities that make it difficult to provide all-day regular-route transit service:

- Development patterns are lower density and destinations are spread out, so bus stops are less likely to be convenient for pedestrians to access many destinations.
- Even in concentrated areas there are few safe and efficient pedestrian connections between potential station locations and nearby destinations; these connections are typically addressed through local infrastructure investments.
- Development patterns in some parts of the corridor are homogenous, generating more homogeneous types of trips and concentrating demand at key destinations and at specific times.
- Street networks are often circuitous and disconnected making transit routing inefficient, reducing the area and destinations served by a single transit stop, and compromising the potential to serve additional destinations through connecting bus service.
- Parking is usually free and abundant, which reduces the attractiveness of transit.

As shown in the following section, transit service in the corridor is generally express bus service used by riders who park in the corridor and ride to their destination in downtown Minneapolis. While transit-friendly development patterns and bicycle and pedestrian connections support express bus service, they are essential to attracting riders to all-day regular-route and station-to-station service.

The range of potential development changes and actions that can be taken in tandem with transit investments has the potential to improve non-automobile access to jobs and destinations for both residents and employees in the corridor. Planning, infrastructure investments, and new development patterns can make transit service viable in communities with many of the barriers listed above. This will require a coordinated effort by the cities, counties, MnDOT, and transit providers beyond just the scope of this study and subsequent project recommendations.

Transit Providers and Service

Four transit providers operate fixed-route bus service through the Highway 169 corridor, as well as on I-394 and Highway 55 between Highway 169 and downtown Minneapolis. Existing bus service is express service that operates mainly between suburban park-and-ride locations and downtown Minneapolis with few local stops. Bus routes in the corridor generally route from suburban locations to downtown Minneapolis in the morning peak period, and from downtown Minneapolis to the suburbs in the evening peak period. As shown in Table 3, there are few reverse commute trips, there is very little mid-day service, and there is no service on nights or weekends on the transit routes operating in the corridors.

Additional information about the transit providers – Metro Transit, SouthWest Transit, Plymouth Metrolink, and Minnesota Valley Transit Authority - is included below. A summary of the existing transit service and providers on Highway 169, Highway 55, and I-394 is included in Table 3. Transit routes by provider are displayed in Figure 12. Figure 12 also includes bus routes that cross Highway 169 or operate immediately adjacent to the Highway, which are further described in Table 4.

Mystic Lake Casino and Land to Air Express also operate shuttle service in the study area, as described below.

Metropolitan Council/Metro Transit

Metro Transit serves as a transportation resource for the Twin Cities, offering an integrated network of buses, light rail, and commuter trains as well as resources for those who carpool, vanpool, walk or bike. Metro Transit is an operating division of the Metropolitan Council. The Metropolitan Council also provides fixed-route and dial-a-ride transit services with private contractors. Together, they provide fixed route transit service in the study area on 18 express and suburban local bus routes.

SouthWest Transit

SouthWest Transit is the transit agency serving the communities of Carver, Chaska, Chanhassen, and Eden Prairie. SouthWest Transit provides express bus service connecting these communities with downtown Minneapolis, and provides service connecting suburban communities. SouthWest Transit operates five express and suburban local routes in the project study area.

Plymouth Metrolink

Plymouth Metrolink is the public transit agency for the City of Plymouth. Plymouth Metrolink provides express bus service connecting Plymouth to downtown Minneapolis, including reverse-commute service. In the project study area, Plymouth Metrolink operates five express and local bus routes.

MVTA

The Minnesota Valley Transit Authority (MVTA) is the public transportation agency for seven suburban communities located approximately 15 miles south of Minneapolis and St. Paul: Savage, Prior Lake, and Shakopee in Scott County and Apple Valley, Burnsville, Eagan, and Rosemount in Dakota County. In the study area, MVTA operates three bus routes, including suburban circulator service and express service.

Table 3: Regular Route Transit Service Characteristics

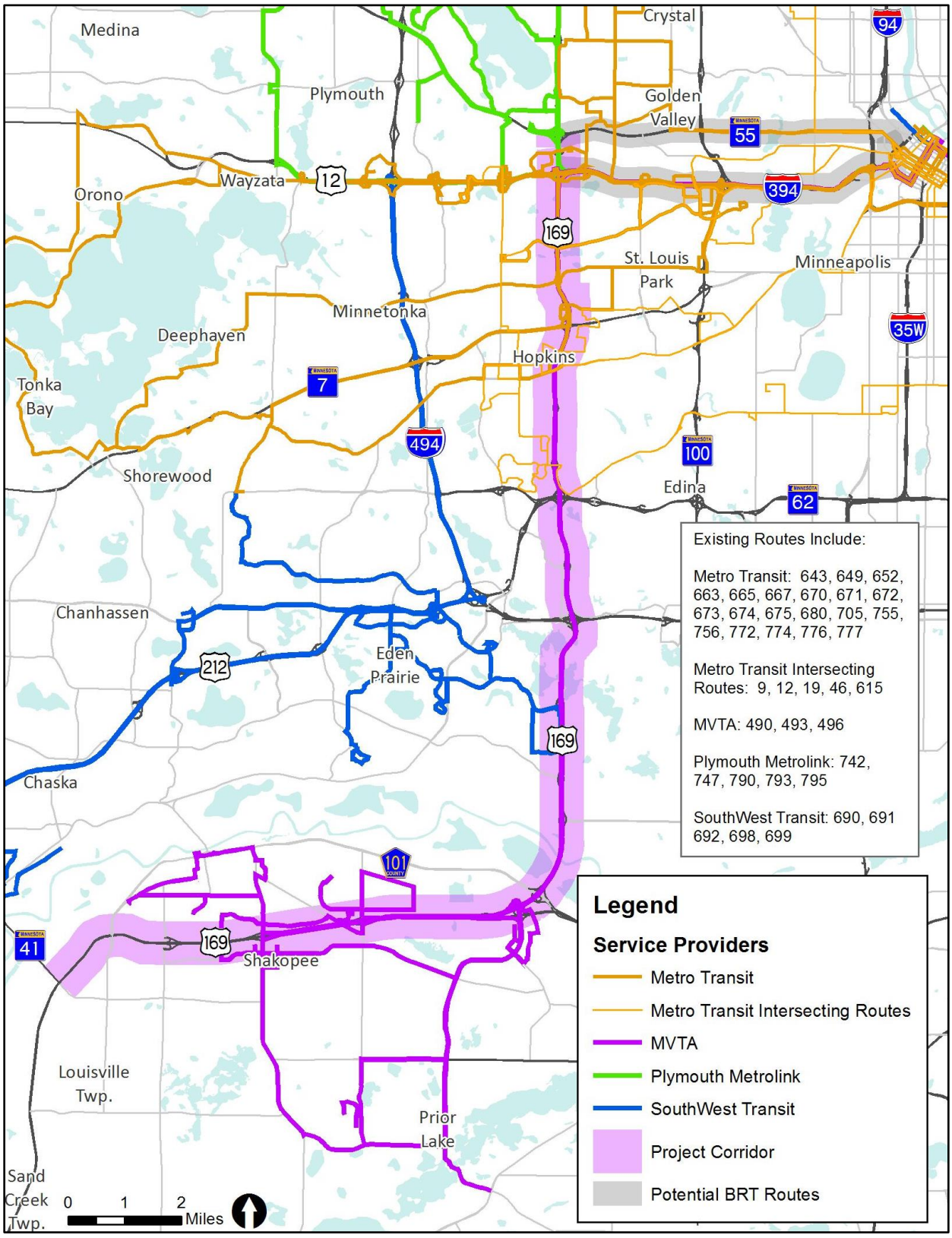
Route	Provider	Span of Service	Frequency (minutes) (Peak/Mid/Eve)	Number of Trips	Study Area Corridors Used
490	MVTA	5:37AM – 7:21PM	10-20 / 0 / 0	AM: 10 PM: 11	Highway 169 I-394
493	MVTA	5:41 AM - 6:38 PM	25-50 / 0 / 0	AM: 4 PM: 4	Highway 169 I-394
496	MVTA	5:40 AM - 6:42 PM	60 / 60 / 60	AM: 13 PM: 12	Highway 169
643	Metro Transit	6:02 AM - 6:37 PM	30 / 0 / 0	AM: 5 PM: 5	I-394
649	Metro Transit	6:13 AM - 6:44 PM	30 / 0 / 0	AM: 9 PM: 10	I-394
652	Metro Transit	6:53AM – 6:25PM	10-60 / 0 / 0	AM: 4 PM: 5	I-394
663	Metro Transit	6:17AM – 6:46PM	15-30 / 0 / 0	AM: 8 PM: 8	I-394
667	Metro Transit	5:29AM – 6:49PM	10-60 / 0 / 0	AM: 12 PM: 9	Highway 169 I-394
670	Metro Transit	6:12AM – 6:16PM	30 / 0 / 0	AM: 3 PM: 3	Highway 169 I-394
671	Metro Transit	6:19AM – 6:08PM	25-35 / 0 / 0	AM: 3 PM: 3	Highway 169 I-394
672	Metro Transit	6:06AM – 6:42PM	15-60 / 0 / 0	AM: 9 PM: 10	I-394
673	Metro Transit	5:53AM – 6:53PM	10-30 / 0 / 0	AM: 16 PM: 12	I-394
674	Metro Transit	6:15AM – 6:15PM	25-35 / 0 / 0	AM: 3 PM: 3	I-394
675	Metro Transit	4:57AM – 10:59PM	30-60 / 30-60 / 60	AM: 30 PM: 34	I-394
690	Southwest Transit	6:04AM – 7:27PM	5-15 / 0 / 0	AM: 24 PM: 22	I-394
691	Southwest Transit	5:15AM – 6:16AM	0 / 0 / 0	AM: 1 PM: 0	I-394

Route	Provider	Span of Service	Frequency (minutes) (Peak/Mid/Eve)	Number of Trips	Study Area Corridors Used
692	Southwest Transit	6:30AM – 6:07PM	15-25 / 0 / 0	AM: 4 PM: 5	I-394
698	Southwest Transit	5:36AM – 10:39PM	30-60 / 60 / 30-60	AM: 13 PM: 20	I-394
699	Southwest Transit	5:55AM – 6:41PM	10-20 / 0 / 0	AM: 11 PM: 11	I-394
705	Metro Transit	5:10 AM - 9:19 PM	60 / 60 / 60	AM: 14 PM: 17	Highway 169 I-394
742	Plymouth Metrolink	5:46AM – 7:00PM	45-60 / 0 / 0	AM: 3 PM: 4	Highway 169 I-394
747	Plymouth Metrolink	5:11AM – 6:10PM	25-30 / 0 / 0	AM: 8 PM: 9	I-394
755	Metro Transit	5:05 AM - 6:58 PM	30 / 0 / 0	AM: 12 PM: 13	Highway 169 Highway 55
756	Metro Transit	6:37AM – 5:49PM	25-35 / 0 / 0	AM: 3 PM: 3	Highway 169 I-394
772	Metro Transit	5:57AM – 6:31PM	20-30 / 0 / 0	AM: 6 PM: 5	I-394
774	Metro Transit	6:09PM -7:41PM	60 / 0 / 0	AM: 0 PM: 2	I-394
776	Metro Transit	5:25AM –6:58PM	15-30 / 0 / 0	AM: 7 PM: 7	I-394
777	Metro Transit	5:43AM – 6:48PM	25-30 / 0 / 0	AM:5 PM:5	I-394
790	Plymouth Metrolink	5:43AM – 6:38PM	15-20 / 0 / 0	AM: 8 PM: 8	Highway 169 I-394
793	Plymouth Metrolink	6:29AM – 7:49PM	30-60 / 0 / 0	AM: 2 PM: 4	Highway 169 I-394
795	Plymouth Metrolink	12:11 PM- 2:58PM	0 / 120 / 0	AM: 0 PM: 2	I-394

Table 4: Transit Routes that Cross Highway 169 or Operate Adjacent to the Corridor

Route	Provider	Span of Service	Frequency (minutes) (Peak/Mid/Eve)	Number of Trips	General Route in the Corridor
9	Metro Transit	5:15AM – 1:40AM	15-20 / 30 / 30	45 in each direction	Cedar Lake Road; terminates at CR 73
12	Metro Transit	5:01AM – 12:37AM	15-20 / 30 / 30	24 in each direction	Excelsior Blvd, Hopkins Main Street; terminates at Opportunity Partners
19	Metro Transit	2:30AM – 1:00AM	8-15 / 15 / 15-20	105 in each direction	Highway 55 in Minneapolis
46	Metro Transit	5:10AM – 10:48PM	15-30 / 30 / 30-60	41 in each direction	Lincoln Drive, Smetana Road; terminates at Opportunity Partners
615	Metro Transit	6:51AM – 7:43PM	60 / 60 / 60	12 in each direction	2nd St NE, Hopkins Main Street; terminates at Ridgedale

Figure 12: Existing Public Transit Routes by Provider



Mystic Lake Casino

Mystic Lake Casino offers free shuttle service to adults ages 18 and older with a valid driver's license or state identification card. The Casino operates 12 shuttle routes from various locations throughout the Twin Cities, as well as from St. Cloud, Rochester, New Ulm and their surrounding areas, as described in Table 5. All routes terminate at Mystic Lake Casino Hotel in Prior Lake.

Table 5: Mystic Lake Casino Shuttle Routes

Shuttle Route	Locations Served	Frequency and Span of Service
1	Brooklyn Center, Robbinsdale, New Hope, Golden Valley, St. Louis Park, Richfield, Bloomington	One round trip daily
2	Shoreview, Roseville, Falcon Heights, Minneapolis	Two round trips daily: morning and evening
3	Brooklyn Park, Brooklyn Center, Minneapolis, Hopkins	Two round trips daily: morning and evening
4	St. Paul, South St. Paul, West St. Paul, Eagan, Burnsville, Apple Valley	Two round trips daily: morning and evening
5	Anoka, Blaine, Spring Lake Park, Fridley, Columbia Heights, Minneapolis	Two round trips daily: morning and evening
6	Maplewood, Little Canada, St. Paul	Two round trips daily: morning and evening
7	Minneapolis, Bloomington	Two round trips daily: morning and evening
8A	New Ulm, Nicollet, North Mankato, St. Peter, Le Sueur, Belle Plaine	One round trip daily
8C	Rochester, Zumbrota, Faribault, Montgomery, New Prague	One round trip daily
8D	Cold Spring, Waite Park, St. Cloud, Monticello, Buffalo, Rockford, Plymouth	One round trip daily
8E	St. Cloud, Monticello, Buffalo, Rockford, Plymouth	One round trip daily
9	Waseca, Owatonna, Faribault, Northfield, New Prague	One round trip daily

Land to Air Express

Land to Air Express offers shuttle service between Mankato and St. Peter and the Minneapolis-St. Paul Airport and downtown Minneapolis. Land to Air operates six route trips on weekdays and three roundtrips on weekends.

Highway Operations

Physical Characteristics

Physical characteristics of Highway 169 were reviewed to identify potential obstacles to implement changes to the corridor and guide the screening of alternatives considered. The Highway 169 corridor varies in its design, width, and configuration throughout the study area. The text that follows is a brief summary of the physical characteristics for the corridor.

Highway 169

The Highway 169 corridor is generally four lanes wide (two in each direction); however, there are multiple locations where the corridor varies from this typical cross section. Extra lanes (referred to as auxiliary lanes) exist near interchanges, shoulder widths vary between four and twelve feet, and shoulders transition from an urban to a rural cross section without curb and gutter south of Bren Road. Furthermore, a six lane bridge crossing the Minnesota River is one of the main connections between Scott County and the rest of the metro area. Interchange spacing in most of the Highway 169 corridor is not consistent with MnDOT freeway spacing guidelines. Within the I-494/I-694 beltway, interchange spacing is recommended to be greater than one mile; outside the beltway spacing is recommended at two miles or more. Between Highway 62 and Highway 55 interchange spacing on Highway 169 ranges from quarter of a mile to one mile, much closer together than the guidelines recommend.

Between Marschall Road and Bren Road, Highway 169 is divided primarily by a grassy median with cable barriers. Between Highway 62/Highway 212 and Highway 7 and between Minnetonka Boulevard and Highway 55, Highway 169 has a concrete median barrier.

Geometric and right-of-way (ROW) constraints vary throughout the corridor. The areas that are most constrained have narrow shoulders (under six feet) and retaining walls to allow for frontage roads and interchange ramps.

Traffic Characteristics

The Highway 169 corridor carries commuter-oriented traffic from southwestern Twin Cities suburban communities to major employment centers in and near downtown Minneapolis, commercial and industrial areas along Highway 169; and jobs at Eden Prairie Center. This results in greater volumes of traffic in the northbound direction during the a.m. peak period and in the southbound direction during the p.m. peak period. Reverse commuters travel in the opposite direction to employment centers in Scott County. In addition, as one of the major north-south connectors across the Minnesota River in the region, Highway 169 connects Scott County to region-wide destinations via major highways including I-494, Highway 62, Highway 7, I-394 and Highway 55.

Highway 169 is also the primary route from much of the metro area to recreational attractions in Scott County including Mystic Lake Casino, Valley Fair, the Renaissance Festival, and Canterbury Park. This results in distinct weekend and seasonal travel patterns.

This section describes several indicators of travel patterns on Highway 169:

- Directional split: the percentage of total traffic traveling in a given direction at a given time
- Peak-hour percent of daily traffic: a measure of traffic volume during peak periods in relation to volumes during the rest of the day
- Volumes approaching capacity: the volume to capacity ratio indicates locations where the highway is nearly full, and may not be able to accommodate additional peak period demand without creating delay for users
- Duration of peak period congestion: the duration of peak period congestion allows for comparison between minor, moderate, and severe congestion in various locations during the peak periods
- Time of peak hour traffic flow/onset of congestion: peak hour traffic flow provides an indication of when congestion begins and, in turn, when MnPASS operations would be warranted and most valuable
- Freight traffic: the percentage of overall traffic comprised of heavy commercial vehicles

Directional Split

A highway's directional split describes the percentage of total traffic traveling in a given direction. In a mature corridor surrounded by diverse and established land uses and relatively dense development patterns, highways tend to be used nearly evenly in both directions throughout the day, referred to as a 50/50 directional split. This describes Highway 169 between Highways 55 and 62. South of Highway 62, Highway 169 is has a predominate direction of travel: northbound in the morning peak period and southbound in the evening peak period. Table 6 and Table 7 show that north of Highway 62, directional splits on Highway 169 hover around 50 percent in each direction during both the a.m. and p.m. peak periods, while directional splits south of Highway 62 are more disparate, with a greater percentage of traffic traveling northbound in the morning and southbound in the evening peak period.

Table 6: Traffic Characteristics – A.M. Peak Directional Split

	CSAH 69 to Canterbury Road	Canterbury Road to Highway 101	Highway 101 to Old Shakopee Road	Old Shakopee Road to I-494
NB Highway 169	66	69	64	59
SB Highway 169	34	31	36	41
	I-494 to Highway 62	Highway 62 to Excelsior Boulevard	Excelsior Boulevard to I-394	I-394 to Highway 55

NB Highway 169	60	50	48	55
SB Highway 169	40	50	52	45

Table 7: Traffic Characteristics – P.M. Peak Directional Split

	CSAH 69 to Canterbury Road	Canterbury Road to Highway 101	Highway 101 to Old Shakopee Road	Old Shakopee Road to I-494
NB Highway 169	33	38	36	36
SB Highway 169	67	62	64	64
	I-494 to Highway 62	Highway 62 to Excelsior Boulevard	Excelsior Boulevard to I-394	I-394 to Highway 55
NB Highway 169	39	47	44	54
SB Highway 169	61	53	56	46

Peak-Hour Percent of Daily Traffic

Like the directional split indicator, peak-hour percent of daily traffic provides information about the character of a corridor. In a mature corridor that is fully developed with a diversity of land uses, like Highway 169 between Highways 62 and 55, highways are busy in both directions all day. Traffic during the peak periods may be heaviest, but is not that much heavier than during non-peak times. Peak-hour percentage of daily traffic tends to be higher in developing corridors that have less diversity of land use, like Highway 169 south of Highway 62, because these corridors tend to have more residential land use that generates commuter trips during the peak periods.

In less developed corridors the highway itself is less constrained and has less congestion, which allows people to drive during the peak periods. In mature, congested corridors, drivers often start their trips early or leave later in the morning or evening in order to avoid the worst congestion. This spreads out the peak period and makes it more likely that the hour of the day that sees the most traffic won't be much greater than other times.

For the analysis of the percent of daily traffic that occurs during peak hours, Highway 169 was divided into two segments.

- South of Highway 62: This segment functions as a commuter corridor and peak-hour percent of daily traffic ranges from nine to 11 percent in the peak direction (northbound in the a.m.) and five to seven percent in the non-peak direction (southbound in the a.m.).

- Between Highways 62 and 55: This segment of Highway 169 has high use throughout the day, and ranges from seven to nine percent in both directions in both the a.m. and p.m. peak hours.

A summary of peak hour traffic, expressed as a percentage of daily traffic is shown in Table 8. The first value in each cell represents the percentage of a.m. peak traffic, and the value in parenthesis (#) represents the p.m. peak percentage.

Table 8: Traffic Characteristics – Peak Hour Percentage of Daily Traffic – A.M./(P.M.) Peaks

	CSAH 69 to Canterbury Road	Canterbury Road to Highway 101	Highway 101 to Old Shakopee Road	Old Shakopee Road to I-494
NB Highway 169	11 (5)	10 (5)	10 (6)	8 (6)
SB Highway 169	6 (10)	5 (9)	5 (10)	5 (9)
	I-494 to Highway 62	Highway 62 to Excelsior Boulevard	Excelsior Boulevard to I-394	I-394 to Highway 55
NB Highway 169	10 (6)	9 (7)	8 (7)	7 (7)
SB Highway 169	7 (9)	8 (8)	8 (7)	6 (6)

Volumes Approaching Capacity

Volume refers to the number of vehicles using a roadway; capacity refers to how many vehicles a roadway can hold in a given location. The volume to capacity ratio indicates locations where the highway is nearly full, and may not be able to accommodate additional peak period demand without creating delay for users.

The capacity of a freeway is 2,000 vehicles per lane per hour. Traffic volumes approach and exceed this threshold in several locations on Highway 169 during both the morning and evening peak periods. As shown in Table 9, a.m. peak period traffic volumes are more than 80 percent of capacity at the following locations:

- Northbound Highway 169 between Canterbury Road and Old Shakopee Road
- Northbound Highway 169 between Pioneer Trail and I-494
- Northbound Highway 169 between Bren Road and Lincoln Drive
- Northbound Highway 169 between Highway 7 and W. 36th Street
- Northbound Highway 169 between Cedar Lake Road and 16th Street
- Northbound Highway 169 between I-394 and Betty Crocker Drive
- Southbound Highway 169 between I-394 and Cedar Lake Road

In the a.m. peak period, volumes exceed capacity on:

- Southbound Highway 169 between Lincoln Drive and Bren Road

Table 9: Traffic Characteristics – A.M. Peak Volumes Approaching Capacity (Volume/Capacity)

	CSAH 69 to Canterbury Road	Canterbury Road to Highway 101	Highway 101 to Old Shakopee Road	Old Shakopee Road to I-494
NB Highway 169	.67	.86	.82	.99
SB Highway 169	.30	.45	.47	.61
	I-494 to Highway 62	Highway 62 to Excelsior Boulevard	Excelsior Boulevard to I-394	I-394 to Highway 55
NB Highway 169	.70	.92	.95	.82
SB Highway 169	.59	1.03	.92	.59

These locations correspond to congestion produced at bottlenecks observed on MnDOT's 2014 *Congestion Maps*.

In the p.m. peak period, volumes are over 80 percent of capacity on:

- Northbound Highway 169 between Bren Road and Lincoln Drive
- Southbound Highway 169 between Lincoln Drive and Highway 62
- Southbound Highway 169 between Pioneer Trail and CSAH 101
- Southbound Highway 169 between CSAH 101 and Canterbury Road

In the p.m. peak period, volumes exceed capacity on:

- Southbound Highway 169 between I-394 and Cedar Lake Road
- Southbound Highway 169 between Anderson Lakes Pkwy and Pioneer Trail

Table 10: Traffic Characteristics – P.M. Peak Volumes Approaching Capacity (Volume/Capacity)

	CSAH 69 to Canterbury Road	Canterbury Road to Highway 101	Highway 101 to Old Shakopee Road	Old Shakopee Road to I-494
NB Highway 169	.27	.44	.47	.65
SB Highway 169	.61	.83	.86	1.09
	I-494 to Highway 62	Highway 62 to Excelsior Boulevard	Excelsior Boulevard to I-394	I-394 to Highway 55
NB Highway 169	.53	.86	.75	.69
SB Highway 169	.72	.89	1.00	.61

These locations correspond to congestion produced at bottlenecks observed on MnDOT's year *2014 Congestion Maps*.

Duration of Peak Period Congestion

When congestion occurs, fewer cars can get through and drivers experience delay. Congestion is something to be avoided, as it results in lost productivity and increased costs to drivers in time lost, fuel consumed, and stress. Measuring the duration of peak period congestion allows for comparison between minor, moderate, and severe congestion in various locations during the peak periods.

The duration of peak period traffic congestion varies throughout the corridor. In the a.m. peak period, northbound congestion is observed between Highway 101 and I-394 for one to three hours. In the southbound direction, congestion extends from north of Highway 55 to Excelsior Boulevard and lasts for one to two hours.

Traffic congestion in the p.m. peak hour is much greater. On northbound Highway 169, congestion extends from Cedar Lake Road to Highway 55 for more than three hours, and from Highway 62 to Cedar Lake Road for one to two hours. Southbound Highway 169 congestion also occurs for two to three hours between I-494 and south of Old Shakopee Road. Southbound Highway 169 is also congested between Highway 55 and I-394 for one to two hours during the p.m. peak.

Table 11: Traffic Characteristics – Duration of Congested Conditions During A.M. Peak

	CSAH 69 to Canterbury Road	Canterbury Road to Highway 101	Highway 101 to Old Shakopee Road	Old Shakopee Road to I-494
NB Highway 169	-	-	2-3 hours	1-2 hours
SB Highway 169	-	-	-	-
	I-494 to Highway 62	Highway 62 to Excelsior Boulevard	Excelsior Boulevard to I-394	I-394 to Highway 55
NB Highway 169	< 1 hour	< 1 hour	1-2 hours	-
SB Highway 169	-	-	1-2 hours	1-2 hours

Table 12: Traffic Characteristics – Duration of Congested Conditions During P.M. Peak

	CSAH 69 to Canterbury Road	Canterbury Road to Highway 101	Highway 101 to Old Shakopee Road	Old Shakopee Road to I-494
NB Highway 169	-	-	-	-
SB Highway 169	-	-	< 1 hour	2-3 hours
	I-494 to Highway 62	Highway 62 to Excelsior Boulevard	Excelsior Boulevard to I-394	I-394 to Highway 55
NB Highway 169	< 1 hour	1-2 hours	> 3 hours	> 3 hours

	CSAH 69 to Canterbury Road	Canterbury Road to Highway 101	Highway 101 to Old Shakopee Road	Old Shakopee Road to I-494
SB Highway 169	-	-	1-2 hours	1-2 hours

Time of Peak Hour Traffic Flow/Onset of Congestion

The time of the peak hour traffic flow provides an indication of when congestion begins and, in turn, when MnPASS operations would be warranted and most valuable. For example, if there is no congestion in the general purpose lanes, there is no reason to operate the MnPASS lane as a managed lane. As congestion begins in the general purpose lanes, the MnPASS lane provides a transit advantage and travel time reliability to users.

Due to the length of the corridor, the time of the highest hour of volumes in each peak (peak hour traffic flow) varies by location.

The a.m. peak hour starts between 6:15 a.m. and 7:15 a.m. on Highway 169. Earlier peak hours (6:15/6:30 a.m.) were observed in both northbound and southbound directions near I-394 and south of Old Shakopee Road, with later peaks (7:00/7:15 a.m.) happening between I-494 and I-394. The beginning of the peak hour across the study area network was observed to be 7:00 a.m., on average, based on detector-recorded traffic volumes.

During the p.m. peak period, a similar trend exists on the corridor, but the variance of the start of the peak hour is much greater. Near the center of the study area near Bren Road, the peak hour is observed to start at 4:00 p.m., while the north and south ends of the study corridors experience peak traffic between 2:15 p.m. and 3:15 p.m.

The p.m. peak hour has greater variability throughout the study area. This variation was attributed to a greater variety of trip purposes, volumes approaching capacity, and longer duration of peak traffic demand in the afternoon.

Table 13: Traffic Characteristics – A.M. Peak Hour Start Time

	CSAH 69 to Canterbury Road	Canterbury Road to Highway 101	Highway 101 to Old Shakopee Road	Old Shakopee Road to I-494
NB Highway 169	6:15	6:15	6:15	6:15
SB Highway 169	6:30	6:30	6:45	7:00
	I-494 to Highway 62	Highway 62 to Excelsior Boulevard	Excelsior Boulevard to I-394	I-394 to Highway 55
NB Highway 169	6:45	6:45	6:45	7:15
SB Highway 169	7:15	7:15	6:45	6:15

Table 14: Traffic Characteristics – P.M. Peak Hour Start Time

	CSAH 69 to Canterbury Road	Canterbury Road to Highway 101	Highway 101 to Old Shakopee Road	Old Shakopee Road to I-494
NB Highway 169	4:15	4:15	4:15	4:00
SB Highway 169	3:00	3:00	3:00	3:00
	I-494 to Highway 62	Highway 62 to Excelsior Boulevard	Excelsior Boulevard to I-394	I-394 to Highway 55
NB Highway 169	3:45	3:45	3:00	2:15
SB Highway 169	3:30	3:45	3:45	3:00

Freight Traffic

To better understand use of Highway 169 by freight carriers, heavy commercial traffic counts were reviewed for the study area. Heavy commercial traffic volumes are from the most recent available data on the MnDOT Traffic Mapping Analysis Tool (Draft 2014). These volumes are summarized in Table 15.

Available data suggests commercial vehicles comprise a significant percentage of traffic on Highway 169, particularly on the segment south of the Minnesota River. Average weekday commercial vehicle volumes along the Highway 169 corridor range from 3,000 to 6,000, while the daily percentage of traffic ranges from 4.5 to 9.7 percent. Between I-494 and Highway 55 the percentage of commercial vehicles ranges from 4.5 to 5.3 percent, while volumes between range from 6.2 to 9.7 percent from I-494 to Marschall Road.

Table 15: Share of Heavy Commercial Volumes on Highway 169

Roadway	Percent Passenger Car Share (volume)	Percent Heavy Commercial Vehicle Share (volume)
CSAH 69 to Canterbury Road	90.3%-92.6% (31,000-46,000)	7.4%–9.7% (3,000-3,400)
Canterbury Road to Highway 101	93.4% (68,000)	6.6% (4,500)
Highway 101 to Old Shakopee Road	93.8% (103,000)	6.2% (6,400)
Old Shakopee Road to I-494	93.4%-93.8% (90,000-97,000)	6.2%-6.6% (5,900-6,000)
I-494 to Highway 62	94.7%-94.8% (64,000-66,000)	5.2%-5.3% (3,300-3,500)
Highway 62 to Excelsior Boulevard	94.9%-95.1% (94,000-98,000)	4.9%-5.1% (4,800)
Excelsior Boulevard to I-394	94.9%-95.0% (97,000-106,000)	5.0%-5.1% (4,900-5,300)

I-394 to Highway 55	94.5%-95.0% (94,000-107,000)	4.5%-5.0% (4,200-5,300)

Congestion Levels and Bottleneck Locations

This analysis provides a detailed look at specific locations in the corridor that might be candidates for spot improvements. Bottlenecks are places where design, volume, or capacity issues cause congestion. Six causes of congestion were identified along the study corridor:

- Entering traffic
- Ramp-to-ramp weaving
- Substandard geometry
- Exit ramp capacity
- Lane drops
- Mainline weaving

These causes of congestion can lead to bottlenecks. Table 16 through

Table 19 list the locations, types, description, severity, and extent of the bottlenecks. Bottleneck locations were identified using a lane assignment technique that helps identify places where lane volume will overwhelm capacity, or capacity is reduced because of weaving movements.

Table 16: Northbound Highway 169 Bottleneck Locations – A.M. Peak

Location	Type/Cause	Description	Severity (Duration)	Extent
Highway 101 to Old Shakopee Road	Mainline Weaving	Entering volume from Highway 101 conflicts with volume exiting to Old Shakopee Road overloading right through lane	2-3 hrs	1.5 mi
Old Shakopee Road to Pioneer Trail	Ramp-to-Ramp Weave	Entering volume from Old Shakopee Road conflicts with volume exiting to Pioneer Trail overloading right through lane	1-2 hrs	0.75 mi
Anderson Lakes Pkwy	Entering Traffic	Entering volume from Anderson Lakes Pkwy conflicts with an overloaded right through lane as vehicles align themselves for the I-494 interchange	< 1 hr	1.75 mi
Lincoln Drive to I-394	Ramp-to-Ramp Weave	Several closely spaced interchanges with high entering and exiting volumes overload the right through lane at weave locations	< 1 hr	4 mi

Table 17: Southbound Highway 169 Bottleneck Locations – A.M. Peak

Location	Type/Cause	Description	Severity (Duration)	Extent
Plymouth Avenue to 16th Street	Ramp-to-Ramp Weave	Entering and exiting volume from I-394 overloads right through lane for both on ramps and for the I-394 eastbound (EB) off ramp	1-2 hrs	2 mi
Minnetonka Boulevard to Cedar Lake Road	Ramp-to-Ramp Weave	Entering volume from Cedar Lake Road conflicts with an overloaded right through lane as traffic is skewed into the right lane because of closely spaced interchanges	< 1 hr	1.5 mi
Cedar Lake Road to Excelsior Boulevard	Ramp-to-Ramp Weave	Over capacity at Highway 7 and the weave between Highway 7 and Excelsior Boulevard causes a higher percent of right lane volume to left lane volume.	< 1 hr	1.5 mi

Table 18: Northbound Highway 169 Bottleneck Locations – P.M. Peak

Location	Type/Cause	Description	Severity (Duration)	Extent
Highway 62 to Bren Road	Entering Volume	Entering volume from Bren Road overloads the right through lane which spills back and effects entering and exiting traffic from Highway 62	1-2 hrs	1mi
Bren Road to Highway 7	Ramp-to-Ramp Weave	High entering volume at Excelsior Boulevard and exiting volume at Highway 7 overloads the right through lane	1-2 hrs	1.5 mi
Highway 7 to Cedar Lake Road	Ramp-to-Ramp Weave	Several closely spaced interchanges with entering and exiting volumes overload the right through lane at weave locations	2-3 hrs	1.5 mi
Cedar Lake Road to Betty Crocker Drive	Entering Volume	High entering volume from I-394 eastbound (EB) and westbound (WB) overload the right through lane	> 3 hrs	1.5 mi
Betty Crocker Drive to Bass Lake Road	Ramp-to-Ramp Weave	Closely-spaced interchange ramps overload the right through lane at weave locations between I-394 and Bass Lake Road	> 3 hrs	6 mi

Table 19: Southbound Highway 169 Bottleneck Locations – P.M. Peak

Location	Type/Cause	Description	Severity (Duration)	Extent
Plymouth Avenue to Minnetonka Boulevard	Ramp-to-Ramp Weave	Right lane is overloaded from entering traffic from Cedar Lake Road and exiting traffic to Minnetonka Boulevard	1-2 hrs	3 mi
I-494 to	Entering Volume	Entering volume from EB and WB I-494 causes an overloaded right lane approaching the lane drop at Anderson Lakes Pkwy	2-3 hrs	0.5 mi
Anderson Lakes Pkwy to Old Shakopee Road	Over Capacity	2-lane section of roadway at Old Shakopee Road, Pioneer Trail, and Anderson Lakes Pkwy are all over capacity	2-3 hrs	4 mi
Old Shakopee Road to Highway 101	Lane Drop	Exiting volume to Highway 101 and Highway 13 overload the right lane because both exit lanes develop from the right lane.	1-2 hrs	0.5 mi

Travel Time Reliability

Travel time reliability measures the variability in travel time along a segment or corridor. Traffic measures often focus on average congestion, but ignore variability. Travel time reliability is important because the more travel times vary on a given route, the earlier travelers must leave to ensure on-time arrival. A congested but consistent commute is easier to plan for than a less congested but very unreliable commute.

This analysis of Highway 169 focuses on the reliability of a.m. and p.m. peak period travel times. Table 20 and Table 21 below summarize travel time reliability indices for eight segments (four in each direction) along Highway 169 from Highway 55 to CSAH 69. Table 20 includes reliability indices from the a.m. peak period from 6:00 to 9:00 and Table 21 covers the p.m. peak period from 3:00-6:00. Both tables are limited to Tuesday through Thursday to represent typical traffic condition during weekdays (Monday and Friday normally have different traffic patterns). The indices include:

- Planning Time Index (PTI): The PTI compares the 95 percent travel time to the free flow travel time. The 95 percent travel time can be thought of as ones worst commute during a month of commuting (five days per week).
- Average total peak period delay: The total delay of all vehicles during an average peak period, accounting for the severity of delay as well as the number of vehicles experiencing the delay.
- Reliability rating: The percentage of trips which are shorter than 1.25 times the free flow travel time in all conditions, in weather conditions, and in crash conditions.

Travel time and volume data consisted primarily of MnDOT loop detector data with supplemental data from the National Performance Management Research Data Set

(NPMRDS). Crash data came from the Minnesota Crash Mapping Analysis Tool (MnCMAT) and weather data from the National Oceanic and Atmospheric Administration (NOAA). The data was aggregated into 1- minute time intervals and analyzed using tools developed through the Strategic Highway Research Program 2 (SHRP 2).

Table 20: Highway 169 Travel Time Reliability during the a.m. Peak Period (06:00 – 09:00)

SB ↓

PTI	Delay (hr)	RR	Weather RR	Crash RR	Segment	PTI	Delay (hr)	RR	Weather RR	Crash RR
1.72	69	89%	78%	50%	MINNESOTA 55	1.64	56	89%	72%	38%
1.48	26	91%	78%	47%	Excelsior	1.80	71	88%	68%	14%
1.05	3	99%	93%	N/A	INTERSTATE 494	2.05	199	54%	37%	13%
1.22	16	95%	78%	47%	Old Shakopee	2.94	291	53%	36%	13%
					CH 69					

↑ NB

Table 21: Highway 169 Travel Time Reliability during the P.M. Peak Period (3:00 – 6:00)

SB ↓

PTI	Delay (hr)	RR	Weather RR	Crash RR	Segment	PTI	Delay (hr)	RR	Weather RR	Crash RR
1.33	44	92%	77%	33%	MINNESOTA 55	3.42	446	41%	19%	16%
2.30	78	89%	75%	67%	Excelsior	2.20	136	76%	51%	8%
2.06	162	66%	51%	50%	INTERSTATE 494	1.00	2	100%	99%	N/A
1.40	60	91%	81%	70%	Old Shakopee	1.30	39	95%	87%	50%
					CH 69					

↑ NB

Notes:
Date reflects Tuesday – Thursday conditions for a.m. and p.m. peak periods

Planning Time Index (PTI) = $\frac{TT_{95\%}}{TT_{FreeFlow}}$

Reliability Rating (RR) = $\frac{Trips_{TT<1.25*FFTT}}{Trips_{total}}$

Delay is the total delay (for all vehicles) during an average peak period in hours
N/A = Insufficient Data to generate reliability measures

The least reliable segments are bolded in Table 20Table 21. They include northbound Highway 169 between County Highway 69 and Excelsior Boulevard in the a.m. peak period; and in the p.m. peak period southbound between Excelsior Boulevard and Old Shakopee Road and northbound between I-494 and Highway 55. These segments all experience large amounts of delay and have reliability ratios below 70 percent. Crashes and weather conditions lead to reliability ratios generally under 50 percent for these segments.

The Minnesota River crossing is a bottleneck for a.m. peak period traffic heading northbound and for p.m. peak period traffic heading southbound. In addition, commuters experience heavy congestion approaching Anderson Lakes Pkwy from the south during the a.m. peak and approaching I-394 and Highway 55 from the south in the p.m. peak.

High Crash Areas

Crashes hurt people, cost money, and can disrupt highway operations, causing congestion. MnDOT strives to increase safety and reduce the number of crashes on the highway system. Crash patterns provide valuable insight into potential locations and types of projects that could improve traffic flow and safety.

A safety analysis was performed on the Highway 169 corridor within the study area. The Highway 169 corridor study area includes 24 interchanges, 11 of which are ranked in the top 200 statewide interchanges by crash cost in the *2013 MnDOT Interchange Crash Toolkit*. Two of these interchanges were in the top 50 highest crash cost interchanges.

The probability of crashes increases when congestion is present, driver confusion exists, and/or driver expectancy is not met. Two individual safety assessments of the corridors were completed using standard MnDOT reporting processes and covering crash data from the calendar years 2010 to 2014; the Mainline Assessment assesses crash density (crashes per mile per year) and crash rates, and the Interchange Assessment assess crash costs and crash rates.

Highway 169 Mainline Assessment

To evaluate the Highway 169 crash data and road characteristics, crashes were categorized into interchange or mainline segment clusters. Interchange clusters included all crash data in the interchange influence area including the freeway mainline, the ramps, and the ramp intersections. Segment clusters included mainline crash data between interchanges and for interchange clusters, where only the mainline crash data was included. The mainline assessment included calculating crash density and crash rates.

To avoid skewed crash rates due to analyzing short segments, crash data was aggregated into eight crash data segments along Highway 169. Table 22 provides a summary of the crash data characteristics within each of the crash data segments.

Results of the mainline assessment indicate that four of the Highway 169 segments have a crash rate greater than the average crash rate for segments with similar characteristics and two of the segments have a crash rate greater than the critical crash rate. It should be noted that a higher than average crash rate does not necessarily indicate a significant crash problem.

Therefore, the crash rates were compared to the critical crash rates to determine the statistical significance of the above average crash rates. If the calculated crash rate is below the critical crash rate, crashes that occurred are typically due to the random nature of crashes and are not necessarily the result of a geometric design issue. However, a crash rate that is greater than the critical crash rate indicates that there may be a geometric design or other issues and warrants further review or mitigation.

Table 22: Highway 169 Crash Data (2010 – 2014)

Segment #	Segment Extent	Length	Free-way Type	Total Crashes	AADT	Crash Density (Crashes/ Mi per Yr)	Crash Rate (Crashes per million VMT)	Crash Rate vs Average / Critical Crash Rate
1	I-394 through Highway 55	1.2	4-Lane Urban	296	87,000	49.3	1.55	> Critical
2	Excelsior Boulevard to I-394	3.4	4-Lane Urban	383	78,000	22.5	0.79	> Average < Critical
3	Highway 62 to Excelsior Boulevard	2.5	4-Lane Urban	308	69,000	24.6	.98	> Average < Critical
4	I-494 to Highway 62	2.4	4-Lane Urban	293	66,000	24.4	1.01	> Critical
5	Old Shakopee Road to I-494	3.6	4-Lane Urban	401	84,000	22.3	0.73	< Average
6	Highway 101 to Old Shakopee Road	1.4	6-Lane Urban	170	89,000	24.3	0.75	< Average
7	Canterbury Road to Highway 101	3.3	4-Lane Suburban	251	66,000	15.2	0.63	< Average
8	CSAH 69 to Canterbury Road	4.4	4-Lane Suburban	191	38,000	8.7	0.63	< Average

(1) Source: MnDOT Metro Traffic MnCMAT

(2) AADT represents weighted average along segment

Interchange Assessment

The interchange assessment reviewed corridor mainline crashes within the 24 interchange influence areas in the study area and included the freeway mainline, the ramps, and the ramp intersections. The analyses used the standardized assessment zones within the *2013 Transportation Information Systems database Critical Intersections/Interchanges crash spreadsheet*.

Table 23 identifies the 11 interchanges in the study area listed in the *2013 MnDOT Interchange Crash Toolkit*, which lists the top 200 highest-crash interchanges by crash cost. The collective crash costs for the 11 interchanges amount to an average of $18.56 million dollars per year from 2009-2013. Four interchanges within the study corridor have a crash rate greater than the critical crash rate. These interchanges listed in order of greatest crash cost were; I-494, CSAH 101, Canterbury Road, and CSAH 17.

Table 23: Highway 169 Corridor Interchanges Included in MnDOT Top 200 Interchanges Report for 2013

	Interchange Description	Approach Volume	Overall Rank	Crash Cost	K	A	B	C	PD	TOT	CR	FAR
494	HIGHWAY 169 /BLOOMINGTON	180,975	32	$2,481,400	0	0	21	82	325	428	**1.30**	0.00
394	HIGHWAY 169	205,310	50	$1,896,360	0	0	17	60	257	334	0.89	0.00
169	HIGHWAY 101 (SHAKOPEE)	82,811	58	$1,775,640	3	0	8	40	143	194	**1.28**	**1.98**
169	HIGHWAY 7/HOPKINS	117,288	93	$1,484,200	1	1	14	34	105	155	0.72	0.93
169	HIGHWAY 212 & HIGHWAY 62	152,119	119	$1,262,480	0	1	8	42	146	197	0.71	0.36
169	CSAH 21 (SHAKOPEE)	68,457	141	$1,125,760	1	1	8	24	102	136	1.09	**1.60**
169	CSAH 83 CANTERBURY BOULEVARD	75,344	144	$1,119,120	0	0	10	38	124	172	**1.25**	0.00
169	CSAH 3 EXCELSIOR BOULEVARD/HOPKINS	104,953	153	$1,061,200	1	1	7	24	80	113	0.59	1.04
169	HIGHWAY 55/GOLDEN VALLEY-PLYMOUTH	121,337	159	$1,038,400	0	1	8	31	115	155	0.70	0.45
169	CSAH 17 MARSCHALL ROAD/SHAKOPEE	63,172	176	$954,040	0	0	6	39	88	133	**1.15**	0.00
169	OLD SHAKOPEE ROAD/CSAH 1	88,620	199	$850,240	1	0	2	26	98	127	0.78	0.62

K: Fatal Crash; A: Incapacitation Injury Crash; B: Non-Incapacitation Injury Crash; C: Possible or Unknown Injury Crash; PD: Property Damage Only Crash;

TOT: Total Crashes within Intersection; CR: Intersection Crash Rate; FAR: Fatal and Severe Crash Rate; Crash period consists of 1,826 days (2009-2013)

Crash Cost based on FY 2014 MnDOT Crash Values with a value of 2 x A for Fatal Crashes

Market Analysis

The INRIX origin-destination data provides information on travel behavior and travel patterns that are difficult to observe from a single or even multiple locations. The data provides general characteristics about trips using the corridor, variations on travel patterns within the corridor, and patterns of trips that start or end near Highway 169. The data gives some indication of how effective certain kinds of improvements or solutions may be and where they could be located to optimally serve trips in the corridor.

Methodology

Data Sources

INRIX is a software/data company that provides historical and real-time traffic information, traffic forecasts, travel times and traffic counts. The origin-destination (O-D) data provided by INRIX indicate real-world traffic patterns along the Highway 169.

The time range of INRIX data used in this study is from February 2015 to April 2015. The data include individual trip information such as providers, types of vehicle, trip origins, trip destinations, etc. In addition, the detailed trip path was provided in the format of XY coordinates and time. The time intervals were usually from 5 seconds to 3 minutes, giving detailed accounts of trip destinations and travel times.

Using the INRIX data, several analyses were conducted to better understand the travel patterns of the corridor, major origins and destinations, and station area activities. This could facilitate modeling, validation and design of the proposed Highway 169 alternative improvements under consideration.

Travel Pattern Investigation

The availability of traveler origin and destination data presents an opportunity to answer detailed questions about current travel patterns around the Highway 169 study area. Analysis of the data provides several types of information with application to the study:

- Travel patterns trips on a given segment, such as the Bloomington Ferry Bridge, and their origins and destinations in both directions and during peak and off-peak periods. This information contributes to determination of appropriate managed lane or transitway termini and validation of the traffic model's prediction of zonal activity.
- The number of drivers that are avoiding congestion on Highway 169 by using other roads and highways, and which roads and highways these travelers use, which allows for an estimate of potential trips attracted to Highway 169 if capacity was expanded.

- On- and off-ramp travel patterns along Highway 169 in each direction during the morning and afternoon peak periods. This information helps to identify segments of Highway 169 with predominately longer trip lengths that may be appropriate for managed lanes, or locations with large proportion of short trips traveling only a few interchanges before exiting.
- Locations where traveler destinations are clustered in the corridor and how many trips are going to various locations. This information aids in refining proposed transitway station locations and targeting project outreach.
- Incoming and outgoing trips within a given distance of possible transitway station locations, which help to determine the relationship between travel patterns and proposed transitway station locations and refine station locations as appropriate.
- Travel patterns along potential transit stations for Green Line and American Boulevard Arterial BRT service that shows the relationship between travel patterns and proposed transitways connecting to potential Highway 169 transit service.

Each of these data analyses is detailed in the following sections.

Travel Patterns using Bloomington Ferry Bridge

Figure 13Figure 14 show the travel pattern across the Bloomington Ferry Bridge for both directions in the a.m. peak period. Of the trips using northbound Highway 169 at the bridge during the a.m. peak hour, 39 percent are from the Highway 169 mainline and 53 percent are merging trips from CSAH 21 and Highway 101 in the south, 6 percent are from Highway 101 to the north, and 2 percent are from other locations. North of the river, 32 percent of trips are taking I-494 east and west to reach their final destinations while the majority (46 percent) stay on Highway 169 north of Highway 62. 18 percent of the trips end at other local destinations along the corridor (referred to in the figures as the percent "remaining").

Figure 13: A.M. Peak Hour Northbound Travel Pattern

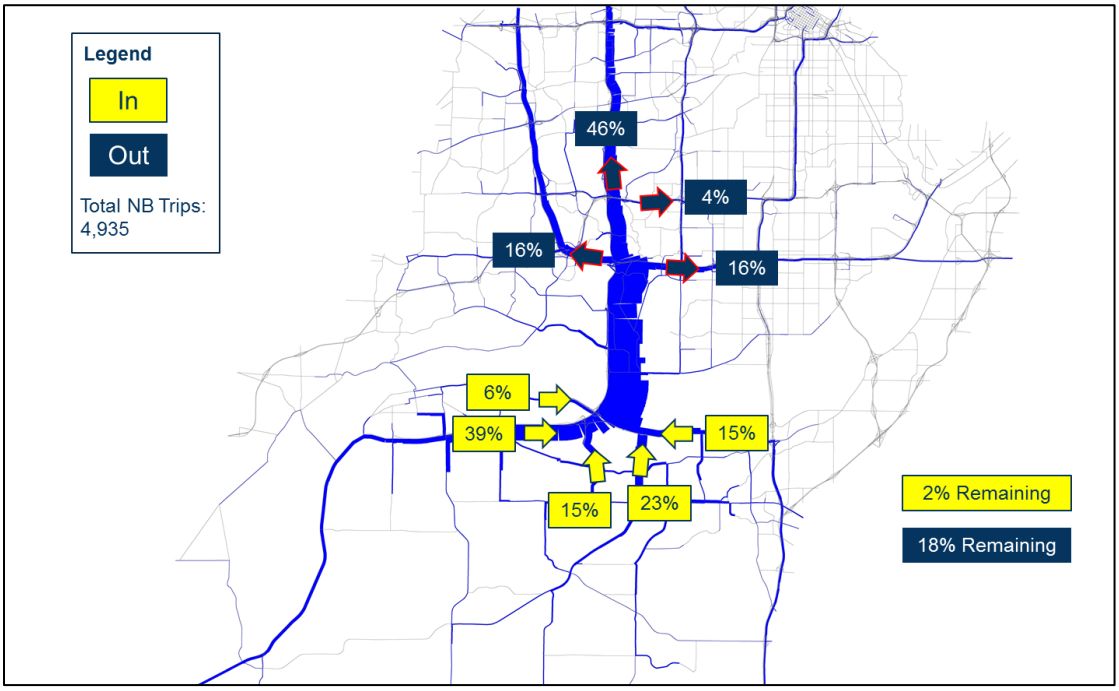
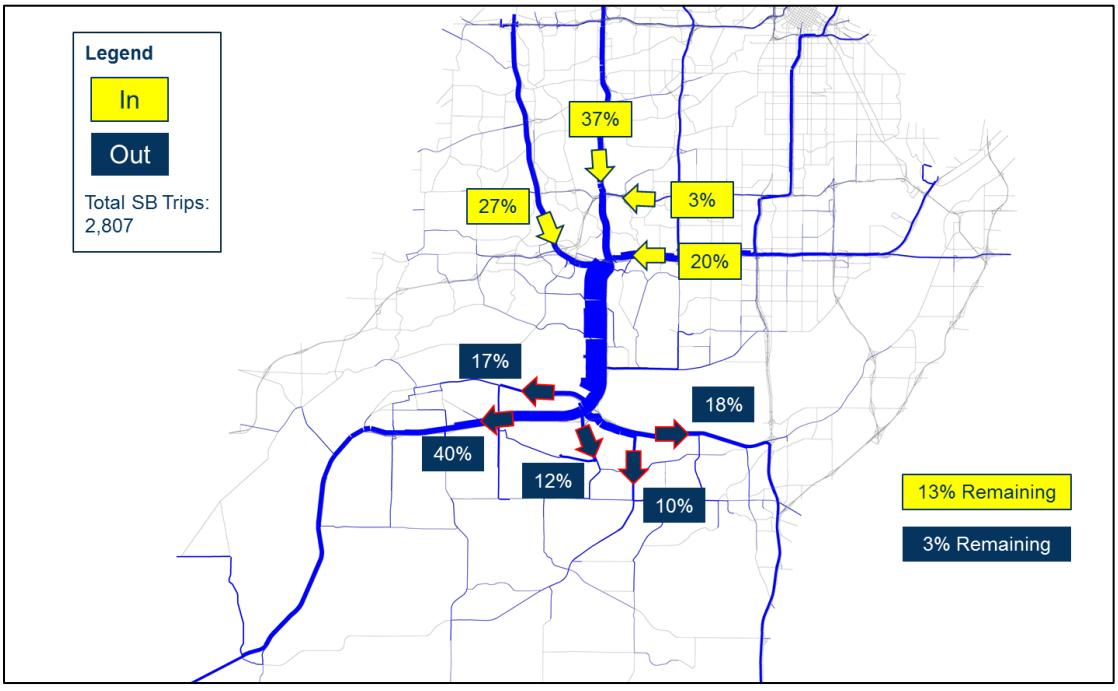


Figure 14: A.M. Peak Hour Southbound Travel Pattern



During the p.m. peak period, southbound traffic mirrors the northbound a.m. peak traffic with 36 percent of trips from the Highway 169 mainline and 38 percent from I-494. A larger percentage (24 percent) of locally originating trips was also observed (referred to in the

figures as the percent "remaining"). Once they pass the bridge, 38 percent of trips stay on Highway 169 and 54 percent take Highway 13 and CSAH 21, as displayed in Figure 15 and Figure 16.

Figure 15: P.M. Peak Hour Northbound Travel Pattern

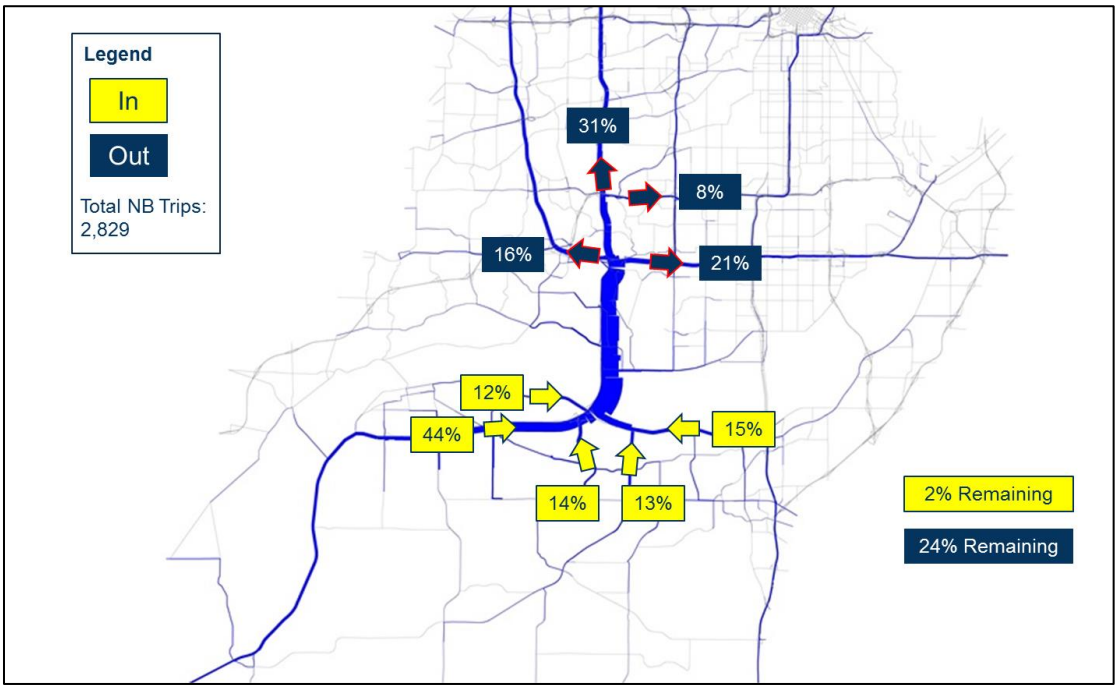
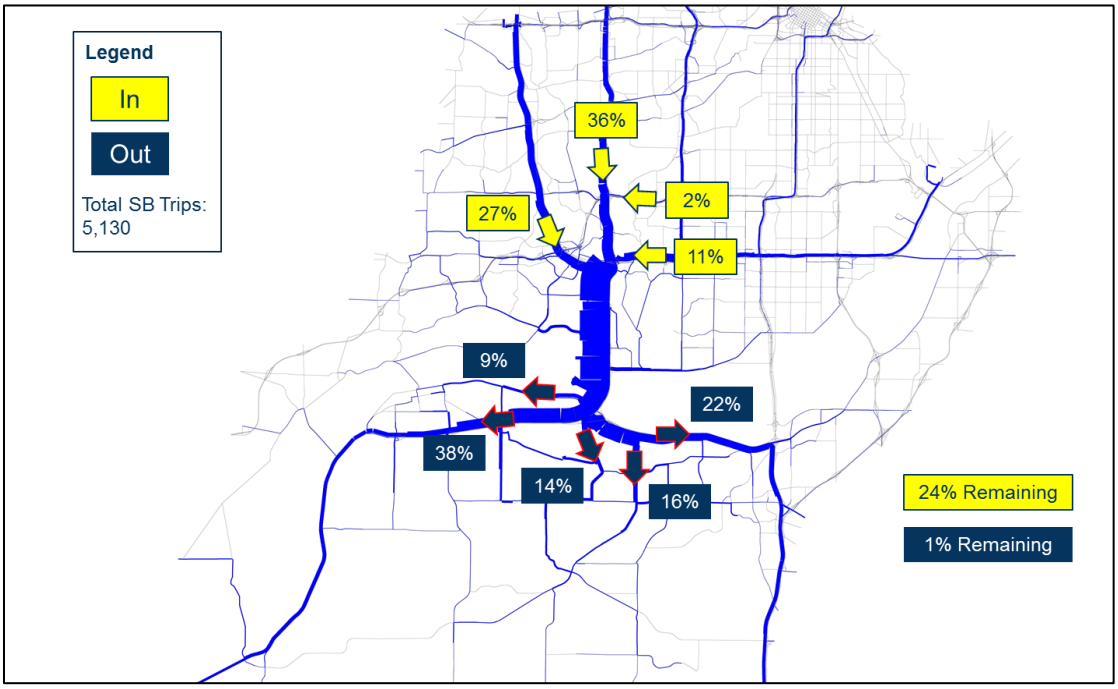


Figure 16: P.M. Peak Hour Southbound Travel Pattern

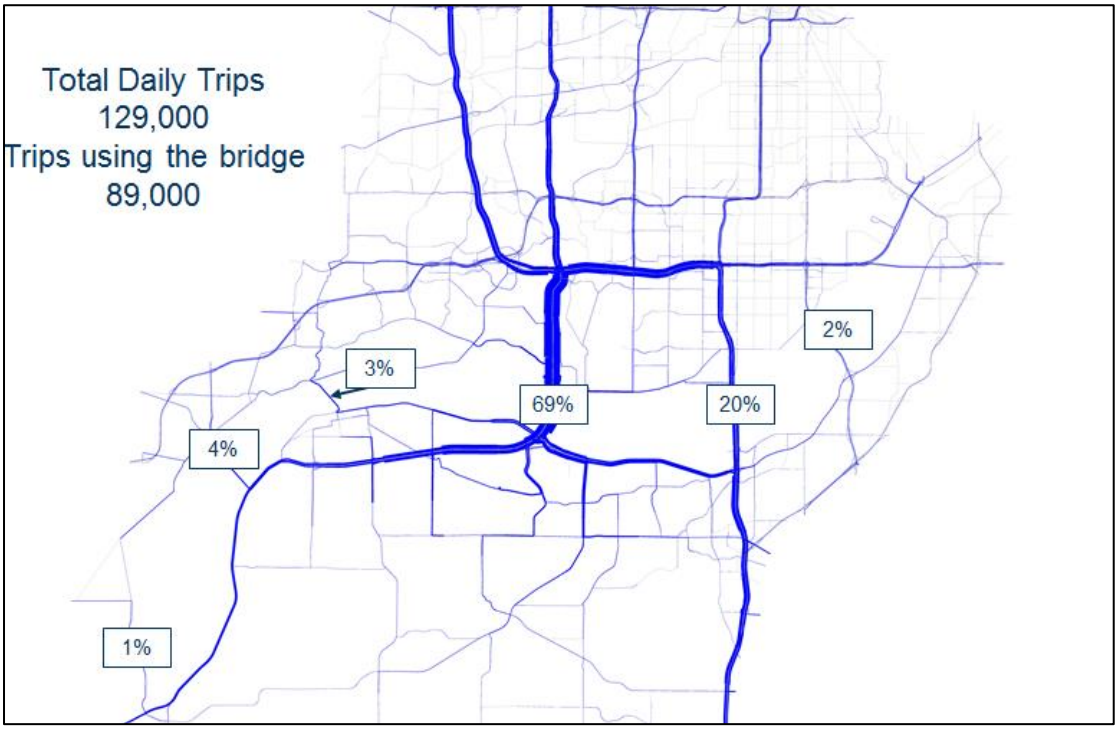


Travel patterns in the off-peak directions (southbound in a.m. and northbound in p.m.) are similar to their peak direction counterparts with traffic more evenly dispersed among major entrances and exits. The influence of CSAH 21 and Highway 101 is diminished for the reverse commute travel patterns, illustrating a stronger draw to employment centers along Highway 169 in Shakopee rather than residential areas around Prior Lake.

Highway 169 River Bridge Diversion

In addition to traveling on the Highway 169 Bloomington Ferry Bridge, there are other alternatives that could serve same trip origins and destinations. Figure 17 shows that while the majority of trips (69 percent) use the Bloomington Ferry Bridge, a significant percentage (20 percent) take I-35W. A small number of trips use other bridge facilities to cross the Minnesota River. The amount of diverted traffic is important because it represents the number of potential trips that could be attracted to Highway 169 if improvements were to reduce congestion. The analysis shows that 129,000 vehicles use the bridge each day, a maximum of an additional 40,000 trips might choose to if the Highway were improved.

Figure 17: Alternative Routes to Highway 169 Bloomington Ferry Bridge



On-ramp and Off-ramp Travel Pattern along Highway 169

A ramp-to-ramp analysis was conducted to better understand the movements between important entrances and exits along Highway 169. Trips are tracked based on where they get on the freeway and where they get off using the routing information from INRIX Origin-Destination data. Key observations include:

In the a.m. peak:

- 30 percent of the ramp-to-ramp trips travel along the segment of Highway 169 south of I-494 (including I-494 ramps); 34 percent travel the segment north of Highway 62.
- Heavy and balanced ramp to ramp movements are observed between I-494 and Highway 101, meaning that a near equal number of vehicles are coming to and from I-494 and Highway 101.
- Heavy ramp-to-ramp movements are observed from/to I-394 and Highway 101 with trips from I-394 almost double the opposite movement
- 15 percent of Highway 169 freeway traffic uses ramps next to each other

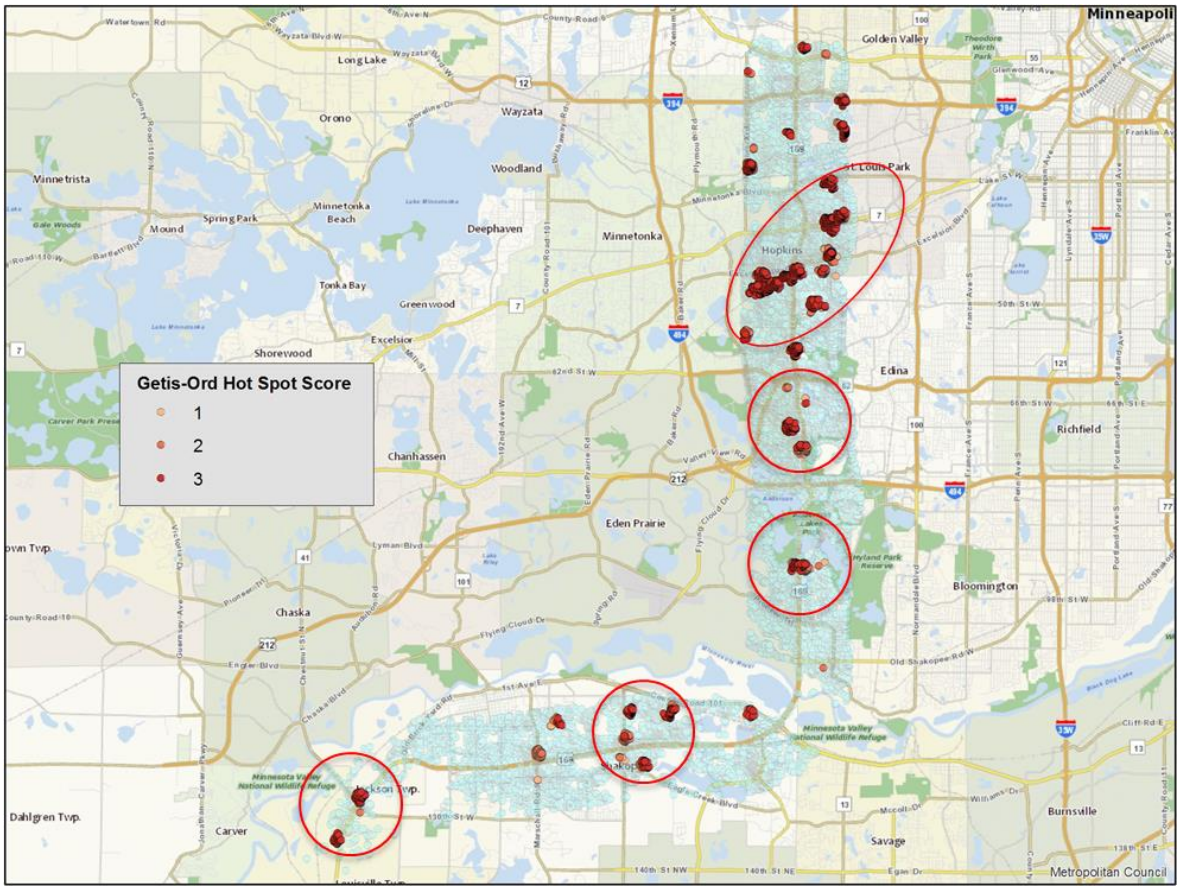
In the p.m. peak:

- 35 percent of the ramp-to-ramp trips travel along the segment of Highway 169 south of I-494 (including I-494 ramps) and 32 percent travel the segment north of Highway 62.
- Heavy ramp-to-ramp movements are observed from/to I-494 and Highway 101 with trips from I-494 almost double the opposite movement
- Heavy ramp-to-ramp movements are observed from/to I-394 and Highway 55 with trips from I-394 almost double the opposite movement
- 17 percent of Highway 169 freeway traffic uses ramps next to each other
- Very strong ramp movements are observed between Canterbury Road and CSAH 21 and from Bren Road to Highway 62 (both are adjacent interchanges)

Corridor Trip Cluster Analysis

A cluster analysis was conducted in ArcGIS based on the INRIX O-D data to identify key destination locations within a half mile of Highway 169. The top five locations identified include: Highway 41 intersection area, Canterbury Road interchange area, Anderson Lake Pkwy interchange area, Valley View Road area, Excelsior Boulevard and Highway 7 area. See Figure 18 where darker colors represent denser concentration of trips.

Figure 18: Corridor Trip Clusters



Transitway Station Area Trip Travel Pattern

Trips starting or ending near proposed highway BRT stations (as proposed in the Metropolitan Council's 2014 *Highway Transitway Corridor Study*) were isolated to understand travel patterns to, from, and within station areas. A half-mile radius buffer was defined for station locations in this analysis. Bren Road along with Excelsior Road and Marschall Road station areas attract the most trips while Marystown Road and Old Shakopee Road each account for less than 1 percent of total trips.

Table 24: Transitway Station Area Trip Travel Pattern

Transit Station Location	# of Trips	% of Total Trips	# of Trips Over Bridge	% of Station Trips Over Bridge
Cedar Lake Rd	5,850	3.6%	30	0.5%
Minnetonka Blvd	5,200	3.2%	143	2.8%
MN7	14,300	8.9%	198	1.4%
Excelsior Blvd	22,300	13.9%	1,093	4.9%
Interlachen Rd	8,350	5.2%	441	5.3%
Bren Rd	34,650	21.5%	706	2.0%

Transit Station Location	# of Trips	% of Total Trips	# of Trips Over Bridge	% of Station Trips Over Bridge
Valley View Rd	13,500	8.4%	856	6.3%
Anderson Lakes Pkwy	9,400	5.8%	1,108	11.8%
Pioneer Trail	4,900	3.0%	613	12.5%
Old Shakopee Rd	1,500	0.9%	212	14.1%
MN 21 (Southbridge Crossing Park & Ride)	9,650	6.0%	3,369	34.9%
Canterbury Rd	8,900	5.5%	2,756	31.0%
Marschall Rd	21,000	13.1%	4,460	21.2%
Marystown Rd	1,400	0.9%	226	16.1%
Total Trips	**160,900**	**100%**	**16,211**	**10.1%**

Green Line and American Boulevard Arterial BRT Trip Travel Patterns

Two major transitway services are identified that might closely interact with Highway 169 corridors: the Green Line Light Rail Transit (LRT) and American Boulevard Arterial BRT. Trips starting or ending near these transitway stations were identified to analyze their travel patterns. Table 25 shows the modest percentage of total trips to each station area that use the Highway 169 Bloomington Ferry Bridge. Green Line stations west of Highway 169 are identified to have the strongest interaction with Highway 169 corridor.

Table 25: Green Line and American Boulevard ABRT Trip Travel Patterns

Transitway	Total Trips starting or ending within 0.5 miles of transitway stations	Percentage of total trips that travel across the Highway 169 bridge
Green Line West of Highway 169	126,900	4.1%
Green Line East of Highway 169	103,200	1.4%
American Boulevard ABRT	127,200	2.5%