Technical Memo 12: Hwy 169 Optimized BRT Transit Service Plan and O&M Costs

Highway 169 Mobility Study

Version 1.0

Prepared for: Minnesota Department of Transportation

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Introduction

This technical memorandum provides detailed descriptions of the preferred bus rapid transit (BRT) service plan and proposed supporting background bus service changes for this Mobility Study. Results of ridership modeling and sensitivity testing yielded an Optimized Scenario that is presented in this Tech Memo. Estimates of service requirements are presented for the Optimized Scenario's alignment and station set. Annual operating and maintenance (O&M) cost methodology and results are also presented.

Highway 169 BRT Alternatives

The BRT alignment currently under consideration begins at the Marschall Road Transit Station in Shakopee, and assumes highway BRT service along Highway 169 and Highway 55 to downtown Minneapolis. Ridership modeling and multiple sensitivity tests as well as discussions with policy and stakeholder groups yielded this current Optimized Scenario.

Proposed Station Locations

Proposed stop locations are as follows:

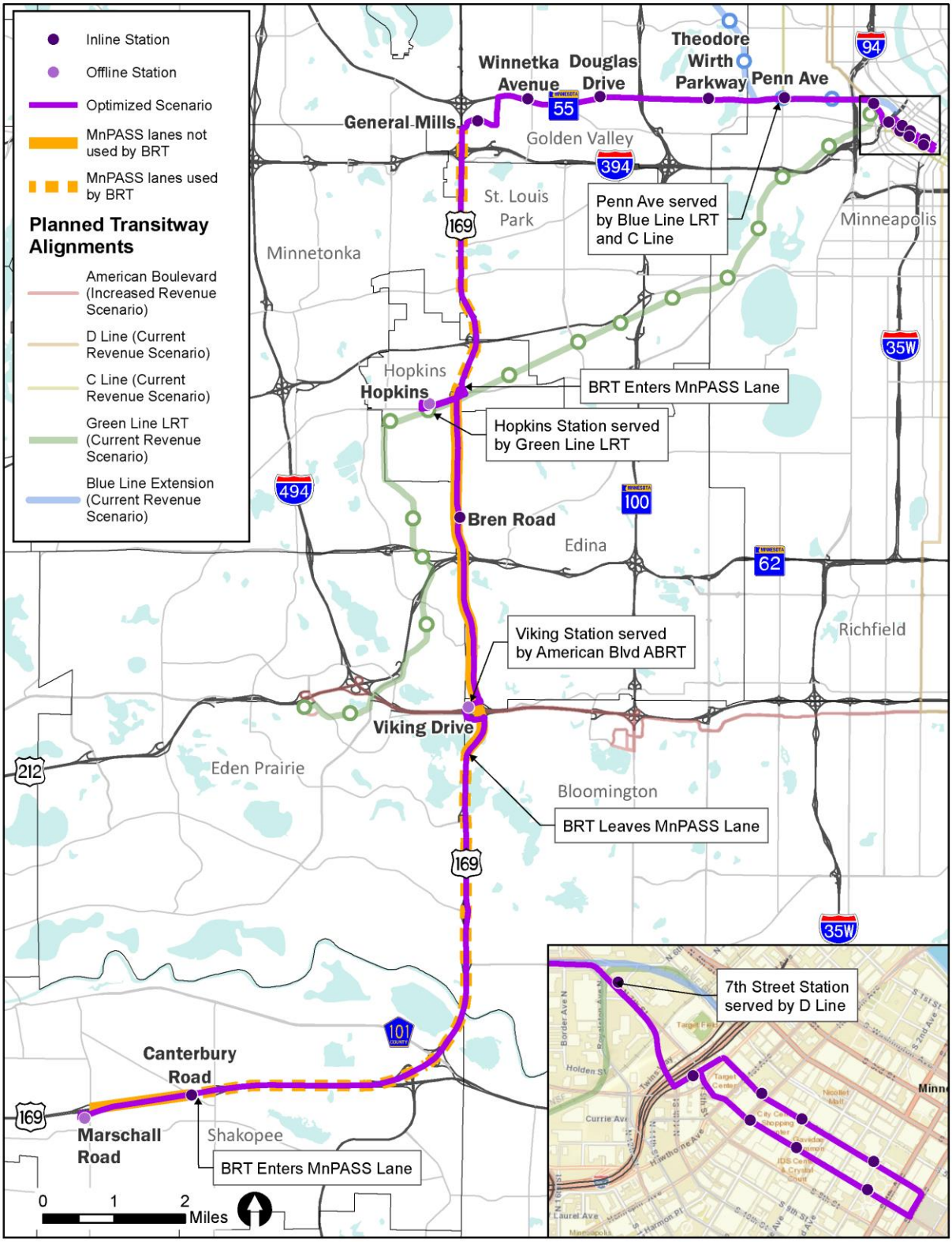
- *Marschall Road Transit Center* – This existing facility is proposed as the southern terminus for BRT service. Northbound service will be able to access the existing slip ramp from the transit station to the Highway 169 off-ramp. Southbound service assumes a new slip ramp from Marshall Road into the transit station (to avoid the need to travel further south to 17th Avenue).
- *Canterbury Road* – BRT stops are proposed in both directions along Highway 169 entrance ramps at Canterbury Road.
- *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 exit at Marth Road/Washington Avenue to reach the station then 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.
- *General Mills* – A BRT stop is proposed at the north end of the General Mills parking lot, off Betty Crocker Drive.
- *Winnetka Avenue*– 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:

- 7th Street Transit Center
- 6th Street/Hennepin Avenue
- 6th Street/Nicollet Mall
- 6th Street/3rd Avenue
- 7th Street/3rd Avenue
- 7th Street/Nicollet Mall
- 7th Street/Hennepin Avenue

Figure 1 illustrates the Optimized Scenario alignment and approximate station locations.

Figure 1. Optimized Scenario BRT alignment and stations



BRT Operating Plan

The BRT operating plan assumes one route pattern that makes all station stops. Proposed frequencies are 15 minutes all day and 30 minutes in the late evening and weekend early morning and evening 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 meets specifications in Met 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 hour	15 min.
	AM Peak	6:00 – 9:00 a.m.	3.0 hours	15 min.
	Midday	9:00 a.m. – 3:00 p.m.	6.0 hours	15 min.
	PM Peak	3:00 – 6:30 p.m.	3.5 hours	15 min.
	Evening	6:30 – 8:30 p.m.	2.0 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 based on the following assumptions.

- 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.

Use of potential MnPASS lanes was assumed between Marschall Road and Viking Drive and between Downtown Hopkins and General Mills. 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

Time Period	Northbound	Southbound
AM Peak	1:16:55	1:12:31
PM Peak	1:17:01	1:14:47
Off-Peak	1:14:36	1:10:50

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 weekday, Saturday and Sunday service. Bus requirements by time period assume a minimum 15 percent layover in the round trip cycle time. As noted in this table, the Optimized Scenario requires 12 peak and 15 fleet buses and 69,700 annual revenue bus-hours.

Table 3. BRT Operating Plan Inputs and Statistics

Service Day	AM Peak Round Trip		Mid Eve Late Rnd Trip		PM Peak Round Trip		Hours by Period					Service Frequency				
	Miles	Minutes	Miles	Minutes	Miles	Minutes	AM	Mid	PM	Eve	Late	AM	Mid	PM	Eve	Late
Monday - Friday	56.13	149.43	56.13	145.43	56.13	151.80	3.0	7.0	3.5	2.0	2.5	15	15	15	15	30
Saturday	56.13	145.43	56.13	145.43	56.13	145.43	3.5	6.5	3.5	2.0	2.5	30	15	15	30	30
Sunday	56.13	145.43	56.13	145.43	56.13	145.43	3.5	6.5	3.5	2.0	2.5	30	15	15	30	30

Service Day	Vehicles		Daily Rev.		Annual Rev.		Bus Requirements				
	Max	Total	Bus-Mi's	Bus-Hrs	Bus-Miles	Bus-Hrs	AM	Mid	PM	Eve	Late
Monday - Friday	12	15	3,761	201.0	959,000	51,300	12	12	12	12	6
Saturday	n/a	n/a	3,143	168.0	163,500	8,700	6	12	12	6	6
Sunday	n/a	n/a	3,143	168.0	182,300	9,700	6	12	12	6	6
	12	15			1,304,800	69,700					

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 6 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 Canterbury Road Station.

Route 499 – This existing route's alignment is modified to provide more direct service between the Marschall Road Transit Station, the Canterbury Road Station and the existing Southbridge Crossings park-and-ride which is served by three other MVTA routes (490, 491

and 492). 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 existing route frequencies (30 minutes in the peak period and 60 minutes in the midday period, weekdays only).

Metro Transit Routes

Route 46 – 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 46 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.

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 616 – 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.
- 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 stations along Highway 55.

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).

With changes to Route 740, it may also be viable to modify alignments for Routes 772, 774 and 777. Plymouth Transit presently operates these express routes from Station 73 to downtown Minneapolis via Zachary Lane, Hopkins Crossroad and I-394. Consideration should be given to modifying these alignments to follow Highways 55 and 169, Betty Crocker Drive and General Mills Blvd. This will provide additional access to the proposed BRT service and to General Mills. These potential changes are anticipated to have negligible impact on route service requirements and annual O&M costs.

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
Totals		37,896	488,225	14	68,538	807,797	22	30,642	319,572	8

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

Figure 2. Shakopee/Southbridge Area Routes

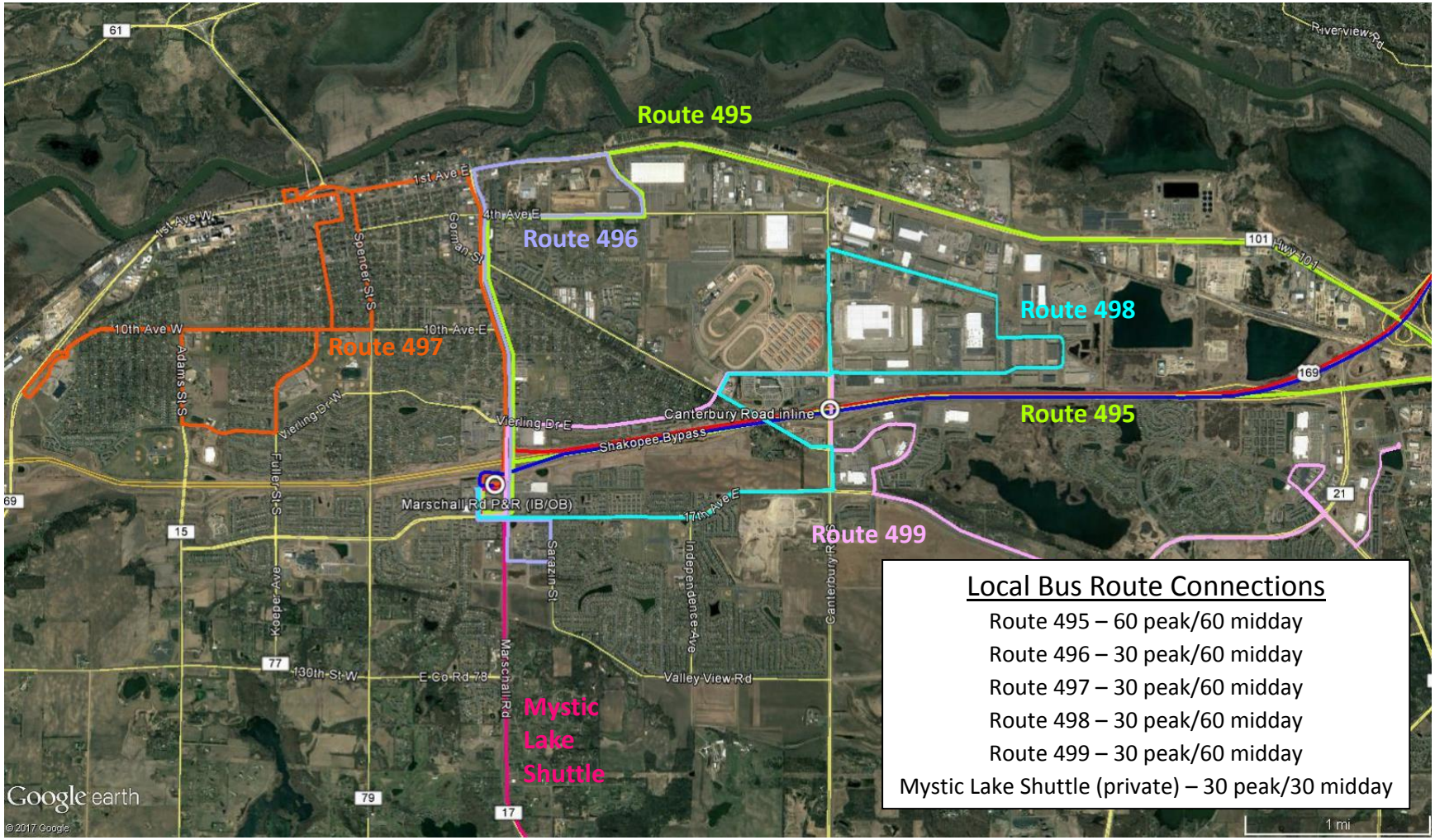


Figure 3. Viking Drive/Washington Avenue Area Routes

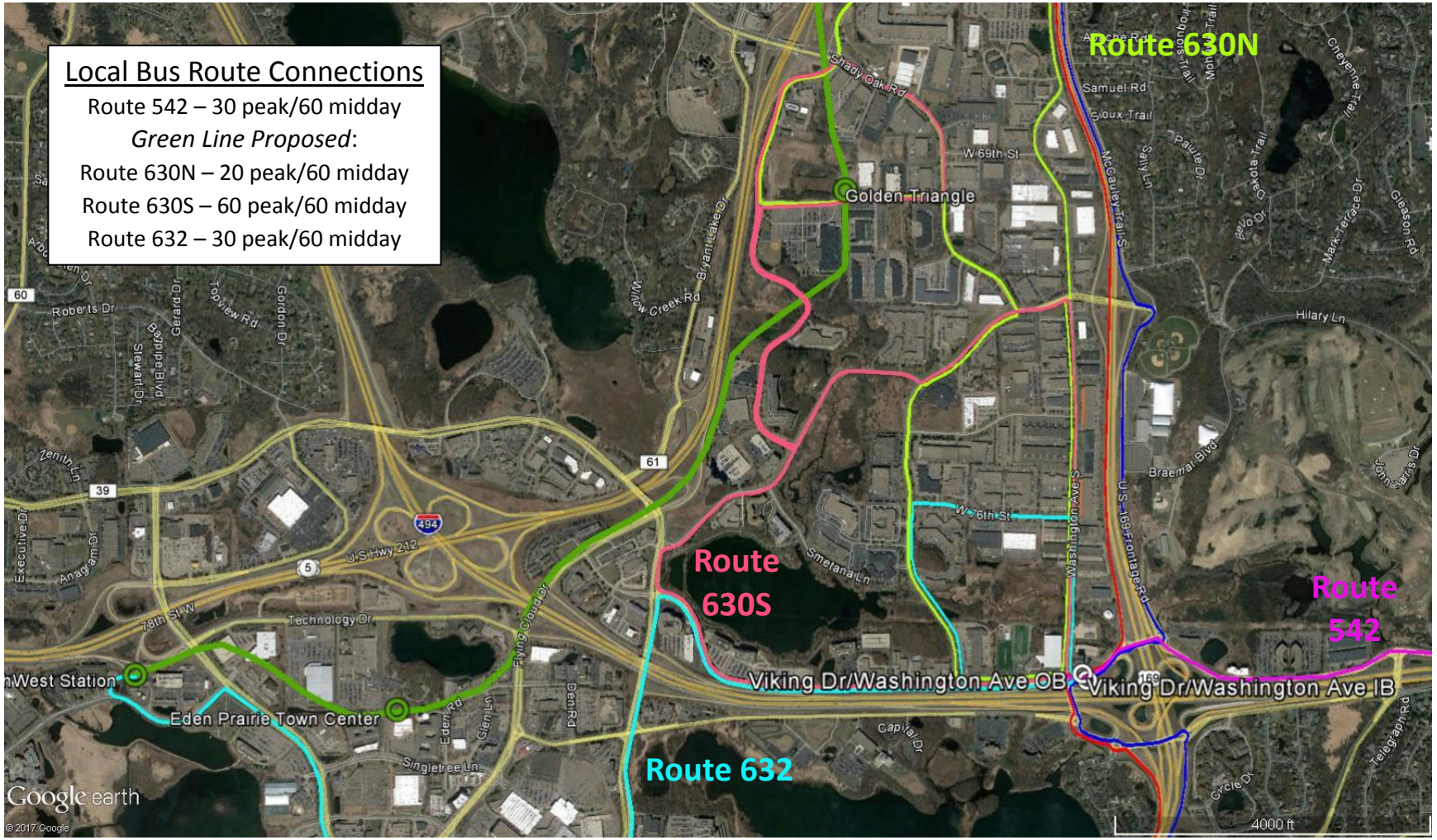


Figure 4. Bren Road Area Routes

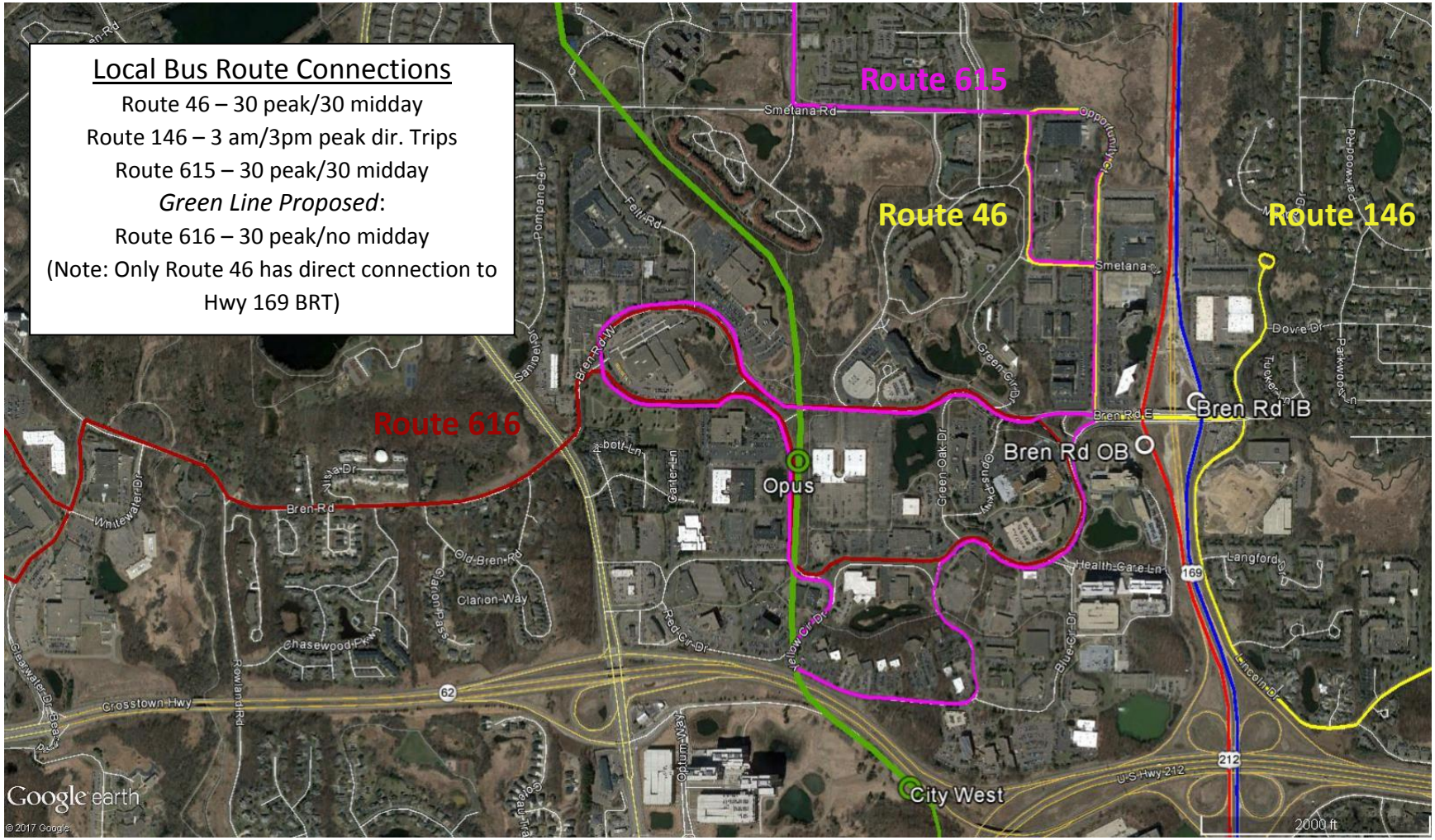


Figure 5. Downtown Hopkins Area Routes

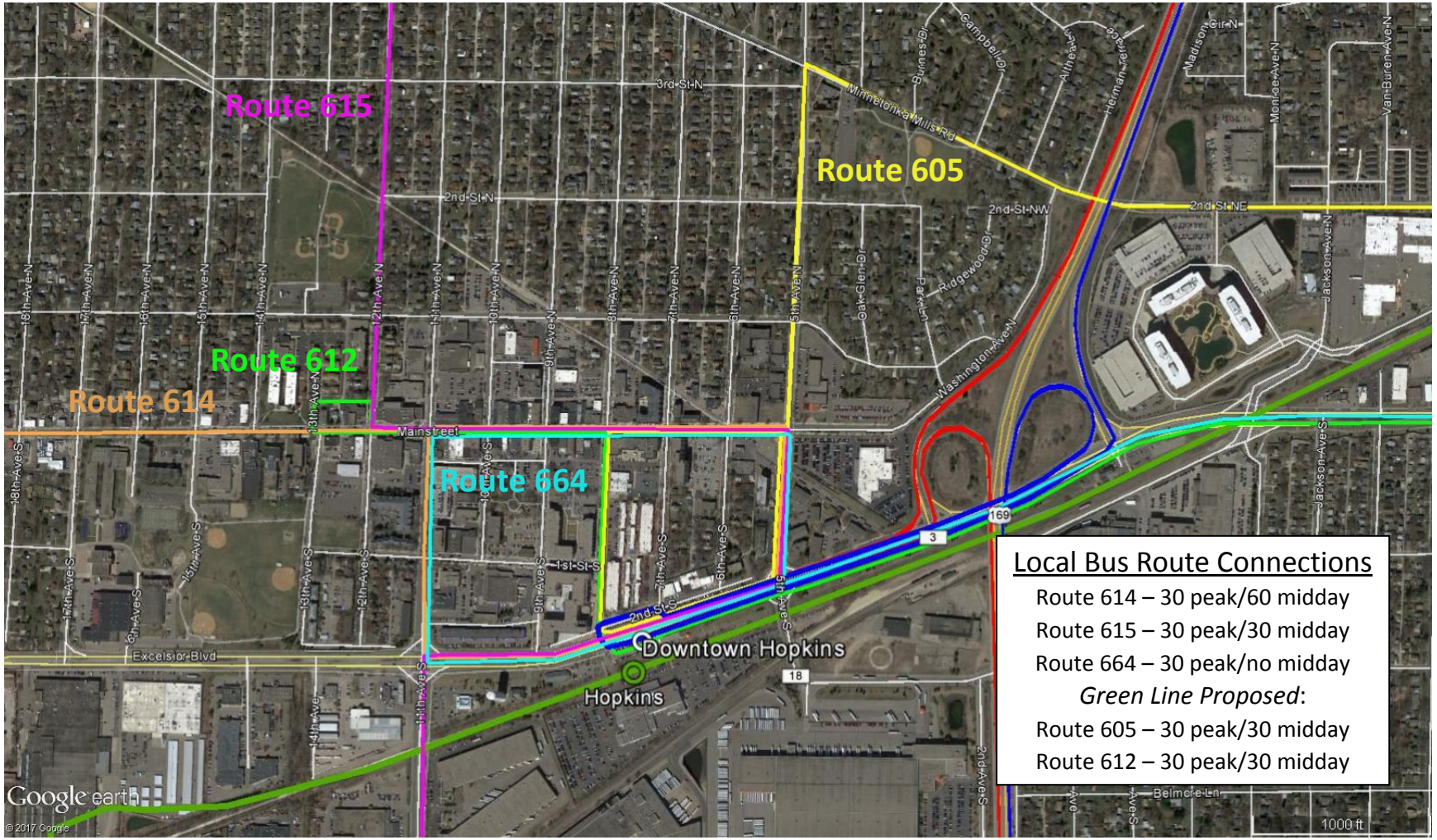
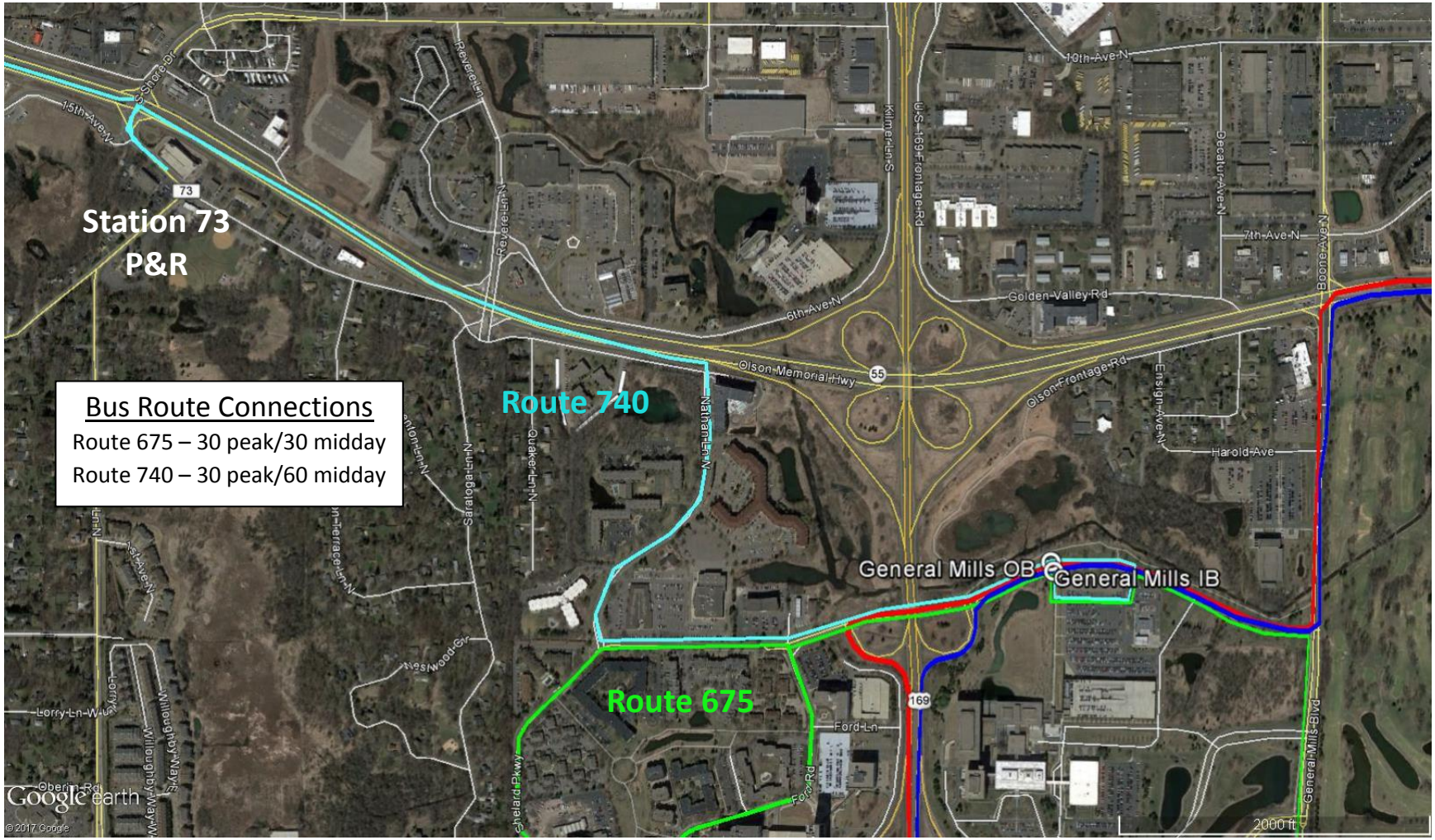


Figure 6. General Mills Area Routes



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 TVM per 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 except at the Glenwood Avenue stop. This is because ABRT is already assumed along 7th Street, and 6th Street stops will be drop-off only. This results in a total of 17 platforms and 34 TVMs.
- *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 17 validators.
- *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. 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 17 platforms.

O&M Cost Results

Annual O&M cost estimates have been prepared for the Optimized Scenario BRT alternative. 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 (cost increases from a No-Build scenario). Total annual O&M costs for both BRT and background bus service changes are estimated to be $13,009,200 (in 2015 dollars).

[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.

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

Cost Item	Unit Cost	TH 55: Optimized Units	TH 55: Optimized Cost
Bus Rapid Transit Service			
Annual Revenue Bus-Miles	$3.29	1,304,800	$4,292,800
Annual Revenue Bus-Hours	$52.30	69,700	$3,645,300
Peak Buses	$44,322	12	$531,900
Maintenance Garages	$15,800	15	$237,000
BRT Service Subtotal			***$8,707,000***
Additional BRT Features			
Police, Fare Enforcement (per rev. bus-hr)	$13.42	69,700	$935,400
Fare Collection (per platform)			
TVMs (light)	$6,000	34	$204,000
Go-To Validators	$165	17	$2,800
Station Maintenance (per platform)			
Maintenance	$2,200	17	$37,400
Snow Removal	$3,850	17	$65,500
ITS	$2,850	17	$48,500
Additional Features Subtotal			***$1,293,600***
Total Cost Estimate			**$10,000,600**

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
Totals		**$3,008,600**

Appendix A: Station-to-Station Travel Time Estimates

AM PEAK PERIOD

Alt. 2, Test 3: Marschall Rd - Minneapolis		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Canterbury Road	2.11	0:04:57	25.6
Canterbury Road	Viking Dr/Washington Ave	8.58	0:11:21	45.4
Viking Dr/Washington Ave	Bren Rd	2.83	0:06:48	25.0
Bren Rd	Downtown Hopkins	2.75	0:07:44	21.3
Downtown Hopkins	General Mills	4.60	0:09:04	30.4
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 (Layover)	0.17	0:01:42	6.0
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**28.41**	**1:16:55**	**22.2**

Alt. 2, Test 3: Minneapolis - Marschall Rd		Soutbound/Outbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St (Layover)	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	Downtown Hopkins	4.94	0:11:30	25.8
Downtown Hopkins	Bren Rd	2.32	0:05:42	24.4
Bren Rd	Viking Dr/Washington Ave	2.81	0:04:34	36.9
Viking Dr/Washington Ave	Canterbury Road	8.53	0:10:53	47.0
Canterbury Road	Marschall Rd Transit Station	2.00	0:05:38	21.3
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**27.72**	**1:12:31**	**22.9**

MIDDAY PERIOD

Alt. 2, Test 3: Marschall Rd - Minneapolis		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Canterbury Road	2.11	0:04:51	26.1
Canterbury Road	Viking Dr/Washington Ave	8.58	0:11:19	45.5
Viking Dr/Washington Ave	Bren Rd	2.83	0:06:22	26.7
Bren Rd	Downtown Hopkins	2.75	0:07:19	22.6
Downtown Hopkins	General Mills	4.60	0:08:50	31.2
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 (Layover)	0.17	0:01:39	6.2
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**28.41**	**1:14:36**	**22.8**

Alt. 2, Test 3: Minneapolis - Marschall Rd		Soutbound/Outbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St (Layover)	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	Downtown Hopkins	4.94	0:11:21	26.1
Downtown Hopkins	Bren Rd	2.32	0:05:31	25.2
Bren Rd	Viking Dr/Washington Ave	2.81	0:04:18	39.2
Viking Dr/Washington Ave	Canterbury Road	8.53	0:10:48	47.4
Canterbury Road	Marschall Rd Transit Station	2.00	0:05:24	22.2
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**27.72**	**1:10:50**	**23.5**

PM PEAK PERIOD

Alt. 2, Test 3: Marschall Rd - Minneapolis		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Canterbury Road	2.11	0:04:56	25.7
Canterbury Road	Viking Dr/Washington Ave	8.58	0:11:19	45.5
Viking Dr/Washington Ave	Bren Rd	2.83	0:06:52	24.7
Bren Rd	Downtown Hopkins	2.75	0:08:03	20.5
Downtown Hopkins	General Mills	4.60	0:09:04	30.4
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 (Layover)	0.17	0:01:42	6.0
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**28.41**	**1:17:01**	**22.1**

Alt. 2, Test 3: Minneapolis - Marschall Rd		Soutbound/Outbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St (Layover)	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	Downtown Hopkins	4.94	0:11:30	25.8
Downtown Hopkins	Bren Rd	2.32	0:06:28	21.5
Bren Rd	Viking Dr/Washington Ave	2.81	0:05:40	29.8
Viking Dr/Washington Ave	Canterbury Road	8.53	0:10:53	47.0
Canterbury Road	Marschall Rd Transit Station	2.00	0:05:43	21.0
TOTAL DISTANCES AND OVERALL AVERAGE SPEEDS		**27.72**	**1:14:47**	**22.2**

Appendix B: Interim Service Plan

Introduction

This appendix provides an overview of two potential interim corridor bus service plans and proposed supporting background bus service changes which could begin prior to bus rapid transit (BRT) service and capital improvements related to the Optimized Scenario of this Mobility Study. Estimates of service requirements are presented for the interim bus service scenarios. Annual operating and maintenance (O&M) cost results are also presented. The cost methodology for the interim bus service is identical to the BRT O&M cost methodology except BRT station amenities are not included in the total cost (BRT amenities are assumed to be phased in at a later date).

Option 1 for an interim service plan assumes service from the Marschall Road Transit Station in Shakopee to the General Mills Station. Interim stops are proposed at Viking Drive/Washington Avenue and Downtown Hopkins. Option 2 assumes continuation of Option 1 service along Highway 55 from General Mills to downtown Minneapolis, stopping at all Optimized Scenario proposed stops along Highway 55 and in downtown Minneapolis. It is assumed that interim bus service would not be implemented until after Green Line Extension LRT opens, currently anticipated in 2023.

Interim Service Operating Plan

The interim service operating plan assumes one route pattern that makes all station stops. Proposed weekday frequencies are 30 minutes during peak periods and hourly during other 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. However, initial service could be provided only during weekdays with weekend service added once benchmarks or other thresholds are met. Table B-1 presents the proposed interim service operating plan.

Table B-1: Interim Service Operating Plan

Service Day	Time Period	Time Span	Hours	Frequency
Weekdays	Early	5:00 – 6:00 a.m.	1.0 hour	60 min.
	AM Peak	6:00 – 9:00 a.m.	3.0 hours	30 min.
	Midday	9:00 a.m. – 3:00 p.m.	6.0 hours	60 min.
	PM Peak	3:00 – 6:30 p.m.	3.5 hours	30 min.
	Evening	6:30 – 8:30 p.m.	2.0 hours	60 min.
	Late Evening	8:30 – 11:00 p.m.	2.5 hours	60 min.
Weekends	Morning	5:00 – 8:30 a.m.	3.5 hours	60 min.
	Midday	8:30 a.m. – 6:30 p.m.	10.0 hours	60 min.

Service Day	Time Period	Time Span	Hours	Frequency
	Evenings	6:30 – 11:00 p.m.	4.5 hours	60 min.

Interim Service Travel Time Estimates

Station-to-station travel time estimates were developed based on the following assumptions.

- A 1.5 mphps acceleration rate and 2.0 mphps deceleration rate was used in the development of travel time estimates.
- For the peak periods, 15 to 20 second average dwells were assumed at all 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.

Table B-2 summarizes one-way trip travel time estimates by time period for Option 1 and Option 2 interim service.

Table B-2: Interim Service Travel Time Estimates Summary

	Opt. 1: Marschall Rd – General Mills		Opt. 2: Marschall Rd - Minneapolis	
Time Period	Northbound	Southbound	Northbound	Southbound
AM Peak	0:38:25	0:36:47	1:15:26	1:11:01
PM Peak	0:38:25	0:37:01	1:15:12	1:11:34
Off-Peak	0:37:22	0:36:15	1:13:17	1:09:43

Interim Service Operating Requirements

Travel times presented above were applied to the phased interim service plan to determine peak and fleet bus requirements and estimates of revenue bus-hours and bus-miles of service. Tables B-3 through B-6 present those estimates for weekday, Saturday and Sunday service. Bus requirements by time period assume a minimum 15 percent layover in the round trip cycle time.

As noted in these tables, Option 1 interim service from the Marschall Road Transit Station to General Mills requires 3 peak and 4 fleet buses and 10,800 annual revenue bus-hours for weekday-only service and 14,800 annual revenue bus-hours for 7-day service. Option 2 interim service from Marschall Road to downtown Minneapolis requires 6 peak and 8 fleet

buses and 18,700 annual revenue bus-hours for weekday-only service and 24,600 annual revenue bus-hours for 7-day service.

Table B-3: Interim Service Plan and Statistics; Option 1: Marschall Rd to General Mills (Weekday Only Service)

Service Day	AM Peak Round Trip		Mid Eve Late Rnd Trip		PM Peak Round Trip		Hours by Period					Service Frequency				
	Miles	Minutes	Miles	Minutes	Miles	Minutes	AM	Mid	PM	Eve	Late	AM	Mid	PM	Eve	Late
Monday - Friday	41.37	75.20	41.37	73.62	41.37	71.78	3.0	7.0	3.5	2.0	2.5	30	60	30	60	60
Saturday	n/a	n/a	n/a	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a
Sunday	n/a	n/a	n/a	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a

Service Day	Vehicles		Daily Rev.		Annual Rev.		Bus Requirements				
	Max	Total	Bus-Mi's	Bus-Hrs	Bus-Miles	Bus-Hrs	AM	Mid	PM	Eve	Late
Monday - Friday	3	4	1,014	42.5	258,500	10,800	3	2	3	2	2
Saturday	n/a	n/a	0	0.0	0	0	0	0	0	0	0
Sunday	n/a	n/a	0	0.0	0	0	0	0	0	0	0
	3	4			258,500	10,800					

Table B-4: Interim Service Plan and Statistics; Option 1: Marschall Rd to General Mills (7-Day Service)

Service Day	AM Peak Round Trip		Mid Eve Late Rnd Trip		PM Peak Round Trip		Hours by Period					Service Frequency				
	Miles	Minutes	Miles	Minutes	Miles	Minutes	AM	Mid	PM	Eve	Late	AM	Mid	PM	Eve	Late
Monday - Friday	41.37	75.20	41.37	73.62	41.37	71.78	3.0	7.0	3.5	2.0	2.5	30	60	30	60	60
Saturday	41.37	75.20	41.37	73.62	41.37	71.78	3.5	6.5	3.5	2.0	2.5	60	60	60	60	60
Sunday	41.37	75.20	41.37	73.62	41.37	71.78	3.5	6.5	3.5	2.0	2.5	60	60	60	60	60

Service Day	Vehicles		Daily Rev.		Annual Rev.		Bus Requirements				
	Max	Total	Bus-Mi's	Bus-Hrs	Bus-Miles	Bus-Hrs	AM	Mid	PM	Eve	Late
Monday - Friday	3	4	1,014	42.5	258,500	10,800	3	2	3	2	2
Saturday	2	3	745	36.0	38,700	1,900	2	2	2	2	2
Sunday	2	3	745	36.0	43,200	2,100	2	2	2	2	2
	3	4			340,400	14,800					

Table B-5: Interim Service Plan and Statistics; Option 2: Marschall Rd to Minneapolis (Weekday Only Service)

Service Day	AM Peak Round Trip Miles	AM Peak Round Trip Minutes	Mid Eve Late Rnd Trip Miles	Mid Eve Late Rnd Trip Minutes	PM Peak Round Trip Miles	PM Peak Round Trip Minutes	Hours by Period AM	Mid	PM	Eve	Late	Service Frequency AM	Mid	PM	Eve	Late
Monday - Friday	56.03	146.45	56.03	143.00	56.03	146.77	3.0	7.0	3.5	2.0	2.5	30	60	30	60	60
Saturday	n/a	n/a	n/a	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a
Sunday	n/a	n/a	n/a	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a

Service Day	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	6	8	1,373	73.5	350,000	18,700	6	3	6	3	3
Saturday	n/a	n/a	0	0.0	0	0	0	0	0	0	0
Sunday	n/a	n/a	0	0.0	0	0	0	0	0	0	0
	6	8			350,000	18,700					

Table B-6: Interim Service Plan and Statistics; Option 2: Marschall Rd to Minneapolis (7-Day Service)

Service Day	AM Peak Round Trip Miles	AM Peak Round Trip Minutes	Mid Eve Late Rnd Trip Miles	Mid Eve Late Rnd Trip Minutes	PM Peak Round Trip Miles	PM Peak Round Trip Minutes	Hours by Period AM	Mid	PM	Eve	Late	Service Frequency AM	Mid	PM	Eve	Late
Monday - Friday	56.03	146.45	56.03	143.00	56.03	146.77	3.0	7.0	3.5	2.0	2.5	30	60	30	60	60
Saturday	56.03	146.45	56.03	143.00	56.03	146.77	3.5	6.5	3.5	2.0	2.5	60	60	60	60	60
Sunday	56.03	146.45	56.03	143.00	56.03	146.77	3.5	6.5	3.5	2.0	2.5	60	60	60	60	60

Service Day	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	6	8	1,373	73.5	350,000	18,700	6	3	6	3	3
Saturday	3	4	1,009	54.0	52,400	2,800	3	3	3	3	3
Sunday	3	4	1,009	54.0	58,500	3,100	3	3	3	3	3
	6	8			460,900	24,600					

Connecting Bus Service

Connecting bus service would closely mirror those improvements described for BRT service in the main body of this memorandum. Interim service could be broken up into a phased-implementation approach with Option 1 service between the Marschall Road Transit Station and General Mills Station and Option 2 as full corridor service from Marschall Road Transit Station to downtown Minneapolis. Connecting bus service could be phased as warranted by demand. Potential bus service changes previously described in the Shakopee/Marschall Road area, the Viking Drive/Washington Avenue area and the General Mills area are also applicable for the interim service plan.

Table B-7 presents estimates of service requirements for potential background bus service changes for the interim service plan. As noted previously for the Optimized Scenario service plan, Plymouth Transit routes 772, 774 and 777 could also be modified to serve the General Mills stop with nominal impacts on service requirements or O&M costs. As noted above, all of these service changes do not necessarily need to be implemented in conjunction with interim service. For example, alignment modifications to Plymouth Transit routes 772, 774 and 777 could be implemented in conjunction with this interim service plan, with the Route 740 extension (listed below) implemented as interim service is upgraded to BRT service.

Table B-7: 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	542	5,872	70,812	3	9,072	104,328	4	3,200	33,516	1
Totals		18,787	251,546	9	42,834	548,186	16	24,047	296,640	7

O&M Cost Requirements

Annual operations and maintenance (O&M) costs were estimated for the interim service and utilized methodologies outlined in the main body of this memorandum. Bus O&M costs for background bus service changes are expressed as additional O&M costs over a No-Build scenario. Table B-8 presents cost estimates for interim service between Marschall Road Transit Station and General Mills for either weekday-only service or 7-day service (Option 1) and Table B-9 presents cost estimates for interim service between Marschall Road Transit Station and downtown Minneapolis for both weekday-only and 7-day service (Option 2). Table B-10 presents route-specific cost estimates for background bus service changes (cost increases from a No-Build scenario). These costs do not include O&M costs for BRT station amenities.

Table B-8: Option 1 (Marschall Rd to General Mills) Interim Service Annual O&M Cost Estimates (2015 dollars).

Cost Item	Unit Cost	Weekday Only Units	Weekday Only Cost	7-Day Service Units	7-Day Service Cost
Hwy 169 Interim Service					
Annual Revenue Bus-Miles	$3.29	258,500	$850,500	340,400	$1,119,900
Annual Revenue Bus-Hours	$52.30	10,800	$564,800	14,800	$774,000
Peak Buses	$44,322	3	$133,000	3	$133,000
Maintenance Garages	$15,800	4	$63,200	4	$63,200
Total Cost Estimate			**$1,611,500**		**$2,090,100**

Table B-9: Option 2 (Marschall Rd to downtown Minneapolis) Interim Service Annual O&M Cost Estimates (2015 dollars)

Cost Item	Unit Cost	Weekday Only Units	Weekday Only Cost	7-Day Service Units	7-Day Service Cost
Hwy 169 Interim Service					
Annual Revenue Bus-Miles	$3.29	350,000	$1,151,500	460,900	$1,516,400
Annual Revenue Bus-Hours	$52.30	18,700	$978,000	24,600	$1,286,600
Peak Buses	$44,322	6	$265,900	6	$265,900
Maintenance Garages	$15,800	8	$126,400	8	$126,400
Total Cost Estimate			**$2,521,800**		**$3,195,300**

Table B-10: 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	542	$322,000
Totals		**$2,543,900**

Performance Measures

Performance benchmarks applied to the interim service could be used to determine appropriate timeframes for upgrading the level of service (more midday or peak period trips), the span of service (weekday-only to 7-day service), expansion of the alignment (Option 1 to General Mills vs. Option 2 to downtown Minneapolis), eventual inclusion of BRT features (including the addition of stops at Canterbury Road and Bren Road). However, this does not commit the service to mandatory upgrades, only the consideration of additional service, and would be dependent on available funding. These service benchmarks could be used as one of several evaluation measures for interim service to see if it is ready for improvements to a next level of service.

Based on regional transit guidelines, suburban local service should reach 15 passengers per in-service hour (PPISH) and if service reaches the downtown urban core, that number goes up to 25 PPISH. It is anticipated that it will take a period of time to build ridership for this new regional route. This route will need to capture approximately 600 (Option 1) to 1,000 (Option 2) weekday passenger trips per day to reach a 15 PPISH threshold. The Downtown Hopkins stop is anticipated to be important to this route's success since the proposed Highway 169 service provides a means to distribute Green Line trips north to General Mills, and south to Shakopee. It is recommended that this route achieve a minimum of 25 PPISH before upgrading to BRT service. MnPASS lanes and/or upgraded bus-on-shoulder lanes should also be in place prior to upgrading to BRT service.

Finally, a key objective of this route is capturing reverse commute trips. Passenger surveys should be used to determine trip purpose and general passenger use on the interim route. Survey information will be useful to determining appropriate adjustments to the interim route's span of service, days of operation and passenger travel patterns.

Station-to-Station Travel Time Estimates (Interim Service)

AM PEAK PERIOD

Interim Service Estimate		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Viking Dr/Washington Ave	10.59	0:16:18	39.0
Viking Dr/Washington Ave	Downtown Hopkins	5.74	0:13:03	26.4
Downtown Hopkins	General Mills	4.60	0:09:04	30.4
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 (Layover)	0.17	0:01:42	6.0
		28.47	**1:15:26**	**22.6**

Interim Service Estimate		Southbound/Outbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St (Layover)	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	Downtown Hopkins	4.94	0:11:30	25.8
Downtown Hopkins	Viking Dr/Washington Ave	5.02	0:08:42	34.6
Viking Dr/Washington Ave	Marschall Rd Transit Station	10.48	0:16:35	37.9
		27.56	**1:11:01**	**23.3**

MIDDAY PERIOD

Interim Service Estimate		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Viking Dr/Washington Ave	10.59	0:16:08	39.4
Viking Dr/Washington Ave	Downtown Hopkins	5.74	0:12:24	27.8
Downtown Hopkins	General Mills	4.60	0:08:50	31.2
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 (Layover)	0.17	0:01:39	6.2
		28.47	**1:13:17**	**23.3**

Interim Service Estimate		Southbound/Outbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St (Layover)	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	Downtown Hopkins	4.94	0:11:21	26.1
Downtown Hopkins	Viking Dr/Washington Ave	5.02	0:08:38	34.9
Viking Dr/Washington Ave	Marschall Rd Transit Station	10.48	0:16:16	38.7
		27.56	**1:09:43**	**23.7**

PM PEAK PERIOD

Interim Service Estimate		Northbound/Inbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
Marschall Rd Transit Station	Viking Dr/Washington Ave	10.59	0:16:17	39.0
Viking Dr/Washington Ave	Downtown Hopkins	5.74	0:13:04	26.4
Downtown Hopkins	General Mills	4.60	0:09:04	30.4
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 (Layover)	0.17	0:01:42	6.0
		28.47	**1:15:12**	**22.7**

Interim Service Estimate		Southbound/Outbound		
Start Station	**End Station**	**Dist**	**Time**	**Avg Spd**
4th Ave/7th St (Layover)	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	Downtown Hopkins	4.94	0:11:30	25.8
Downtown Hopkins	Viking Dr/Washington Ave	5.02	0:08:51	34.0
Viking Dr/Washington Ave	Marschall Rd Transit Station	10.48	0:16:40	37.7
		27.56	**1:11:34**	**23.1**