Technical Memo 6: Hwy 169 BRT Transit Service Plan and O&M Costs

Highway 169 Mobility Study

Draft

Prepared for: Minnesota Department of Transportation

SRF Consulting Group, Inc. | Engineers Planners Designers

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Introduction

This technical memorandum provides detailed descriptions of bus rapid transit (BRT) service plans and proposed supporting background bus service changes for alternatives being considered in this Mobility Study. Estimates of service requirements are presented for the two build alternatives being considered. Annual operating and maintenance (O&M) cost methodology and results are also presented.

Highway 169 BRT Alternatives

There are two BRT alignments being evaluated in this study. Both alignments begin at the Marschall Road Transit Station in Shakopee, and assume highway BRT service to downtown Minneapolis. The first alternative assumes service along Highway 169 and I-394. The second alternative assumes service along Highway 169 and Highway 55.

Proposed Station Locations

Proposed stop locations are as follows:

- *Marschall Road Transit Center* – This existing facility is proposed as the southern terminus for BRT service. Northbound service will be able to access the existing slip ramp from the transit station to the Highway 169 off-ramp. Southbound service assumes a new slip ramp from Marshall Road into the transit station (to avoid the need to travel further south to 17th Avenue).
- *Seagate/12th Street* - This stop is located on the Seagate property along 12th Avenue (across from Canterbury Park). Buses will access this stop from Highway 169 via Canterbury Road and 12th Avenue.
- *Southbridge Park-and-Ride* – BRT service will include a stop at this existing facility. Northbound buses will access the stop via Highway 21 and a new left turn lane onto Hansen Avenue. After stopping at the park-and-ride, northbound buses will be able to continue north on Stagecoach Road to use the existing bus-only ramp onto Highway 169. Southbound buses will access the stop via Highway 21 and the proposed new left turn lane onto Hansen Avenue. Return access to Highway 169 is via this same alignment.
- *Pioneer Trail* – BRT stops are proposed in both directions along Highway 169 entrance ramps at Pioneer Trail.
- *Viking Drive/Washington Avenue* – BRT stops are proposed on Viking Drive, just east of Washington Avenue. Buses will access this stop via existing Highway 169 on/off ramps. Southbound buses will use the existing Viking Drive exit ramp. Northbound buses will return to Highway 169 via the existing Highway 169 frontage road to the Valley View Road interchange.
- *Bren Road* – BRT stops are proposed in both directions along Highway 169 entrance ramps at Bren Road.
- *Downtown Hopkins* – A BRT stop is proposed at the Green Line Extension's Downtown Hopkins Station. Buses will access this stop via Excelsior Boulevard. Buses will need to loop around 9th Avenue, 1st Street and 8th Avenue to access the station.

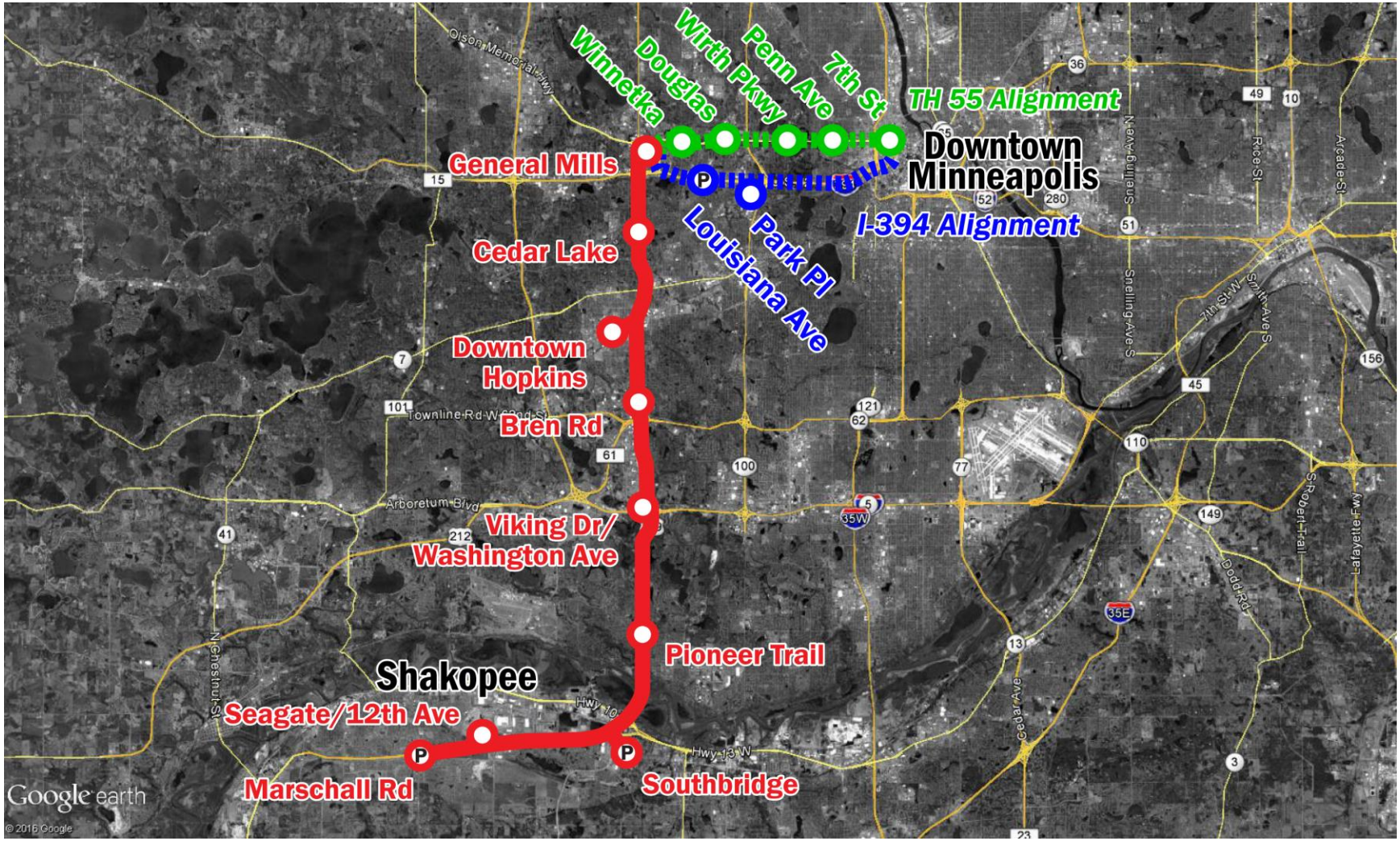
- *Cedar Lake Road* – Station assumptions at this location are dependent on proposed MnPASS lane concepts. Presently, on-line stops are assumed along new interchange ramps at this location.
- *General Mills* – A BRT stop is proposed at the north end of the General Mills parking lot, off Betty Crocker Drive.
- *Louisiana Avenue (I-394 alignment)* – Eastbound buses are assumed to use the existing off-ramp transit stop. A new stop is assumed on the I-394 on-ramp for westbound buses.
- *Park Place (I-394 alignment)* – Eastbound buses are assumed to stop on the I-394 on-ramp adjacent to an existing small park-and-ride lot. Eastbound buses could then use Wayzata Boulevard to access I-394 MnPASS lanes at Highway 100 when they are open, or continue east on I-394 shoulders or general purpose lanes. Westbound buses are assumed to use a new stop on the I-394 westbound on-ramp.
- *Winnetka Avenue (Highway 55 alignment)* – Stops are assumed west of Winnetka Avenue, near the existing pedestrian bridge.
- *Douglas Drive* – Far side stops are assumed at this intersection.
- *Theodore Wirth Parkway* – Far side stops are assumed at this intersection.
- *Penn Avenue* – A far side stop is assumed in the eastbound direction and a nearside stop is assumed in the westbound direction. Stops are located for convenient transfers to/from the proposed Penn Avenue LRT station.
- *7th Street* – Curbside stops are assumed along 7th Street, just north of 5th Avenue.

In addition to the stops listed above, downtown stops are proposed at the following locations:

- Glenwood Avenue (Highway 55 alignment option only)
- 6th Street/Hennepin Avenue
- 6th Street/Nicollet Mall
- 6th Street/3rd Avenue
- 4th Avenue, between 6th and 7th Streets (inbound routing terminus/outbound routing starting point)
- 7th Street/3rd Avenue
- 7th Street/Nicollet Mall
- 7th Street/Hennepin Avenue
- 7th Street/Twins Way (Highway 55 alignment option only)
- Hawthorne Avenue/9th Street (I-394 alignment option only)

Figure 1 illustrates the two proposed alignment options and station locations.

Figure 1. Proposed BRT Alignments and Station Locations



BRT Operating Plan

The BRT operating plan assumes one route pattern that makes all station stops. Proposed frequencies are 10 minutes in the peak periods, 15 minutes in the midday and evening periods, and 30 minutes in the late evening and weekend early morning periods. A span of 18 hours is proposed seven days a week to accommodate employment in the Shakopee area with seven-day-a-week shift work. Proposed frequencies and span of service meet specifications in Metropolitan Council's Regional Transitway Guidelines. Table 1 presents the proposed BRT operating plan.

Table 1. BRT Operating Plan

Service Day	Time Period	Time Span	Hours	Frequency
Weekdays	Early	5:00 – 6:00 a.m.	1.0 hours	15 min.
	AM Peak	6:00 – 8:30 a.m.	2.5 hours	10 min.
	Midday	8:30 a.m. – 3:30 p.m.	7.0 hours	15 min.
	PM Peak	3:30 – 6:00 p.m.	2.5 hours	10 min.
	Evening	6:00 – 8:30 p.m.	2.5 hours	15 min.
	Late Evening	8:30 – 11:00 p.m.	2.5 hours	30 min.
Weekends	Morning	5:00 – 8:30 a.m.	3.5 hours	30 min.
	Midday	8:30 a.m. – 6:30 p.m.	10.0 hours	15 min.
	Evenings	6:30 – 11:00 p.m.	4.5 hours	30 min.

BRT Travel Time Estimates

Station-to-station travel time estimates were developed for both the I-394 and Highway 55 alignment alternatives.

- A 1.5 mphps acceleration rate and 2.0 mphps deceleration rate was used in the development of travel time estimates.
- Pre-boarding fare payment is assumed at all stations. For the peak periods, 15 to 20 second average dwells were assumed at all BRT station stops based on anticipated passenger volume. During non-peak periods, 15 second dwells were assumed at all stops.
- Average traffic signal delays were assumed to be 30 to 45 seconds, depending on the intersection.
- Maximum off-peak speeds generally reflect posted speed limits.
- Peak period speeds along Highway 169 reflect speed data from MnDOT loop detectors.

BRT use of potential MnPASS lanes was not assumed because BRT buses are entering and exiting Highway 169 frequently and thus would not be able to use proposed MnPASS lanes. Station-to-station travel time estimates are presented in Appendix A. Table 2 summarizes one-way trip travel time estimates by time period.

Table 2. BRT Travel Time Estimate Summary

Alignment Option	Time Period	Northbound	Southbound
I-394 Alignment	AM Peak	1:28:40	1:22:14
	PM Peak	1:26:58	1:27:34
	Off-Peak	1:19:11	1:18:26
Hwy 55 Alignment	AM Peak	1:39:45	1:29:40
	PM Peak	1:37:52	1:33:32
	Off-Peak	1:32:08	1:26:44

BRT Operating Requirements

Travel times presented above were applied to the proposed service plan to determine peak and fleet BRT bus requirements and estimates of revenue bus-hours and bus-miles of service. Table 3 presents those estimates for each alignment option. Bus requirements by time period assume a minimum 15 percent layover in the round trip cycle time. As noted in this table, the I-394 alignment option requires 21 peak and 26 fleet buses (20 percent spare ratio). The Highway 55 alignment option requires 23 peak and 28 fleet buses.

Table 3. BRT Operating Plan and Statistics

I-394 Alignment Option	AM Pk Rnd Trip Dist. (Mi.)	AM Pk Rnd Trip Time (min.)	Midday Rnd Trip Dist. (Mi.)	Midday Rnd Trip Time (min.)	PM Pk Rnd Trip Dist. (Mi.)	PM Pk Rnd Trip Time (min.)	Service Frequency AM	Mid	PM	Eve	Late
Monday-Friday Service	63.48	170.90	63.10	157.62	63.10	174.53	10	15	10	15	30
Saturday Service	63.10	157.62	63.10	157.62	63.10	157.62	30	15	15	30	30
Sunday Service	63.10	157.62	63.10	157.62	63.10	157.62	30	15	15	30	30

TH 55 Alignment Option	AM Pk Rnd Trip Dist. (Mi.)	AM Pk Rnd Trip Time (min.)	Midday Rnd Trip Dist. (Mi.)	Midday Rnd Trip Time (min.)	PM Pk Rnd Trip Dist. (Mi.)	PM Pk Rnd Trip Time (min.)	Service Frequency AM	Mid	PM	Eve	Late
Monday-Friday Service	63.19	189.42	63.19	178.87	63.19	191.40	10	15	10	15	30
Saturday Service	63.19	178.87	63.19	178.87	63.19	178.87	30	15	15	30	30
Sunday Service	63.19	178.87	63.19	178.87	63.19	178.87	30	15	15	30	30

I-394 Alignment Option	Vehicles Max	Vehicles Total	Daily Rev. Bus-Mi's	Daily Rev. Bus-Hrs	Annual Rev. Bus-Miles	Annual Rev. Bus-Hrs	Bus Requirements AM	Mid	PM	Eve	Late
Monday-Friday Service	21	26	4,864	256.5	1,240,400	65,400	20	13	21	13	7
Saturday Service	n/a	n/a	3,534	186.0	183,700	9,700	7	13	13	7	7
Sunday Service	n/a	n/a	3,534	186.0	204,900	10,800	7	13	13	7	7
ANNUAL	**21**	**26**			**1,629,000**	**85,900**					

TH 55 Alignment Option	Vehicles Max	Vehicles Total	Daily Rev. Bus-Mi's	Daily Rev. Bus-Hrs	Annual Rev. Bus-Miles	Annual Rev. Bus-Hrs	Bus Requirements AM	Mid	PM	Eve	Late
Monday-Friday Service	23	28	4,866	277.0	1,240,700	70,600	22	14	23	14	7
Saturday Service	n/a	n/a	3,539	196.0	184,000	10,200	7	14	14	7	7
Sunday Service	n/a	n/a	3,539	196.0	205,200	11,400	7	14	14	7	7
ANNUAL	**23**	**28**			**1,629,900**	**92,200**					

Connecting Bus Service Plan Assumptions

Several changes were recommended to background bus service to improve connections at proposed Highway 169 BRT stations. The background bus network assumes the following major transit improvements to be in place by 2040 as part of a "No-Build" condition (this project's Horizon Year):

- Green and Blue Line LRT Extension and Orange Line Projects
- Penn Avenue and Chicago/Fremont ABRT
- Background bus changes build from Green and Blue Line LRT Extension bus service plans
- No changes to Highway 169 Corridor Express Bus Services, with exception of express buses being able to use proposed MnPASS lanes

Other proposed changes specific to routes that operate in the Highway 169 corridor are as follows. Figures 2 through 8 at the end of this section illustrate route alignments in the Highway 169 corridor.

MVTA Routes

Route 495 – No changes are proposed to this route. Route 495 will have a connection to Highway 169 BRT service at the Marschall Road Transit Station.

Route 496 – This is a new route assumed for purposes of this study. This route provides a direct connection between the Amazon distribution facility in Shakopee and the Marschall Road Transit Station. Proposed frequencies are 30 minutes in the peak periods and 60 minutes in the midday period, weekdays only.

Route 497 – This existing route is anchored at the Marschall Road Transit Station and provides circulator service in Shakopee. No changes are proposed to this route's alignment. Service frequencies, however, are assumed to be improved to 30 minutes in the peak periods, 60 minutes in the midday period, with weekend service at 60 minutes.

Route 498 – This is a new route assumed for purposes of this study. This route replaces portions of service presently provided by Route 499. Proposed frequencies are 30 minutes in the peak periods and 60 minutes in the midday period, weekdays only. Route 498 has connections to BRT service at the Marschall Road Transit Station and the Seagate/12th Avenue Station.

Route 499 – This existing route's alignment is modified to provide more direct service between the Marschall Road Transit Station, the Seagate/12th Avenue Station and the Southbridge Crossings park-and-ride Station. Service frequencies are assumed to be

improved to 30 minutes in the peak periods, 60 minutes in the midday period, with weekend service at 60 minutes.

Southwest Transit Routes

Route 632 – This is a new route proposed in the Green Line Extension bus service plans. This route will provide service between the Southwest Transit Station and the Eden Prairie Town Center. For purposes of this study, this route is assumed to be extended to the proposed Viking Drive/Washington Avenue BRT Station. No changes are assumed to route frequencies (30 minutes in the peak period and 60 minutes in the midday period, weekdays only).

Metro Transit Routes

Route 42 – This existing route presently has limited service (one a.m. and one p.m. trip) to Opportunity Partners, located along Smetana Drive. For purposes of this study, it is assumed that Route 42 service is expanded with all trips operating to this location, resulting in approximate 30-minute all-day frequencies (weekdays only). This route connects to Highway 169 BRT service at the Bren Road Station.

Route 542 – This existing route serves the American Boulevard corridor. For purposes of this study, it is assumed this route is extended west to the Viking Drive/Washington Avenue BRT Station. Proposed frequencies are 30 minutes in the peak periods and 60 minutes in the midday period, weekdays only.

Route 547 – This is a new route assumed for purposes of this study. This route provides east-west service between the proposed Pioneer Trail BRT Station and the South Bloomington Transit Center, thus providing a connection to the proposed Orange Line. Proposed frequencies are 30 minutes in the peak periods and 60 minutes in the midday period, weekdays only.

Other Metro Transit routes that will connect to Highway 169 BRT service with no required alignment or frequency changes are as follows:

- Routes 630N and 630S – proposed circulator routes in the Green Line Extension bus service plans. Routes will have a connection to Highway 169 BRT service at Viking Drive/Washington Avenue.
- Route 615 – Green Line Extension service plans result in this route connecting to Highway 169 BRT service at Bren Road and at Downtown Hopkins.
- Route 615 – This new route in the Green Line Extension service plans will have transfer opportunities to Highway 169 BRT service at Bren Road.
- Routes 605, 612, 614 and 664 – These routes from the Green Line Extension bus service plans will have transfer opportunities to Highway 169 BRT service at Downtown Hopkins.

- Routes 9, 643 and 663 – These routes from the Green Line Extension bus service plans will have transfer opportunities to Highway 169 BRT service at the Cedar Lake Station.
- Route 675 – This route will have transfer opportunities to Highway 169 BRT service at the General Mills BRT Station.

Several other Metro Transit routes will have transfer opportunities to Highway 169 BRT service at the Louisiana Avenue and Park Place stations (I-394 alignment option) and at stations along Highway 55 (Highway 55 alignment option).

Plymouth Transit

Route 740 – This route presently operates peak period only, terminating at the Station 73 park-and-ride lot. For purposes of this study it is assumed this route is extended to the General Mills Station with all-day service (30 minutes in the peak periods and 60 minutes in the midday period).

Other Routes

Mystic Lake Shuttle – All-day service is assumed between the Marschall Road Transit Station and the Mystic Lake Casino. Assumed frequencies are 30 minutes all day.

Service Requirements

Table 4 presents estimates of service requirements for each corridor route with proposed alignment and/or frequency changes. As noted below, proposed changes to the background bus service are estimated to result in the need for 11 additional buses for peak period service (14 fleet buses with a 20 percent spare ratio).

Table 4. Estimates of Bus Statistics for Background Bus Service Changes

		Est'd. Existing Statistics			Est. Future Statistics			Net Change		
Operator	Route	Rev. Hrs.	Rev. Miles	Pk Bus	Rev. Hrs.	Rev. Miles	Pk Bus	Rev. Hrs.	Rev. Miles	Pk Bus
MVTA	496	0	0	0	2,772	45,461	1	2,772	45,461	1
MVTA	497	4,032	50,400	1	6,864	85,800	2	2,832	35,400	1
MVTA	498	0	0	0	4,788	54,583	2	4,788	54,583	2
MVTA	499	4,032	91,123	2	6,864	120,120	2	2,832	28,997	0
Plymouth	740	2,016	16,531	2	6,804	92,534	3	4,788	76,003	1
SW Transit	632	2,835	22,680	1	5,670	45,360	2	2,835	22,680	1
Metro Transit	46*	19,109	236,678	5	25,704	259,610	6	6,595	22,932	1
Metro Transit	542	5,872	70,812	3	9,072	104,328	4	3,200	33,516	1
Metro Transit	547	0	0	0	6,804	90,720	3	6,804	90,720	3
Totals		**37,896**	**488,225**	**14**	**75,342**	**898,517**	**25**	**37,446**	**410,292**	**11**

Note: Route 46 statistics are for weekday service only, since only weekday service is proposed to be extended.

Figure 2. Shakopee/Southbridge Area Routes

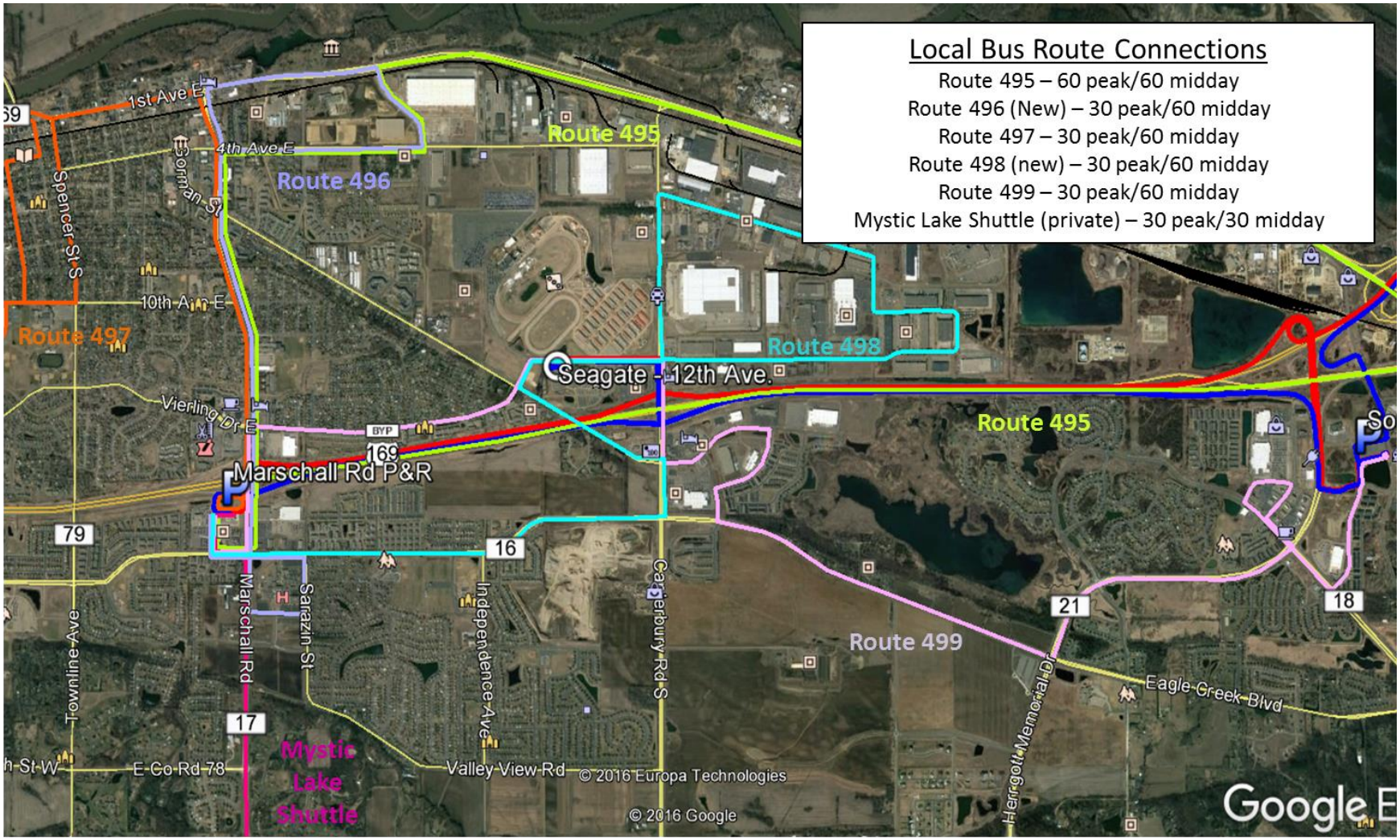


Figure 3. Pioneer Trail Area Routes

Figure 4. Viking Drive/Washington Avenue Area Routes

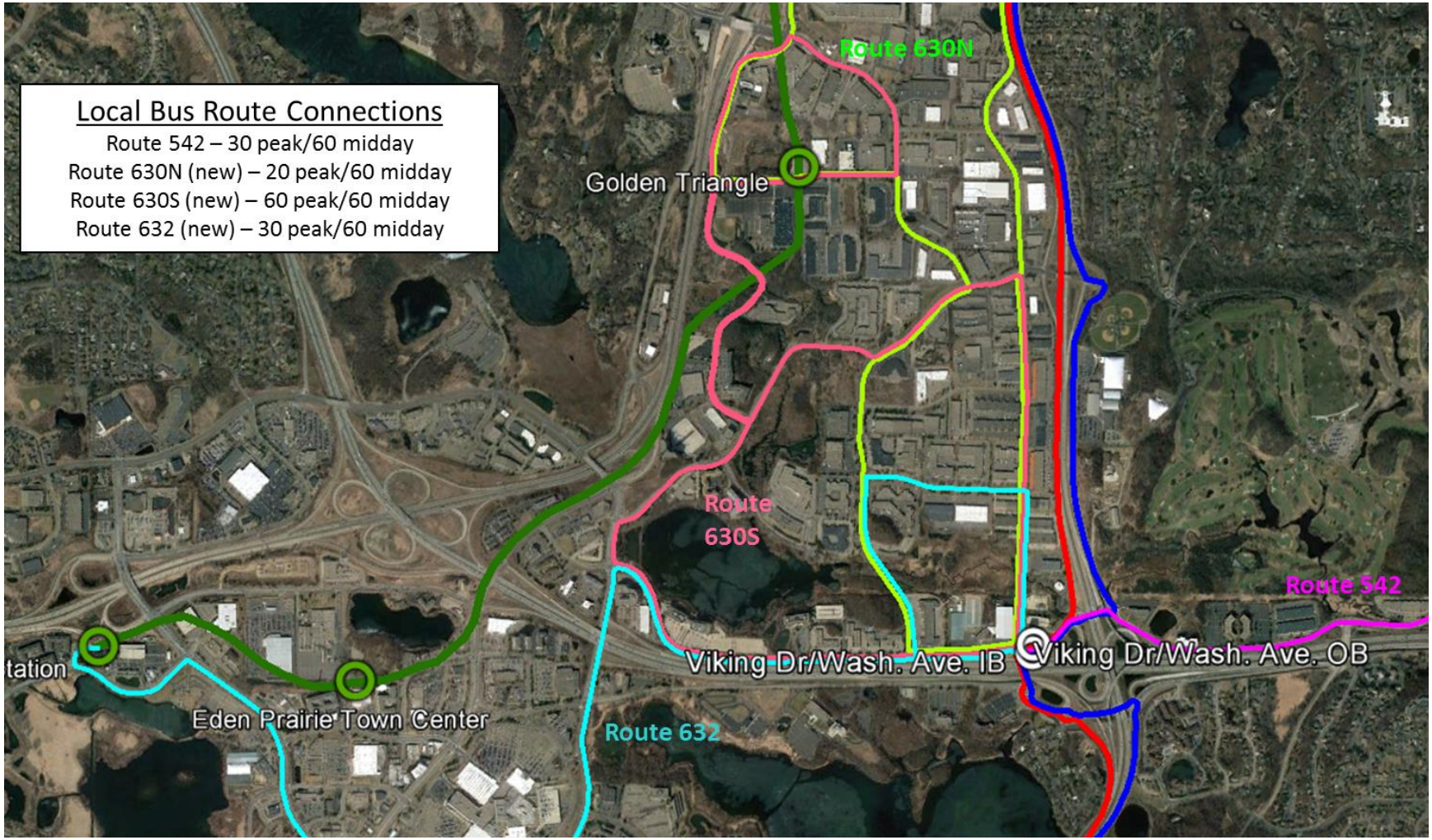


Figure 5. Bren Road Area Routes

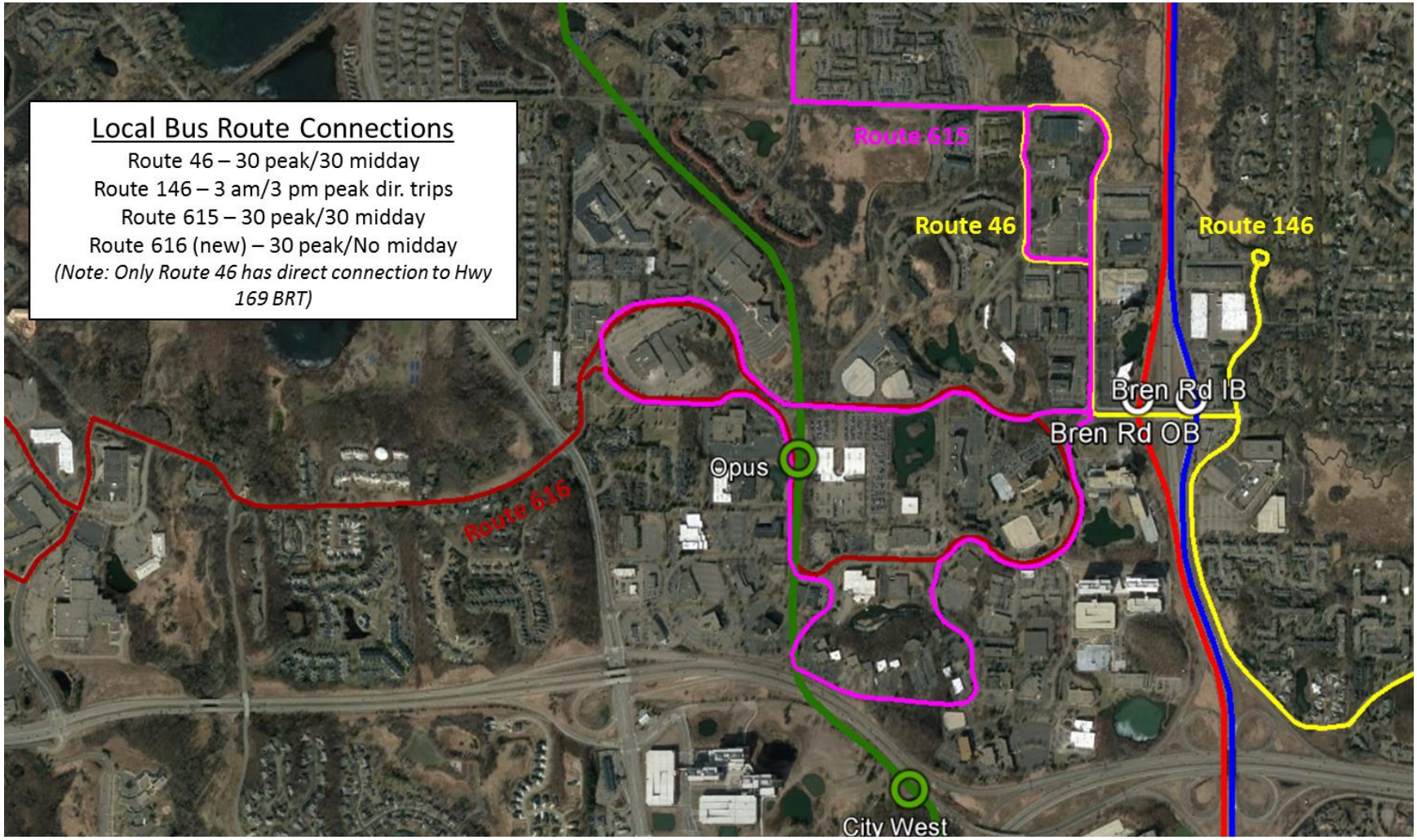


Figure 6. Downtown Hopkins Area Routes

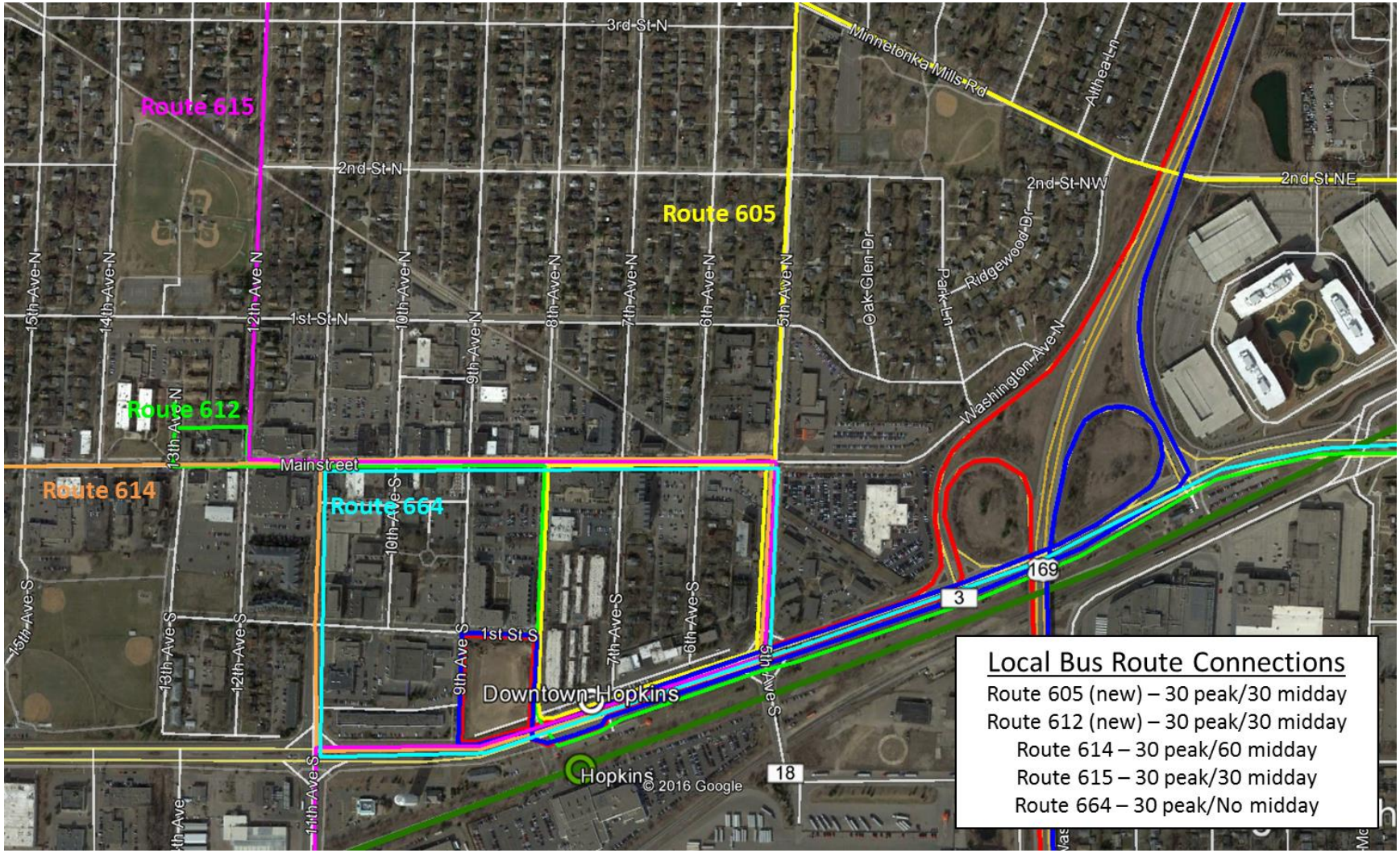
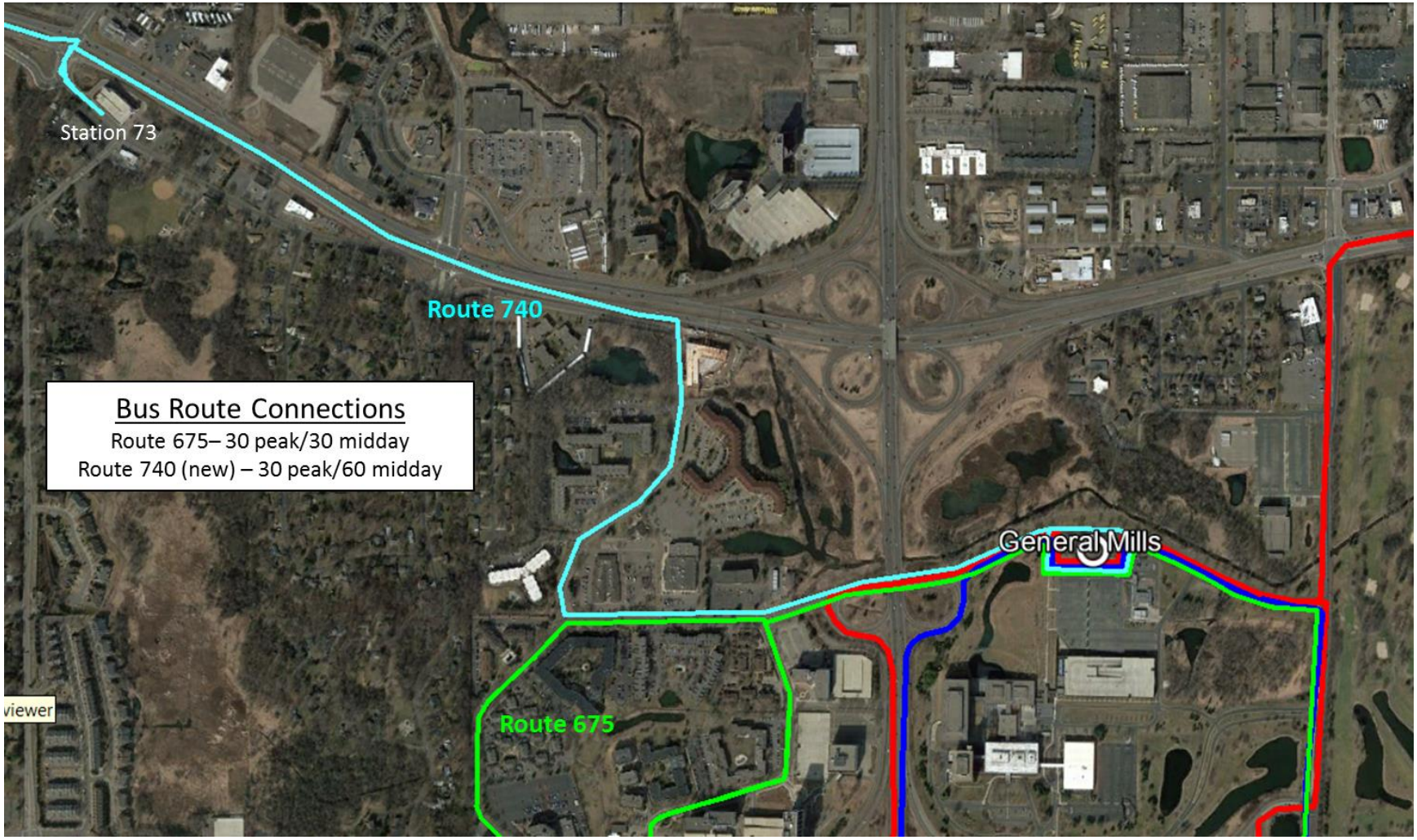


Figure 7. Cedar Lake Road Area Routes

Figure 8. General Mills Area Routes



O&M Cost Estimates

Annual operations and maintenance (O&M) costs were estimated with methodologies described in the *Blue Line Extension Operating and Maintenance Cost Methodology and Results Report* dated July 2016 (subsequently referred to as the *Blue Line O&M Report*) and unit costs identical to those recently updated and used for the local bus and BRT modes in Ramsey County Regional Rail Authority's Rush Line Corridor study and Washington County's Gold Line Corridor Study.

The methodology used for the Blue Line LRT project is consistent with Federal Transit Administration requirements. The transit O&M cost models are resource-driven, meaning that supply variables such as revenue hours, revenue miles, or peak vehicles are associated with cost items such as operator labor, fuel, and utilities, for example. Unit costs are then created with recent actual annual costs or budget for O&M line item expenses. An example of how costs are reported is as follows: to supply one revenue hour of bus service will cost X dollars for bus operator wages and salaries. Cost model supply variables are also referred to as *cost drivers* because changing values for the variables (as is commonly the case with study alternatives) also will change the associated cost.

Local Bus Service Cost Methodology

For the Highway 169 Build alternatives, the local bus component represents new connecting bus service. The *Blue Line O&M Report* documents supply unit costs for local bus based on Metro Transit Bus calendar year 2015 expenses.

- $3.29 * annual revenue bus-miles +
- $52.30 * annual revenue bus-hours +
- $44,332.32 * maximum buses in peak service +
- $2,024,018.14 * number of maintenance garages

A portion of Metro Transit's annual O&M costs is assigned to maintenance garages in the Metro Transit O&M cost model. Highway 169 BRT service on its own will not trigger the need for a new maintenance garage. But, it could contribute towards to the need for a new garage. Therefore, the unit cost for maintenance garage has been proportioned based on fleet bus requirements, resulting in a unit cost of $15,800 per fleet bus (cost derived by dividing Metro Transit's bus fleet as reported in the 2015 NTD report by Metro Transit's existing six maintenance garages).

Detail regarding original calculation of these unit costs is available in the *Blue Line O&M Report*.

Bus Rapid Transit Service Cost Methodology

O&M costs for BRT assume identical base unit costs as identified for local bus service, with some additional expenses related to its status as a premium transit service. BRT's premium elements are modeled as separate line item costs. For the Highway 169 corridor project, additional BRT-specific line items assumed are as follows. Once again, all unit costs are shown in 2015 dollars.

- *Police/Fare Enforcement* - A rate of $13.42 per BRT revenue bus-hour of service is assumed, primarily related to additional fare enforcement that is assumed for the BRT mode.[1]
- *Fare Collection Equipment Maintenance* - $6,000 annually per ticket vending machine (TVM) based on information provided by Metro Transit Revenue Operations in June 2015 for TVMs that are similar to those being used for the A Line. For purposes of this project, two TVMs have been assumed at every station platform. No TVMs are assumed at downtown stations except at the Glenwood Avenue stop (Highway 55 alignment alternative) and at the Hawthorne Avenue stop (I-394 alignment alternative). This is because arterial BRT station infrastructure is already assumed along 7th Street, and 6th Street stops will be drop-off only. This results in a total of 18 platforms and 36 TVMs for the I-394 alignment and 22 platforms and 44 TVMs for the Highway 55 alignment.
- *GoTo Validators* - $165 annually per machine. For purposes of this project, a GoTo Validator has been assumed at every station platform, for a total of 18 validators for the I-394 alignment alternative and 22 validators for the Highway 55 alignment alternative.
- *Station Maintenance:* Snow removal is assumed to cost $3,850 annually per station platform directional stop. Maintenance/janitorial annual full-time employee wages and benefits are estimated as $88,000, with one FTE assumed per 40 directional stops, or $2,200 per station platform. Intelligent transportation system (ITS) applications at stations (e.g., real-time bus arrival information) are estimated at $2,850 annually per station platform (directional stop). As previously noted, there are 18 platforms for the I-394 alignment alternative and 22 platforms for the Highway 55 alignment alternative.

O&M Cost Results

Annual O&M cost estimates have been prepared for both BRT alignment alternatives (I-394 and Highway 55). Bus O&M costs for background bus service changes are expressed as additional O&M costs over a No-Build scenario. Table 5 presents cost estimates for BRT service. Table 6 presents route-specific cost estimates for background bus service changes

[1] This is estimated as 0.2416 police officer for every revenue BRT-hour / 1,800 police hours per full-time equivalent (FTE) * $100,000 wages and fringe benefits per FTE = $13.42.

(cost increases from a No-Build scenario). Total annual O&M costs for the two alternatives are as follows (in 2015 dollars):

- I-394 Alternative: $16,521,500
- Highway 55 Alternative: $17,142,900

Table 5. BRT Annual O&M Cost Estimates (2015 dollars)

Cost Item	Unit Cost	I-394 Alignment Option Units	I-394 Alignment Option Cost	TH 55 Alignment Option Units	TH 55 Alignment Option Cost
Bus Rapid Transit Service					
Annual Revenue Bus-Miles	$3.29	1,629,000	$5,359,400	1,629,900	$5,362,400
Annual Revenue Bus-Hours	$52.30	85,900	$4,492,600	92,200	$4,822,100
Peak Buses	$44,322	21	$930,800	23	$1,019,400
Maintenance Garages	$15,800	26	$410,800	28	$442,400
BRT Service Subtotal			***$11,193,600***		***$11,646,300***
Additional BRT Features					
Police, Fare Enforcement (per rev. bus-hr)	$13.42	85,900	$1,152,800	92,200	$1,237,300
Fare Collection (per platform)					
TVMs (light)	$6,000	36	$216,000	44	$264,000
Go-To Validators	$165	18	$3,000	22	$3,600
Station Maintenance (per platform)					
Maintenance	$2,200	18	$39,600	22	$48,400
Snow Removal	$3,850	18	$69,300	22	$84,700
ITS	$2,850	18	$51,300	22	$62,700
Additional Features Subtotal			***$1,532,000***		***$1,700,700***
Total Cost Estimate			**$12,725,600**		**$13,347,000**

Table 6. Additional O&M Costs for Background Bus Service Improvements (2015 dollars)

Operator	Route	Annual O&M Cost
MVTA	496	$338,900
MVTA	497	$308,900
MVTA	498	$518,600
MVTA	499	$243,500
Plymouth	740	$544,800
SW Transit	632	$267,200
Metro Transit	46*	$464,700
Metro Transit	542	$322,000
Metro Transit	547	$787,300
Totals		**$3,795,900**

Appendix A: Station-to-Station Travel Time Estimates

HWY 169 BRT
Run Time Estimates Workbook
Station to Station Summary Sheet

VIA I-394

AM PEAK PERIOD

via I-394; Marschall Rd - Minneapolis		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Seagate (12th Ave)	2.83	0:09:12	18.5
Seagate (12th Ave)	Southbridge Crossings P&R	4.33	0:12:30	20.8
Southbridge Crossings P&R	Pioneer Trail	3.39	0:07:29	27.2
Pioneer Trail	Viking Dr/Washington Ave	3.20	0:06:07	31.4
Viking Dr/Washington Ave	Bren Rd	2.95	0:06:58	25.4
Bren Rd	Downtown Hopkins	2.75	0:07:44	21.3
Downtown Hopkins	Cedar Lake Rd	2.97	0:08:14	21.6
Cedar Lake Rd	General Mills	1.94	0:04:10	27.9
General Mills	Louisiana P&R	1.75	0:06:09	17.1
Louisiana P&R	Park Pl	1.08	0:04:22	14.8
Park Pl	6th St./Hennepin Ave.	4.06	0:08:51	27.5
6th St./Hennepin Ave.	6th St./Nicollet Mall	0.20	0:02:08	5.6
6th St./Nicollet Mall	6th St./Third Ave.	0.40	0:02:44	8.8
6th St./Third Ave.	4th Ave/7th St	0.17	0:02:02	5.0
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**32.02**	**1:28:40**	**21.7**

via I-394; Minneapolis - Marschall Rd		Southbound/Outbound		
Dist	**Time**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St	7th St./2nd Ave.	0.13	0:01:55	4.1
7th St./2nd Ave.	7th St./Nicollet Mall	0.17	0:02:02	5.0
7th St./Nicollet Mall	7th St./Hennepin Ave.	0.19	0:02:06	5.4
7th St./Hennepin Ave.	7th St. Transit Center	0.25	0:02:58	5.1
7th St. Transit Center	Park Pl	3.85	0:09:43	23.8
Park Pl	Louisiana P&R	0.93	0:02:50	19.7
Louisiana P&R	General Mills	1.77	0:05:14	20.3
General Mills	Cedar Lake Rd	2.04	0:04:56	24.8
Cedar Lake Rd	Downtown Hopkins	3.00	0:09:03	19.9
Downtown Hopkins	Bren Rd	2.30	0:05:41	24.3
Bren Rd	Viking Dr/Washington Ave	2.72	0:04:28	36.5
Viking Dr/Washington Ave	Pioneer Trail	3.13	0:05:36	33.5
Pioneer Trail	Southbridge Crossings P&R	3.90	0:08:00	29.3
Southbridge Crossings P&R	Seagate (12th Ave)	4.52	0:09:16	29.3
Seagate (12th Ave)	Marschall Rd Transit Station	2.56	0:08:26	18.2
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.46**	**1:22:14**	**23.0**

MIDDAY PERIOD

All Stop Pattern; Marschall Rd - Minneapolis		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Seagate (12th Ave)	2.83	0:08:56	19.0
Seagate (12th Ave)	Southbridge Crossings P&R	4.33	0:11:25	22.8
Southbridge Crossings P&R	Pioneer Trail	3.39	0:05:57	34.2
Pioneer Trail	Viking Dr/Washington Ave	3.20	0:05:30	34.9
Viking Dr/Washington Ave	Bren Rd	2.95	0:06:30	27.2
Bren Rd	Downtown Hopkins	2.75	0:07:19	22.6
Downtown Hopkins	Cedar Lake Rd	2.97	0:06:45	26.4
Cedar Lake Rd	General Mills	1.94	0:03:36	32.3
General Mills	Louisiana P&R	1.75	0:05:47	18.2
Louisiana P&R	Park Pl	1.08	0:04:01	16.1
Park Pl	6th St./Hennepin Ave.	3.68	0:07:06	31.1
6th St./Hennepin Ave.	6th St./Nicollet Mall	0.20	0:01:58	6.1
6th St./Nicollet Mall	6th St./Third Ave.	0.40	0:02:27	9.8
6th St./Third Ave.	4th Ave/7th St	0.17	0:01:54	5.4
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.64**	**1:19:11**	**24.0**

All Stop Pattern; Minneapolis - Marschall Rd		Southbound/Outbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St	7th St./2nd Ave.	0.13	0:01:48	4.3
7th St./2nd Ave.	7th St./Nicollet Mall	0.17	0:01:54	5.4
7th St./Nicollet Mall	7th St./Hennepin Ave.	0.19	0:01:57	5.8
7th St./Hennepin Ave.	7th St. Transit Center	0.25	0:02:51	5.3
7th St. Transit Center	Park Pl	3.85	0:08:51	26.1
Park Pl	Louisiana P&R	0.93	0:02:42	20.7
Louisiana P&R	General Mills	1.77	0:05:07	20.8
General Mills	Cedar Lake Rd	2.04	0:04:30	27.2
Cedar Lake Rd	Downtown Hopkins	3.00	0:08:23	21.5
Downtown Hopkins	Bren Rd	2.30	0:05:30	25.1
Bren Rd	Viking Dr/Washington Ave	2.72	0:04:12	38.9
Viking Dr/Washington Ave	Pioneer Trail	3.13	0:05:28	34.4
Pioneer Trail	Southbridge Crossings P&R	3.90	0:07:53	29.7
Southbridge Crossings P&R	Seagate (12th Ave)	4.52	0:09:10	29.6
Seagate (12th Ave)	Marschall Rd Transit Station	2.56	0:08:10	18.8
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.46**	**1:18:26**	**24.1**

PM PEAK PERIOD

via I-394; Marschall Rd - Minneapolis		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Seagate (12th Ave)	2.83	0:09:06	18.7
Seagate (12th Ave)	Southbridge Crossings P&R	4.33	0:12:25	20.9
Southbridge Crossings P&R	Pioneer Trail	3.39	0:05:57	34.2
Pioneer Trail	Viking Dr/Washington Ave	3.20	0:05:30	34.9
Viking Dr/Washington Ave	Bren Rd	2.95	0:07:20	24.1
Bren Rd	Downtown Hopkins	2.75	0:08:19	19.8
Downtown Hopkins	Cedar Lake Rd	2.97	0:08:14	21.6
Cedar Lake Rd	General Mills	1.94	0:03:54	29.8
General Mills	Louisiana P&R	1.75	0:05:57	17.6
Louisiana P&R	Park Pl	1.08	0:04:13	15.4
Park Pl	6th St./Hennepin Ave.	3.68	0:09:09	24.1
6th St./Hennepin Ave.	6th St./Nicollet Mall	0.20	0:02:08	5.6
6th St./Nicollet Mall	6th St./Third Ave.	0.40	0:02:44	8.8
6th St./Third Ave.	4th Ave/7th St	0.17	0:02:02	5.0
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.64**	**1:26:58**	**21.8**

via I-394; Minneapolis - Marschall Rd		Southbound/Outbound		
Dist	**Time**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St	7th St./2nd Ave.	0.13	0:01:55	4.1
7th St./2nd Ave.	7th St./Nicollet Mall	0.17	0:02:02	5.0
7th St./Nicollet Mall	7th St./Hennepin Ave.	0.19	0:02:06	5.4
7th St./Hennepin Ave.	7th St. Transit Center	0.25	0:02:58	5.1
7th St. Transit Center	Park Pl	3.85	0:11:00	21.0
Park Pl	Louisiana P&R	0.93	0:03:04	18.2
Louisiana P&R	General Mills	1.77	0:05:30	19.3
General Mills	Cedar Lake Rd	2.04	0:04:56	24.8
Cedar Lake Rd	Downtown Hopkins	3.00	0:09:03	19.9
Downtown Hopkins	Bren Rd	2.30	0:06:10	22.4
Bren Rd	Viking Dr/Washington Ave	2.72	0:05:05	32.1
Viking Dr/Washington Ave	Pioneer Trail	3.13	0:07:03	26.6
Pioneer Trail	Southbridge Crossings P&R	3.90	0:08:53	26.3
Southbridge Crossings P&R	Seagate (12th Ave)	4.52	0:09:18	29.2
Seagate (12th Ave)	Marschall Rd Transit Station	2.56	0:08:31	18.0
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.46**	**1:27:34**	**21.6**

HWY 169 BRT
Run Time Estimates Workbook
Station to Station Summary Sheet

VIA TH 55

AM PEAK PERIOD

via TH 55; Marschall Rd - Minneapolis		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Seagate (12th Ave)	2.83	0:09:12	18.5
Seagate (12th Ave)	Southbridge Crossings P&R	4.33	0:12:30	20.8
Southbridge Crossings P&R	Pioneer Trail	3.39	0:07:29	27.2
Pioneer Trail	Viking Dr/Washington Ave	3.20	0:06:07	31.4
Viking Dr/Washington Ave	Bren Rd	2.95	0:06:58	25.4
Bren Rd	Downtown Hopkins	2.75	0:07:44	21.3
Downtown Hopkins	Cedar Lake Rd	2.97	0:08:14	21.6
Cedar Lake Rd	General Mills	1.94	0:04:10	27.9
General Mills	Winnetka Ave	1.19	0:05:22	13.3
Winnetka Ave	Douglas Dr	1.05	0:03:36	17.5
Douglas Dr	Theodore Wirth Pkwy	1.57	0:05:20	17.7
Theodore Wirth Pkwy	Penn Ave	0.98	0:03:05	19.1
Penn Ave	7th St	1.30	0:07:20	10.6
7th St	7th St. Transit Center	0.42	0:02:44	9.2
7th St. Transit Center	6th St./Hennepin Ave.	0.26	0:03:00	5.2
6th St./Hennepin Ave.	6th St./Nicollet Mall	0.20	0:02:08	5.6
6th St./Nicollet Mall	6th St./Third Ave.	0.40	0:02:44	8.8
6th St./Third Ave.	4th Ave/7th St	0.17	0:02:02	5.0
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.9**	**1:39:45**	**19.2**

via TH 55; Minneapolis - Marschall Rd		Soutbound/Outbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St	7th St./2nd Ave.	0.13	0:01:55	4.1
7th St./2nd Ave.	7th St./Nicollet Mall	0.17	0:02:02	5.0
7th St./Nicollet Mall	7th St./Hennepin Ave.	0.19	0:02:06	5.4
7th St./Hennepin Ave.	7th St. Transit Center	0.16	0:02:06	4.6
7th St. Transit Center	7th St	0.35	0:02:21	8.9
7th St	Penn Ave	1.33	0:07:35	10.5
Penn Ave	Theodore Wirth Pkwy	1.02	0:02:47	22.0
Theodore Wirth Pkwy	Douglas Dr	1.56	0:04:55	19.0
Douglas Dr	Winnetka Ave	1.03	0:03:49	16.2
Winnetka Ave	General Mills	1.18	0:04:38	15.3
General Mills	Cedar Lake Rd	2.04	0:04:56	24.8
Cedar Lake Rd	Downtown Hopkins	3.00	0:09:03	19.9
Downtown Hopkins	Bren Rd	2.30	0:05:41	24.3
Bren Rd	Viking Dr/Washington Ave	2.72	0:04:28	36.5
Viking Dr/Washington Ave	Pioneer Trail	3.13	0:05:36	33.5
Pioneer Trail	Southbridge Crossings P&R	3.90	0:08:00	29.3
Southbridge Crossings P&R	Seagate (12th Ave)	4.52	0:09:16	29.3
Seagate (12th Ave)	Marschall Rd Transit Station	2.56	0:08:26	18.2
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.29**	**1:29:40**	**20.9**
			1:39:08	

MIDDAY PERIOD

via TH 55; All-Stop Pattern		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Seagate (12th Ave)	2.83	0:08:56	19.0
Seagate (12th Ave)	Southbridge Crossings P&R	4.33	0:11:25	22.8
Southbridge Crossings P&R	Pioneer Trail	3.39	0:05:57	34.2
Pioneer Trail	Viking Dr/Washington Ave	3.20	0:05:30	34.9
Viking Dr/Washington Ave	Bren Rd	2.95	0:06:30	27.2
Bren Rd	Downtown Hopkins	2.75	0:07:19	22.6
Downtown Hopkins	Cedar Lake Rd	2.97	0:06:45	26.4
Cedar Lake Rd	General Mills	1.94	0:03:36	32.3
General Mills	Winnetka Ave	1.19	0:05:18	13.5
Winnetka Ave	Douglas Dr	1.05	0:03:36	17.5
Douglas Dr	Theodore Wirth Pkwy	1.57	0:05:13	18.1
Theodore Wirth Pkwy	Penn Ave	0.98	0:02:53	20.4
Penn Ave	7th St	1.30	0:07:20	10.6
7th St	7th St. Transit Center	0.42	0:02:39	9.5
7th St. Transit Center	6th St./Hennepin Ave.	0.26	0:02:52	5.4
6th St./Hennepin Ave.	6th St./Nicollet Mall	0.20	0:01:58	6.1
6th St./Nicollet Mall	6th St./Third Ave.	0.40	0:02:27	9.8
6th St./Third Ave.	4th Ave/7th St	0.17	0:01:54	5.4
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.9**	**1:32:08**	**20.8**

via TH 55; All-Stop Pattern		Southbound/Outbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St	7th St./2nd Ave.	0.13	0:01:48	4.3
7th St./2nd Ave.	7th St./Nicollet Mall	0.17	0:01:54	5.4
7th St./Nicollet Mall	7th St./Hennepin Ave.	0.19	0:01:57	5.8
7th St./Hennepin Ave.	7th St. Transit Center	0.16	0:01:57	4.9
7th St. Transit Center	7th St	0.35	0:02:18	9.1
7th St	Penn Ave	1.33	0:07:30	10.6
Penn Ave	Theodore Wirth Pkwy	1.02	0:02:47	22.0
Theodore Wirth Pkwy	Douglas Dr	1.56	0:04:55	19.0
Douglas Dr	Winnetka Ave	1.03	0:03:49	16.2
Winnetka Ave	General Mills	1.18	0:04:33	15.6
General Mills	Cedar Lake Rd	2.04	0:04:30	27.2
Cedar Lake Rd	Downtown Hopkins	3.00	0:08:23	21.5
Downtown Hopkins	Bren Rd	2.30	0:05:30	25.1
Bren Rd	Viking Dr/Washington Ave	2.72	0:04:12	38.9
Viking Dr/Washington Ave	Pioneer Trail	3.13	0:05:28	34.4
Pioneer Trail	Southbridge Crossings P&R	3.90	0:07:53	29.7
Southbridge Crossings P&R	Seagate (12th Ave)	4.52	0:09:10	29.6
Seagate (12th Ave)	Marschall Rd Transit Station	2.56	0:08:10	18.8
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.29**	**1:26:44**	**21.6**

PM PEAK PERIOD

via TH 55; Marschall Rd - Minneapolis		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Seagate (12th Ave)	2.83	0:09:06	18.7
Seagate (12th Ave)	Southbridge Crossings P&R	4.33	0:12:25	20.9
Southbridge Crossings P&R	Pioneer Trail	3.39	0:05:57	34.2
Pioneer Trail	Viking Dr/Washington Ave	3.20	0:05:30	34.9
Viking Dr/Washington Ave	Bren Rd	2.95	0:07:20	24.1
Bren Rd	Downtown Hopkins	2.75	0:08:19	19.8
Downtown Hopkins	Cedar Lake Rd	2.97	0:08:14	21.6
Cedar Lake Rd	General Mills	1.94	0:03:54	29.8
General Mills	Winnetka Ave	1.19	0:05:22	13.3
Winnetka Ave	Douglas Dr	1.05	0:03:36	17.5
Douglas Dr	Theodore Wirth Pkwy	1.57	0:05:13	18.1
Theodore Wirth Pkwy	Penn Ave	0.98	0:02:58	19.8
Penn Ave	7th St	1.30	0:07:20	10.6
7th St	7th St. Transit Center	0.42	0:02:44	9.2
7th St. Transit Center	6th St./Hennepin Ave.	0.26	0:03:00	5.2
6th St./Hennepin Ave.	6th St./Nicollet Mall	0.20	0:02:08	5.6
6th St./Nicollet Mall	6th St./Third Ave.	0.40	0:02:44	8.8
6th St./Third Ave.	4th Ave/7th St	0.17	0:02:02	5.0
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.9**	**1:37:52**	**19.6**

via TH 55; Minneapolis - Marschall Rd		Southbound/Outbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St	7th St./2nd Ave.	0.13	0:01:55	4.1
7th St./2nd Ave.	7th St./Nicollet Mall	0.17	0:02:02	5.0
7th St./Nicollet Mall	7th St./Hennepin Ave.	0.19	0:02:06	5.4
7th St./Hennepin Ave.	7th St. Transit Center	0.16	0:02:06	4.6
7th St. Transit Center	7th St	0.35	0:02:21	8.9
7th St	Penn Ave	1.33	0:07:39	10.4
Penn Ave	Theodore Wirth Pkwy	1.02	0:02:51	21.5
Theodore Wirth Pkwy	Douglas Dr	1.56	0:05:03	18.5
Douglas Dr	Winnetka Ave	1.03	0:03:52	16.0
Winnetka Ave	General Mills	1.18	0:04:38	15.3
General Mills	Cedar Lake Rd	2.04	0:04:56	24.8
Cedar Lake Rd	Downtown Hopkins	3.00	0:09:03	19.9
Downtown Hopkins	Bren Rd	2.30	0:06:10	22.4
Bren Rd	Viking Dr/Washington Ave	2.72	0:05:05	32.1
Viking Dr/Washington Ave	Pioneer Trail	3.13	0:07:03	26.6
Pioneer Trail	Southbridge Crossings P&R	3.90	0:08:53	26.3
Southbridge Crossings P&R	Seagate (12th Ave)	4.52	0:09:18	29.2
Seagate (12th Ave)	Marschall Rd Transit Station	2.56	0:08:31	18.0
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**31.29**	**1:33:32**	**20.1**