METRO Gold Line

BUS RAPID TRANSIT PROJECT ENVIRONMENTAL ASSESSMENT

Environmental Assessment Appendix A Technical Report

Transportation Resources

September 2019

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FIGURES

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ACRONYMS AND ABBREVIATIONS

2040 TPP	*2040 Transportation Policy Plan*
AASHTO	American Association of State Highway and Transportation Officials
BRT	Bus Rapid Transit
Council	Metropolitan Council
EA	Environmental Assessment
FAA	Federal Aviation Administration
FTA	Federal Transit Administration
HCM	*Highway Capacity Manual*
I-	Interstate
LOS	Level of Service
MAC	Metropolitan Airports Commission
MnDOT	Minnesota Department of Transportation
MOT	Maintenance of Traffic
NEPA	National Environmental Policy Act
OMF	Operations and Maintenance Facility
Project	METRO Gold Line Bus Rapid Transit Project
RPZ	Runway Protection Zone
SR	Service Road
STOPS	Simplified Trips on Project Software
TH	Trunk Highway
VMT	Vehicle Miles Traveled

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3. TRANSPORTATION RESOURCES TECHNICAL REPORT

3.1. Introduction

This report was prepared in support of the METRO Gold Line Bus Rapid Transit (BRT) Project (Project) Environmental Assessment (EA). It provides results of the analysis of impacts to transportation resources from the Project for the No-Build Alternative and Build Alternatives 1 and 2. It also addresses the Hazel Street Station and the Dedicated Guideway at Hadley Avenue and 4th Street design options for Build Alternatives 1 and 2.

The National Environmental Policy Act (NEPA)[1,2] and the Minnesota Environmental Policy Act[3] provide the general basis of consideration for discussing transportation system impacts. Specific laws, regulations, and executive orders apply to the evaluation of some transportation impacts, such as aviation. The regulatory context section references applicable specific statutory or regulatory laws for each resource. This report evaluates the following transportation system resources: traffic; transit; parking and driveways; pedestrian and bicycle facilities; freight rail; and aviation. The *Indirect Effects and Cumulative Impacts Technical Report* in **Appendix A** discusses the Project-related indirect and cumulative effects to these resources.

The analysis defined for each resource a "study area" – a geographic space where potential impacts to the resource were evaluated – based on the Project's "potential limits of disturbance," or the area in which the Project would be built. In some cases, the study area extends beyond the potential limits of disturbance, so the analysis could evaluate impacts to adjacent or nearby resources; for example, transit service areas may extend beyond the potential limits of disturbance.

Table 3.1-1 summarizes the study areas for each resource this technical report evaluates.

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[1] *The National Environmental Policy Act of 1969, as amended. ("The Public Health and Welfare," Title 42, U.S. Code (USC), Sec. 4321 et seq. (1969)). Available at: https://www.gpo.gov/fdsys/pkg/USCODE-2011-title42/pdf/USCODE-2011-title42-chap55-sec4321.pdf. Accessed November 2018.*

[2] *Council on Environmental Quality. "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act." 2005 reprint of "Protection of Environment," Title 40, Code of Federal Regulations (CFR), Parts 1500-1508. Available at: https://www.energy.gov/sites/prod/files/NEPA-40CFR1500_1508.pdf. Accessed October 2018.*

[3] *"Environmental Policy," Chap. 116D, Minnesota Statutes, 2018. Available at: https://www.revisor.mn.gov/statutes/cite/116D. Accessed May 2018.*

TABLE 3.1-1: SUMMARY OF DEFINED STUDY AREAS FOR TRANSPORTATION RESOURCES

Resource Evaluated	Study Area Definition	Basis for Study Area
Traffic	All intersections on Project alignment, adjacent intersections on high-traffic roadways, and intersections within the potential limits of disturbance	*Highway Capacity Manual* and industry standards
Transit	The Twin Cities Metropolitan Area transit system	Estimated area that includes existing and proposed transit service changes identified at this stage of the Project
Parking and Driveways	Within the potential limits of disturbance	Captures potential loss of and/or changes to parking around alignment and stations and potential driveway impacts
Pedestrian and Bicycle Facilities	Within the potential limits of disturbance; facilities adjacent to the Build alternatives alignment; alternate routes within a ½-mile of the Build alternatives alignment; and nearby connections to the regional bicycle system	Represents distance transit-users generally are willing to walk to access a station
Freight Rail	The limits of disturbance on either side of the alignment	Captures existing at-grade freight rail-roadway crossings
Aviation	Aviation facilities within 5 miles of the Project	Elements of the Project within St. Paul Airport (Holman Field) Safety Zones A and B

3.1.1. Overview of Build Alternatives

The *Alternatives Technical Report* in **Appendix A** of this EA provides descriptions of the two Build Alternatives evaluated within the EA, Build Alternative 1 (A1-BC-D3) and Build Alternative 2 (A2-BC-D3). The difference between the two Build Alternatives is within Alignment A in downtown Saint Paul. Alignment A2 of Build Alternative 2 would terminate at Union Depot, and Alignment A1 of Build Alternative 1 would terminate approximately 1 mile to the west at the Smith Avenue Transit Center. The Federal Transit Administration (FTA) and Metropolitan Council (Council) based the anticipated long- and short-term impacts from the Build Alternatives on the 15% Concept Plans for the Project (see **Appendix B**).

3.1.2. Overview of No-Build Alternative

NEPA requires that the Project analysis includes the No-Build Alternative to provide a base point from which to evaluate the potential impacts, benefits and costs of the Build Alternatives, as well as a potential outcome of the EA process. The No-Build Alternative represents the existing transportation system as the Council's *2040*

Transportation Policy Plan (2040 TPP)[4] presents it – with only planned and programmed improvements, and without the Project. Therefore, construction and operation of the Project is not included in the No-Build Alternative. Section 2.6.1 of the *Alternatives Technical Report* in **Appendix A** list some of the funded highway and transit projects in the 2040 TPP that are included in the No-Build Alternative.

The following summary provides a consolidated discussion of the No-Build Alternative for the transportation resources evaluated in this report. This summary assumes future conditions in 2040 in the resource study area if the Project were not built.

3.1.2.1. Traffic

The No-Build Alternative accounts for the following planned, capacity-related roadway improvement projects:

- Add a managed lane (e.g., MnPASS) on I-94 between downtown Minneapolis (5th/6th streets south) and Saint Paul (Mounds Boulevard) (MnDOT)
- Traffic signal and turn lane construction at the 4th Street/Helmo Avenue and 4th Street/Hadley Avenue intersections, based on planned development and traffic (Oakdale)
- Traffic signal construction at the Bielenberg Drive/Nature Path intersection, based on planned development and traffic (Woodbury)

The 2040 No-Build Alternative conditions traffic analysis provides a basis from which the Council could identify Project-related impacts to traffic. The Council based the No-Build Alternative conditions analysis on the forecasted traffic volumes, existing roadway geometrics and intersection control for this scenario (except as noted above). The analysis assumed timing for existing traffic signals would be optimized between the existing and 2040 No-Build Alternative conditions.

This analysis found that all evaluated intersections would operate at LOS D or better during the 2040 AM and PM peak-hour conditions except for the following locations:

- Bielenberg Drive/Tamarack Hills in the 2040 No-Build Alternative conditions PM peak
- Bielenberg Drive/Tamarack Road in the 2040 No-Build Alternative conditions PM peak
- Bielenberg Drive/Guider Drive in the 2040 No-Build Alternative conditions PM peak

Poor operations at the intersection of Bielenberg and Guider drives in this scenario are due to the existing side-street stop control, which makes finding a gap in traffic on Bielenberg Drive difficult for vehicles on the side street. Poor operations at the intersection of Bielenberg Drive and Tamarack Road are due to very high traffic volumes during the peak period, which also contribute to the poor operations and queuing at the Bielenberg Drive/Tamarack Hills intersection.

Attachment A-3-2 includes tables that show the geometrics and intersection control for the 2040 No-Build Alternative conditions. **Attachment A-3-3** includes the complete results of the 2040 No-Build Alternative conditions analysis of delay and LOS.

[4] *Metropolitan Council.* 2040 Transportation Policy Plan. *Adopted January 2015. Available at: https://metrocouncil.org/Transportation/Planning-2/Key-Transportation-Planning-Documents/Transportation-Policy-Plan-(1)/The-Adopted-2040-TPP-(1).aspx. Accessed November 2018.*

ALIGNMENT A1 (SMITH AVENUE TO MOUNDS BOULEVARD) FOR 2040 NO-BUILD ALTERNATIVE

For Alignment A1, the Council used Synchro/SimTraffic to model Intersection 6, consistent with the existing-conditions analysis. The Council used Vissim to model Intersections 1-5. The analysis anticipates that all the intersections would operate at LOS D or better, and it did not identify queuing issues.

Table 3.1-2 lists the 2040 No-Build Alternative analysis results for the resource study area intersections for Alignment A1.

TABLE 3.1-2: ALIGNMENT A1 2040 NO-BUILD ALTERNATIVE AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
1. Sibley St/Kellogg Blvd	23.9	C	17.6	B
2. Sibley St/4th St	10.8	B	10.9	B
3. Sibley St/5th St	7.9	A	8.9	A
4. 5th St/Market St	18.1	B	25.7	C
5. 5th St/St. Peter St	8.7	A	9.4	A
6. Kellogg Blvd/Wacouta St[b]	1.4	A	3.0	A

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

ALIGNMENT B (MOUNDS BOULEVARD TO WHITE BEAR AVENUE) FOR 2040 NO-BUILD ALTERNATIVE

For Alignment B, the Council used Vissim to model Intersections 8-11 and Synchro/SimTraffic to model Intersections 12-15, consistent with the existing-conditions analysis. The analysis anticipates that all the intersections would operate at LOS D or better, and it found the following queuing issue:

- **White Bear Avenue/Old Hudson Road:** For the northbound left-turn movement in the PM peak, the existing left-turn lane is only 50 feet long due to its proximity to the White Bear Avenue/I-94 westbound ramps intersection. This issue also occurs in the existing conditions.

Table 3.1-3 lists the 2040 No-Build Alternative analysis results for the resource study area intersections for Alignment B.

TABLE 3.1-3: ALIGNMENT B 2040 NO-BUILD ALTERNATIVE AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
8. Kellogg Blvd/Mounds Blvd	24.9	C	21.1	C
9. Mounds Blvd/I-94 WB off-ramp	2.1	A	1.6	A
10. Mounds Blvd/I-94 EB on-ramp	4.9	A	8.6	A
11. Earl St/Hudson Rd	6.8	A	7.8	A
12. White Bear Ave/Old Hudson Rd[b]	13.7	B	21.1	C
13. White Bear Ave/I-94 WB ramps[b]	10.4	B	14.2	B
14. White Bear Ave/I-94 EB ramps[b]	16.3	B	23.9	C
15. White Bear Ave/Suburban Ave[b]	14.7	B	15.6	B

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

ALIGNMENT C (WHITE BEAR AVENUE TO I-694) FOR 2040 NO-BUILD ALTERNATIVE

For Alignment C, the Council used Vissim to model Intersections 24-26 and 30-31, and Synchro/SimTraffic to model Intersections 16-23 and 27-29, consistent with the existing-conditions analysis. The analysis anticipates that all the intersections would operate at LOS D or better, and it found the following queuing issues:

- **Century Avenue/Hudson SR/I-94 westbound off-ramp:** Northbound left-turn movement queues through the I-94 eastbound ramps intersection in the AM peak due to heavy traffic accessing I-94 westbound. This issue also occurs in the existing conditions
- **Century Avenue/I-94 eastbound ramps:** Eastbound left-turn movement exceeds the lane storage length in the PM peak due to signal timing that favors the heavier southbound movements on Century Avenue; however, the queue does not reach the mainline freeway

Table 3.1-4 lists the 2040 No-Build Alternative analysis results for the resource study area intersections for Alignment C.

TABLE 3.1-4: ALIGNMENT C 2040 NO-BUILD ALTERNATIVE AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
16. Ruth St/Old Hudson Rd[b]	13.4	B	25.1	C
17. Ruth St/I-94 WB on-ramp[b]	3.0	A	12.7	B
18. Ruth St/I-94 EB off-ramp[b]	7.4	A	13.3	B

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
19. Pedersen St/Old Hudson Rd[b]	1.1	A	2.0	A
20. McKnight Rd/1st St[b]	2.4	A	3.6	A
21. McKnight Rd/Hudson SR[b]	1.8	A	14.1	B
22. McKnight Rd/Hudson Rd/I-94 WB on-ramp[b]	10.3	B	20.7	C
23. McKnight Rd/Burns Ave[b]	9.3	A	16.5	B
24. Hudson Rd/4th St	0.4	A	1.3	A
25. Hudson Rd/8th St	1.0	A	0.4	A
26. Hudson Rd/19th St	1.0	A	0.1	A
27. Century Ave/Hudson Rd/Hudson Blvd[b]	3.2	A	10.1	B
28. Century Ave/Hudson SR/I-94 WB off-ramp[b]	26.0	C	14.8	B
29. Century Ave/I-94 EB ramps[b]	18.3	B	41.6	D
30. 4th St/Hadley Ave	10.4	B	12.7	B
31. 4th St/Hale Ave	2.5	A	2.7	A

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

ALIGNMENT D3 (I-694 TO WOODBURY 494 PARK AND RIDE) FOR 2040 NO-BUILD ALTERNATIVE

For Alignment D3, the Council used Vissim to model Intersections 32-36 and Synchro/SimTraffic to model Intersections 37-44, consistent with the existing-conditions analysis. The analysis anticipates that all the intersections would operate at LOS D or better with the following exceptions:

- The Bielenberg Drive/Tamarack Hills intersection would operate at LOS E in the PM peak due to queues on Bielenberg Drive caused by the congested Tamarack Road intersection
- The Bielenberg Drive/Tamarack Road intersection would operate at LOS F in the PM peak due to heavy eastbound traffic
- The Bielenberg Drive/Guider Drive intersection would operate at LOS F in the PM peak due to traffic volumes that exceed the capacity of the existing side-street stop control

The analysis found the following queuing issues in the 2040 No-Build Alternative conditions:

- **Bielenberg Drive/Tamarack Hills:** Westbound left-turn and through movements and southbound through movements exceed the lane storage length and would operate at LOS F in the PM peak due to congestion and queue spill-back from the Bielenberg Drive/Tamarack Road intersection

- **Bielenberg Drive/Tamarack Road:** All eastbound movements; westbound left-turn and through movements; northbound left- and right-turn movements; and southbound through and right-turn movements exceed the lane storage length and operate at LOS E/F in the PM peak due to very heavy volumes at the intersection. The eastbound, left-turn-movement 95th-percentile queue also exceeds the available lane storage
- **Bielenberg Drive/Guider Drive:** Eastbound left-turn movement 95th percentile queue extends to the upstream intersection and operates at LOS F in the PM peak due to the side-street stop control and the lack of gaps in Bielenberg Drive traffic

Table 3.1-5 lists the 2040 No-Build Alternative analysis results for the resource study area intersections for Alignment D3.

TABLE 3.1-5: ALIGNMENT D3 2040 NO-BUILD ALTERNATIVE AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
32. 4th St/Hudson Blvd/Hayward Ave	5.7	A	9.3	A
33. EB 4th St/BRT Guideway[c]	N/A	N/A	N/A	N/A
34. 4th St/Helmo Ave	8.6	A	14.5	B
35. 3rd St/Helmo Ave	0.7	A	2.2	A
36. Helmo Ave/Hudson Blvd/2nd St[c]	N/A	N/A	N/A	N/A
37. Bielenberg Dr/Hudson Rd[b,c]	N/A	N/A	N/A	N/A
38. Bielenberg Dr/Hartford North Driveway[b]	0.7	A	2.1	A
39. Bielenberg Dr/Hartford South Driveway[b]	3.1	A	3.1	A
40. Bielenberg Dr/Tamarack Hills North[b]	2.7	A	34.2	D
41. Bielenberg Dr/Tamarack Hills[b]	5.8	A	56.1	E
42. Bielenberg Dr/Tamarack Rd[b]	38.1	D	100+	F
43. Bielenberg Dr/Nature Path[b]	3.5	A	7.0	A
44. Bielenberg Dr/Guider Dr[b]	3.6	A	61.9	F

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

[c] *No intersection on No-Build Alternative at this location.*

ALIGNMENT A2 (UNION DEPOT TO MOUNDS BOULEVARD) FOR 2040 NO-BUILD ALTERNATIVE

For Alignment A2, the Council used Synchro/SimTraffic to model this intersection, consistent with the existing-conditions analysis. The analysis anticipates that this intersection would operate at LOS D or better, and it did not identify queuing issues.

Table 3.1-6 lists the 2040 No-Build Alternative analysis results for the resource study area intersections for Alignment A2.

TABLE 3.1-6: ALIGNMENT A2 2040 NO-BUILD ALTERNATIVE AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
7. Kellogg Blvd/Broadway St[b]	12.3	B	11.1	B

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic.*

3.1.2.2. Transit

For the No-Build Alternative, the Council anticipates that local and limited-stop/express buses would carry approximately 10,450 riders in 2040 (see **Table 3.3-3**). The Council anticipates that work-based trips on the entire transit system would comprise approximately 50 percent of total trips. Riders from no-vehicle households would take approximately 35 percent of the total regional transit trips. These No-Build Alternative percentages are similar to those of the existing transit system. The Council anticipates the No-Build Alternative in 2040 would see 335,900 linked trips throughout the region on an average weekday, which is approximately a 23 percent increase over existing linked trips in the region (see **Table 3.3-5**). The No-Build Alternative would not produce long-term impacts to vehicle miles traveled (VMT).

3.1.2.3. Parking and Driveways

The No-Build Alternative would have no associated long-term or short-term impacts to on- or off-street parking within the study area because the Project would not be built. The corridor would also not include the additional parking provided at the three new park-and-ride facilities proposed for construction under the Build Alternatives. Other transportation and development projects constructed within the study area could affect existing on-street and off-street parking supply and demand, depending on where the type and location of the project. These projects would comply with applicable regulations such as minimum off-street parking for commercial developments.

3.1.2.4. Pedestrian and Bicycle Facilities

The No-Build Alternative would have no associated long-term or short-term impacts to pedestrian or bicycle facilities within the study area because the Project would not be built. Other pedestrian and bicycle facilities that would occur under the No-Build Alternative would change the facilities in the corridor, compared to existing conditions, depending on where the type and location of the project. These projects would comply with applicable local requirements that could improve the existing facilities.

3.1.2.5. Freight Rail

The No-Build Alternative would have no associated long-term or short-term impacts to freight rail facilities or operations within the study area because the Project would not be built. Existing freight rail operations would continue and changes to these conditions in 2040 would be the result of changes in market conditions and decisions by freight rail owners and operators.

3.1.2.6. Aviation

The No-Build Alternative would have no associated long-term or short-term impacts to aviation facilities or operations within the study area because the Project would not be built. Existing aviation operations would continue, and changes to these conditions in 2040 would be the result of changes in market conditions and decisions by agencies involved in airport operations.

3.2. Traffic

This section evaluates Project-related impacts to traffic. The traffic analysis is based on the Project scope, as shown in the 15% Concept Plans in **Appendix B**.

3.2.1. Regulatory Context and Methodology

3.2.1.1. Methodology

The traffic operations analysis utilized methodologies from the Highway Capacity Manual (HCM)[5] and created the Project traffic models using Synchro/SimTraffic and Vissim – software packages that implement HCM methodologies. The Project analysis modeled lane geometrics, traffic, transit and pedestrian volumes, intersection-control and signal-timing characteristics.

An intersection's "level of service" (LOS) describes a driver's quality of experience relative to the intersection's operations. The HCM uses six letter "grades," from A to F, to describe an intersection's LOS, with LOS A being the best operating conditions and LOS F being the worst.

The HCM uses equations to calculate the delay motorists experience due to traffic signals or stop signs, as well as conflicting traffic, as the basis to determine an intersection's LOS. **Table 3.2-1** shows the HCM control delay thresholds in seconds per vehicle for each LOS rating.

TABLE 3.2-1: INTERSECTION LEVEL OF SERVICE DEFINITIONS

LOS	Signalized Intersection Average Delay (Seconds per Vehicle)	Unsignalized Intersection Average Delay (Seconds per Vehicle)
A	<10	<10
B	10-20	10-15
C	20-35	15-25
D	35-55	25-35
E	55-80	35-50
F	>80	>50

Source: HCM

[5] *Transportation Research Board.* Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis. *2016. Washington, D.C.*

LOS D/E is the acceptable threshold for intersections during the peak traffic hour for urban and suburban areas, according to standard practice in the traffic engineering industry, guidance from the American Association of State Highway and Transportation Officials (AASHTO), the Minnesota Department of Transportation (MnDOT) and Twin Cities Metropolitan Area practice.

The analysis used both of the following criteria to identify intersections that have traffic backups or queuing issues:

- A 95th percentile queue length that exceeds lane storage length and has one of the following criteria:
  - Average back-of-queue exceeds storage length
  - Traffic movement operates at LOS E or F
  - 95th percentile queue blocks upstream full-access intersection(s)
- A 95th percentile queue length that exceeds 500 feet on a stop-controlled approach

For Project locations where the analysis identified a queuing problem, the FTA and the Council determined the need for mitigation measures by comparing the intersection's two Build Alternative conditions with those of the No-Build Alternative including the severity of the queuing, the potential safety and operations implications at intersections, and whether the queue issue impacts the larger roadway network.

Peak-hour analysis reflects the times of day when a facility is typically busiest; therefore, the peak hours indicate the "worst-case scenario" in terms of impacts. The Council analyzed time periods including the hour of highest traffic volume during the weekday morning (AM) peak period (6-9 a.m.) and afternoon (PM) peak period (3-7 p.m.). The peak hour varied by intersection, but the analysis generally identified AM peak hours as occurring between 7-8:30 a.m., and PM peak hours as occurring between 4:30-5:45 p.m.

The operations analysis also incorporated the requirements and standards in the *Minnesota Manual on Uniform Traffic Control Devices*[6] related to signal operations including transit signals, and transit signal priority and preemption.

3.2.1.2. Study Area

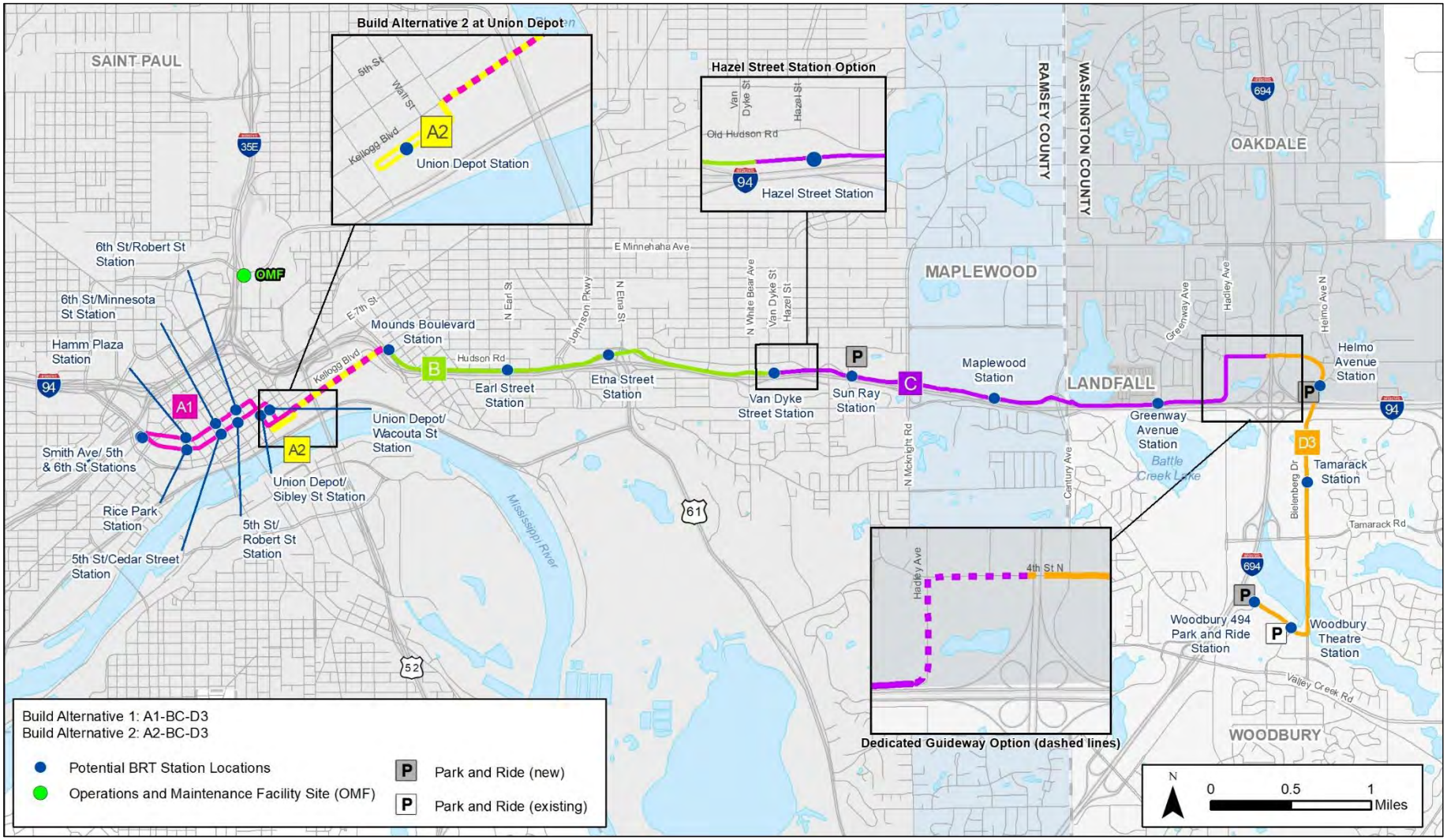
The Project includes alignments with the BRT operating in dedicated guideways, mixed traffic and grade-separated operations, which the following statements define:

- **Dedicated guideway:** BRT would operate in its own, dedicated lane that does not allow general traffic; pedestrian, bicycle, and vehicle traffic cross the guideway at controlled intersections
- **Mixed traffic:** BRT would operate within general traffic and not in its own separate lane
- **Grade-separated:** BRT would operate on a structure over or under the existing roadway

Figure 3.2-1 shows the Build Alternatives within the overall Project area.

[6] *Minnesota Department of Transportation.* Minnesota Manual on Uniform Traffic Control Devices. *Revision 6. Last modified February 21, 2018. Available at: http://www.dot.state.mn.us/trafficeng/publ/mutcd/. Accessed May 2018.*

FIGURE 3.2-1: PROJECT BUILD ALTERNATIVES IN THE ENVIRONMENTAL ASSESSMENT



The study area included all intersections on the Project alignments, adjacent intersections on high-traffic roadways, and intersections within the potential limits of disturbance. The analysis considered changes and potential impacts to each intersection to determine which intersections the traffic modeling should include. The Council also considered impacts from changes in traffic patterns to potential driveway and access closures or modifications. The traffic modeling included all full-access intersections with the dedicated guideway, adjacent intersections on high-traffic roadways, and intersections with geometric or operations changes that could produce a traffic impact.

The analysis evaluated the following five alignments:

- Alignment A1 (Smith Avenue to Mounds Boulevard), which would operate in bus-only lanes and mixed traffic
- Alignment A2 (Union Depot to Mounds Boulevard), which would operate in mixed traffic
- Alignment B (Mounds Boulevard to White Bear Avenue), which would operate primarily in a dedicated guideway with limited areas of mixed traffic and a grade separation at White Bear Avenue
- Alignment C (White Bear Avenue to I-694), which would operate in a dedicated guideway and in mixed traffic and grade separations at Ruth Street, McKnight Road, and Century Avenue
- Alignment D3 (I-694 to Woodbury 494 Park and Ride), which would operate primarily in center running and side running dedicated guideways with limited areas in mixed traffic and grade separation at I-694 and I-94

The Council limited its traffic modeling of BRT operations in downtown Saint Paul to intersections where the Project would modify geometrics or control, which would affect the traffic capacity and operations. The analysis also included adjacent intersections where stakeholders or the analysis identified concerns about bus queuing and upstream impacts. The analysis did not assume transit signal priority or preemption at the traffic signals in downtown Saint Paul.

Along the rest of the Project route in downtown Saint Paul, buses would operate in mixed traffic or in existing bus lanes. In these areas, the Project does not include changes to the number or assignment of traffic lanes, the location of existing traffic signals, or the phasing of the existing traffic signals. The addition of BRT buses on these streets would represent only a 1 to 2 percent change in traffic volumes, and the existing bus lanes would have adequate capacity to accommodate the total bus volumes. The FTA and the Council do not anticipate Project-related traffic impacts at intersections where BRT would operate in mixed traffic through downtown Saint Paul; therefore, the analysis did not include these intersections.

Figure 3.2-2, **Figure 3.2-3** and **Figure 3.2-4** show the locations of the analyzed intersections.

FIGURE 3.2-2: ALIGNMENTS A1, A2 AND B ANALYSIS INTERSECTIONS

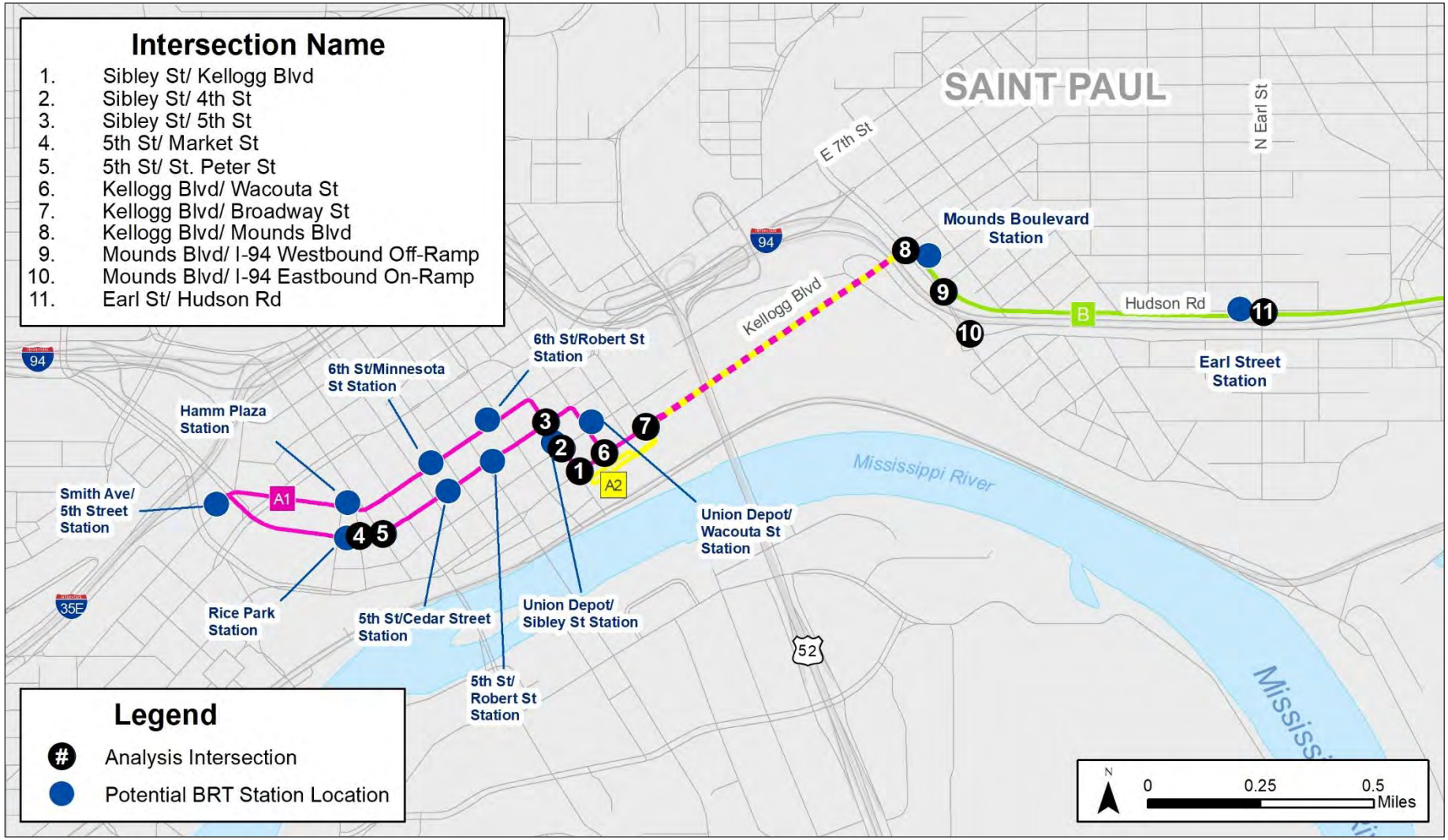


FIGURE 3.2-3: ALIGNMENTS B AND C ANALYSIS INTERSECTIONS

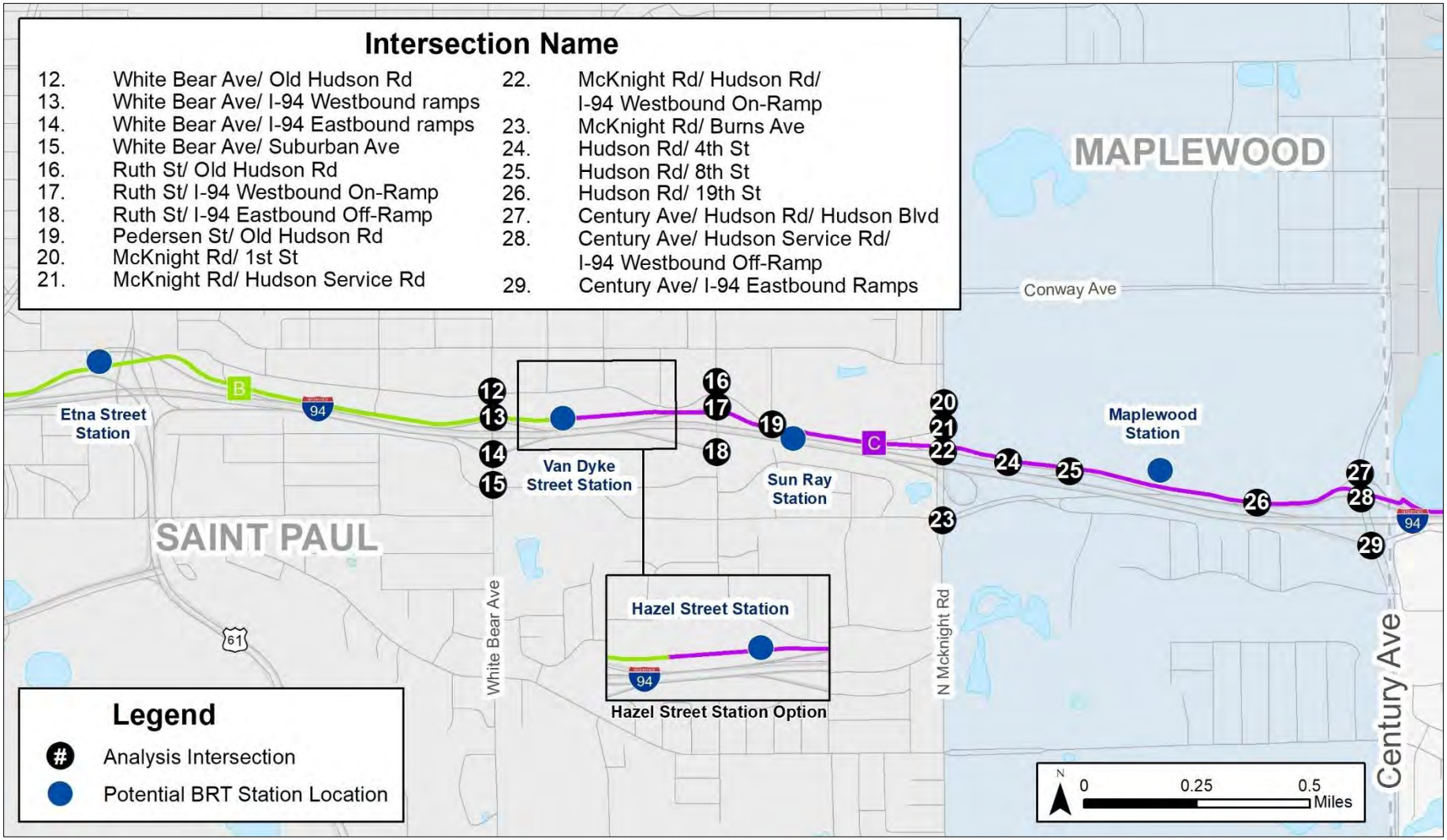


FIGURE 3.2-4: ALIGNMENTS C AND D3 ANALYSIS INTERSECTIONS

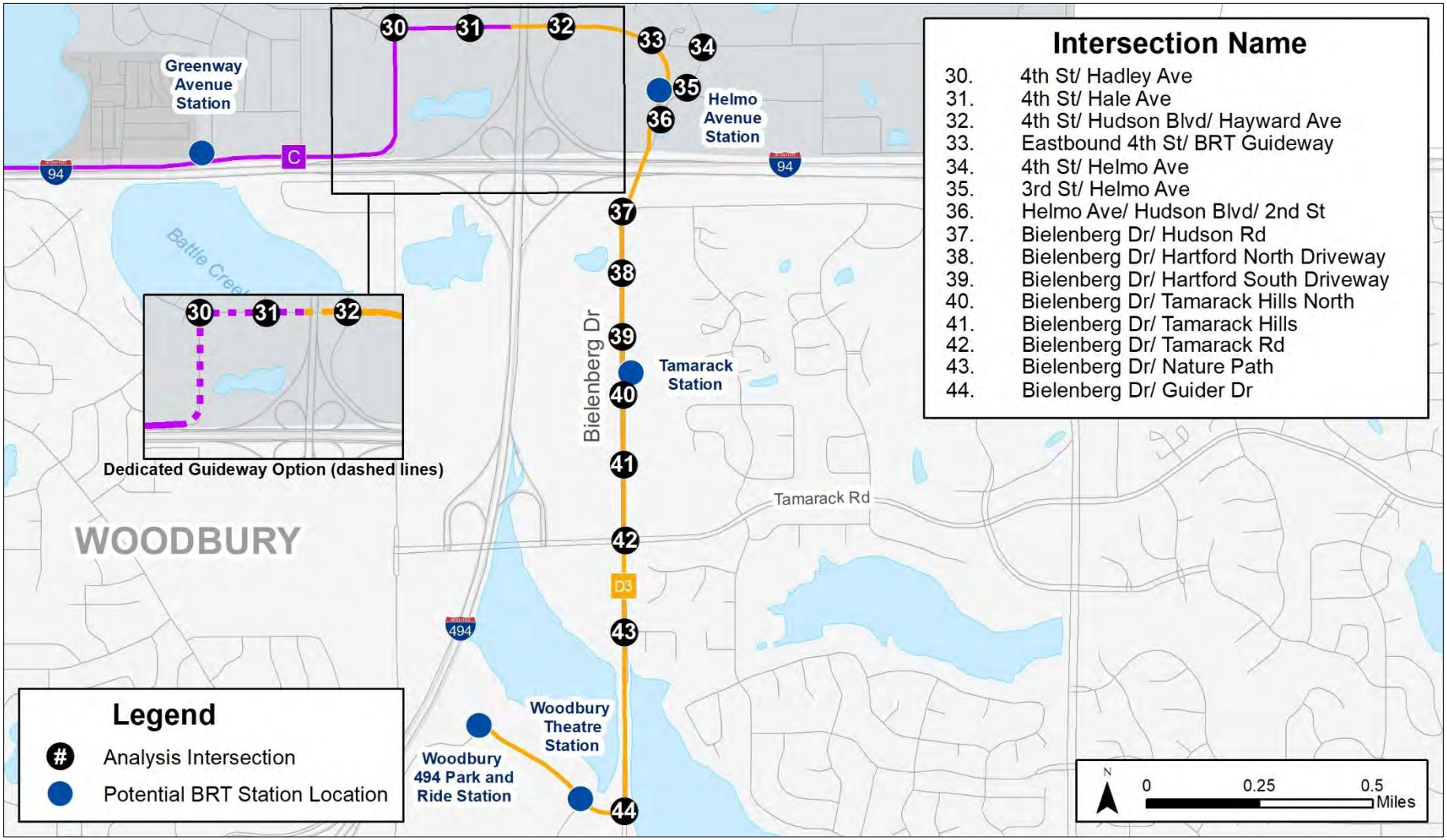


Table 3.2-2 lists the existing bus, vehicle traffic and anticipated BRT volumes in downtown Saint Paul on 5th and 6th streets between Robert and St. Peter streets – locations at which the Project would have the highest volume of operations.

TABLE 3.2-2: DOWNTOWN SAINT PAUL TRAFFIC VOLUMES – EXISTING AND WITH THE PROJECT

Between Robert and St. Peter Streets	5th Street Existing	5th Street BRT[a]	6th Street Existing	6th Street BRT[a]
Daily Volume (vehicles/day)	6,100	+78 buses (1.3% increase in total traffic)	7,000	+78 buses (1.1% increase in total traffic)
Daily Bus Volume (buses/day)	517		517	
AM Peak Volume (vehicles/hour)	537	+6 buses (1.1% increase in total peak-hour traffic)	818	+6 buses (0.7% increase in total peak-hour traffic)
AM Bus Volume (buses/hour)	56		54	
PM Peak Volume (vehicles/hour)	672	+6 buses (0.9% increase in total peak-hour traffic)	652	+6 buses (0.9% increase in total peak-hour traffic)
PM Bus Volume (buses/hour)	50		56	

[a] ***Table 2.2-2*** *in the* ***Environmental Assessment*** *shows BRT volumes based on the operating frequencies.*

3.2.1.3. Forecast Traffic Volumes

The analysis based its future-year traffic forecasts on preliminary 2040 socioeconomic data from local communities consistent with the Council's 2040 TPP. The Council used this data for its regional travel-demand model to generate outputs it could then compare with existing and historic traffic counts. The Council developed its future-year forecasts for each roadway segment within the Project area using this data combined with changes in land use and population anticipated in the *Thrive MSP 2040* regional development program.

3.2.2. Affected Environment

3.2.2.1. Existing-Conditions Analysis

The Council based its existing-conditions analysis on traffic volumes, roadway geometrics and signal operations as they existed in 2017-2018, when the Project team completed its data collection. The analysis found that all evaluated intersections operate at LOS D or better during the existing-conditions AM and PM peak hours.

Attachment A-3-1 includes tables showing the existing peak-hour traffic volumes. **Attachment A-3-2** includes intersection layout tables showing existing-condition geometrics and intersection control. **Attachment A-3-3** includes the complete results of the existing-conditions analysis of delay and LOS.

ALIGNMENT A1 (SMITH AVENUE TO MOUNDS BOULEVARD) EXISTING CONDITIONS

For Alignment A1, the Council used Vissim to model Intersections 1-5, where BRT buses would stop in the traffic lane at stations; it used Synchro/SimTraffic to model Intersection 6, where BRT buses would operate in mixed traffic. The existing-conditions analysis showed that all the intersections operate at LOS D or better, and it did not identify queuing issues. **Table 3.2-3** lists the existing-conditions analysis results for the resource study area intersections for Alignment A1.

TABLE 3.2-3: ALIGNMENT A1 EXISTING AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
1. Sibley St/Kellogg Blvd	23.8	C	17.4	B
2. Sibley St/4th St	10.6	B	10.7	B
3. Sibley St/5th St	7.7	A	8.7	A
4. 5th St/Market St	17.9	B	25.5	C
5. 5th St/St. Peter St	8.7	A	9.4	A
6. Kellogg Blvd/Wacouta St[b]	1.3	A	2.9	A

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

ALIGNMENT B (MOUNDS BOULEVARD TO WHITE BEAR AVENUE) EXISTING CONDITIONS

For Alignment B, the Council used Vissim to model Intersections 8-11 due to the dedicated guideway, complex traffic signal phasing, or the need to model vehicle interactions in detail at these locations. The Council used Synchro/SimTraffic to model Intersections 12-15 because they are typical and would not have operational interactions with the dedicated guideway under the two Build Alternative conditions. The existing-conditions analysis showed that all intersections operate at LOS D or better, and it found the following queuing issue:

- **White Bear Avenue/Old Hudson Road:** For the northbound left-turn movement in the PM peak, the left-turn lane is only 50 feet long due to its proximity to the White Bear Avenue/I-94 westbound ramps intersection

Table 3.2-4 lists the existing-conditions analysis results for the resource study area intersections for Alignment B.

TABLE 3.2-4: ALIGNMENT B EXISTING AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
8. Kellogg Blvd/Mounds Blvd	24.5	C	20.8	C
9. Mounds Blvd/I-94 WB off-ramp	1.9	A	1.5	A

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
10. Mounds Blvd/I-94 EB on-ramp	4.7	A	8.3	A
11. Earl St/Hudson Rd	6.5	A	7.5	A
12. White Bear Ave/Old Hudson Rd[b]	13.2	B	19.7	B
13. White Bear Ave/I-94 WB ramps[b]	9.7	A	13.8	B
14. White Bear Ave/I-94 EB ramps[b]	16.2	B	21.5	C
15. White Bear Ave/Suburban Ave[b]	14.4	B	15.5	B

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

ALIGNMENT C (WHITE BEAR AVENUE TO I-694) EXISTING CONDITIONS

For Alignment C, the Council used Vissim to model Intersections 24-26 and 30-31 due to the dedicated guideway, and complex geometrics and traffic signal phasing. The Council used Synchro/SimTraffic to model Intersections 16-23 and 27-29 because they are typical and would not interact operationally with the dedicated guideway under the two Build Alternative conditions. The existing-conditions analysis showed that all the intersections operate at LOS D or better, and it found the following queuing issues:

- **Century Avenue/Hudson Service Road (SR)/I-94 westbound off-ramp:** Northbound left-turn movement queues through the I-94 eastbound ramps intersection in the AM peak due to heavy traffic accessing I-94 westbound
- **Century Avenue/I-94 eastbound ramps:** Eastbound left-turn movement exceeds the storage length in the AM peak due to signal timing that favors Century Avenue's heavier northbound movements; however, the queue does not reach the mainline freeway

Table 3.2-5 lists the existing-conditions analysis results for the resource study area intersections for Alignment C.

TABLE 3.2-5: ALIGNMENT C EXISTING AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS
16. Ruth St/Old Hudson Rd[b]	12.8	B	22.8	C
17. Ruth St/I-94 WB on-ramp[b]	2.8	A	10.2	B
18. Ruth St/I-94 EB off-ramp[b]	7.3	A	10.7	B
19. Pedersen St/Old Hudson Rd[b]	1.0	A	1.8	A
20. McKnight Rd/1st St[b]	2.4	A	3.8	A
21. McKnight Rd/Hudson SR[b]	1.6	A	10.9	B

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS
22. McKnight Rd/Hudson Rd/I-94 WB on-ramp[b]	7.7	A	20.7	C
23. McKnight Rd/Burns Ave[b]	9.0	A	15.1	B
24. Hudson Rd/4th St	0.3	A	1.4	A
25. Hudson Rd/8th St	0.9	A	0.4	A
26. Hudson Rd/19th St	0.8	A	0.1	A
27. Century Ave/Hudson Rd/Hudson Blvd[b]	2.8	A	8.4	A
28. Century Ave/Hudson SR/I-94 WB off-ramp[b]	27.7	C	13.6	B
29. Century Ave/I-94 EB ramps[b]	21.6	C	36.8	D
30. 4th St/Hadley Ave	4.8	A	6.6	A
31. 4th St/Hale Ave	0.6	A	1.2	A

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

ALIGNMENT D3 (I-694 TO WOODBURY 494 PARK AND RIDE) EXISTING CONDITIONS

For Alignment D3, the Council used Vissim to model Intersections 32-36 based on the proposed guideway alignment crossings, and complex geometrics and traffic signal phasing. The Council used Synchro/SimTraffic to model Intersections 37-44 because the proposed BRT guideway under the two Build Alternative conditions would operate in the median, parallel to through traffic. The existing-conditions analysis showed that all the intersections operate at LOS D or better, and it found the following queuing issue:

- **Bielenberg Drive/Tamarack Road:** Southbound through and right-turn movement queues exceed the storage length in the PM peak due to the heavy traffic on Tamarack Road

Table 3.2-6 lists the existing-conditions analysis results for the resource study area intersections for Alignment D3.

TABLE 3.2-6: ALIGNMENT D3 EXISTING AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
32. 4th St/Hudson Blvd/Hayward Ave	2.1	A	3.0	A
33. EB 4th St/BRT Guideway[c]	N/A	N/A	N/A	N/A
34. 4th St/Helmo Ave	13.4	B	22.1	C
35. 3rd St/Helmo Ave	0.6	A	2.0	A
36. Helmo Ave/Hudson Blvd/2nd St[c]	N/A	N/A	N/A	N/A

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
37. Bielenberg Dr/Hudson Rd[b, c]	N/A	N/A	N/A	N/A
38. Bielenberg Dr/Hartford North Driveway[b]	0.6	A	1.1	A
39. Bielenberg Dr/Hartford South Driveway[b]	2.5	A	2.5	A
40. Bielenberg Dr/Tamarack Hills North[b]	2.1	A	7.9	A
41. Bielenberg Dr/Tamarack Hills[b]	4.8	A	27.4	C
42. Bielenberg Dr/Tamarack Rd[b]	26.1	C	51.4	D
43. Bielenberg Dr/Nature Path[b]	1.1	A	2.0	A
44. Bielenberg Dr/Guider Dr[b]	2.5	A	8.9	A

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

[c] *No existing intersection at this location.*

ALIGNMENT A2 (UNION DEPOT TO MOUNDS BOULEVARD)

For Alignment A2, the Council used Synchro/SimTraffic to model Intersection 7, where Project buses would operate in mixed traffic. The existing-conditions analysis showed that this intersection operates at LOS D or better, and it did not identify queuing issues. **Table 3.2-7** lists existing analysis results for the resource study area intersections for Alignment A2.

TABLE 3.2-7: ALIGNMENT A2 EXISTING AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
7. Kellogg Blvd/Broadway St[b]	11.6	B	11.0	B

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic.*

3.2.3. Environmental Consequences

This section describes the anticipated Project-related long- and short-term impacts to traffic operations based on design advancement.

3.2.3.1. Operating Phase (Long-Term) Impacts

Interstates, state highways, county highways and some city streets comprise the region's highway system. The Council's 2040 TPP anticipates that the roadway network will experience a substantial increase in automobile demand by the year 2040, with a regional forecast of 89.4 million daily VMT – a 23 percent increase compared

with 2010 VMT. However, the state and municipalities have limited roadway-expansion projects planned for the resource study area that would address this VMT increase.

2040 BUILD ALTERNATIVE 1 (A1-BC-D3)

The Project proposes four park-and-ride facilities: The Project would newly construct three, and one would use the existing Woodbury Theatre facility, where most of the existing spaces would be available for Project users. **Table 3.2-8** lists the Project's proposed park-and-ride sites.

TABLE 3.2-8: PROJECT PARK-AND-RIDE SITES

Park-and-Ride Site	Number of Spaces	Type of Structure
Sun Ray Station	150	New Surface Lot
Helmo Avenue Station	100	New Surface Lot
Woodbury Theatre Station	150	Existing Surface Lot
Woodbury 494 Park and Ride Station	200	New Surface Lot

For Build Alternative 1 Alignments A1, B, C, D3 and the Dedicated Guideway Option at Hadley Avenue and 4th Street, the Council would incorporate several improvements that would provide adequate infrastructure to accommodate buses, pedestrians and park-and-ride traffic near stations; provide LOS D or better traffic operations at all intersections; and safely and efficiently control BRT bus movements at intersections.

At full-access intersections with a dedicated center or side running guideway, the Project would construct new traffic signals to safely control the movements of vehicles, pedestrians, bicycles and the BRT buses through the intersections. Full-access intersections where BRT buses operate in mixed traffic, or where the guideway would run curbside to the right of the vehicle lane, generally would not need traffic signals to safely accommodate the BRT traffic. **Attachment A-3-2** includes tables that show the geometrics and intersection control for the 2040 Build Alternative conditions. **Attachment A-3-3** includes the complete results of the No-Build Alternative conditions analysis of delay and LOS.

The 2040 Build Alternative 1 modeling factored the following roadway infrastructure improvements. The 15% Concept Plans in **Appendix B** show all traffic signal modifications/reconstructions, grade crossings, one-way streets, and other infrastructure changes that are part of the Project.

- **Alignment A1**
  - Would include a reconstructed traffic signal and median opening at the Kellogg Boulevard/Wacouta Street intersection to allow buses to turn left from southbound Wacouta Street onto eastbound Kellogg Boulevard
- **Alignment B**
  - Would add a new traffic signal at the Mounds Boulevard/I-94 westbound off-ramp intersection to provide a controlled pedestrian crossing and to control the merging of the northbound movements
  - Would add a new traffic signal at the Earl Street/Hudson Boulevard intersection to provide controlled pedestrian crossings to the station and control movements at the intersection with the BRT guideway

- **Alignment C**
  - Would add all-way stop control at the Pedersen Street/Old Hudson Road intersection to provide controlled pedestrian crossings to the station, provide adequate sight lines on Pedersen Street at the intersection, and accommodate narrower roadway sections on both streets
  - Would close the southbound right-turn movement at the Hudson Road/4th Street intersection due to low traffic volumes and geometric constraints with the BRT guideway
  - Would add a new traffic signal at the Hudson Road/4th Street intersection to control movements at the intersection with the BRT guideway; the traffic signal would not stop Hudson Road through traffic
  - Would add a new traffic signal at the Hudson Road/8th Street intersection to control movements at the intersection with the BRT guideway; the traffic signal would not stop Hudson Road through traffic
  - Would add a new traffic signal at the Hudson Road/19th Street intersection to control movements at the intersection with the BRT guideway; the traffic signal would not stop Hudson Road through traffic
- **Dedicated Guideway Option at Hadley Avenue and 4th Street**
  - Would add a new traffic signal and turn lanes at the 4th Street/Hadley Avenue intersection to control movements at the intersection with the BRT guideway; 2040 No-Build Alternative conditions assumed the City of Oakdale or a developer would construct traffic signal by 2040 due to increased traffic from developments; however, the Dedicated Guideway Option would need to build a traffic signal as part of the Project due to the center running guideway
  - Would add a new traffic signal and turn lanes at the 4th Street/Hale Avenue to control movements at the intersection with the BRT guideway
- **Alignment D3**
  - Would add a new traffic signal and turn lanes at the 4th Street/Hayward Avenue/Hudson Boulevard intersection to control movements at the intersection with the BRT guideway
  - Would add a new traffic signal on 4th Street between the Hayward Avenue/Hudson Boulevard and Helmo Avenue intersections to control the movement of buses from center- to side-running guideway
  - Would add a new traffic signal and turn lanes at the 4th Street/Helmo Avenue intersection to increase the intersection capacity; 2040 No-Build Alternative conditions assumed that the City of Oakdale or a developer would construct a traffic signal by 2040 due to increased traffic from developments; however, Alignment D3 would need to build a traffic signal as part of the Project due to increased traffic from the park-and-ride and the Bielenberg bridge across I-94
  - Would add a new traffic signal and turn lanes at the Helmo Avenue/Hudson Boulevard/2nd Street North intersection to provide controlled pedestrian crossings to the station, accommodate the park-and-ride traffic, and to control the movement of BRT buses from side to center running guideway
  - Would add a new traffic signal at the Bielenberg Drive/Hudson Road intersection to control movements at the intersection with the BRT guideway
  - Would add a second northbound through lane for traffic capacity and add a new traffic signal at the Bielenberg Drive/Hartford North Driveway intersection to control movements at the intersection with the BRT guideway

- Would add a second northbound through lane for traffic capacity and add a new traffic signal at the Bielenberg Drive/Hartford South Driveway intersection to control movements at the intersection with the BRT guideway
- Would add a new traffic signal at the Bielenberg Drive/Tamarack Hills North intersection to control movements at the intersection with the BRT guideway
- Would add an additional westbound left-turn lane at the Bielenberg Drive/Tamarack Road intersection to improve the operations of the congested intersection
- Would add a new traffic signal at the Bielenberg Drive/Nature Path intersection to control movements at the intersection with the BRT guideway and to control the movement of buses from center-running guideway to mixed traffic; 2040 No-Build Alternative conditions assumed that the City of Woodbury or a developer would construct a traffic signal by 2040 due to increased traffic from developments; however, Alignment D3 would need to build a traffic signal as part of the Project due to the center running BRT guideway
- Would add a new traffic signal at the Bielenberg Drive/Guider Drive intersection to provide efficient movement of BRT buses onto Bielenberg Drive

The 2040 Build Alternative 1 conditions analysis included the following factors and assumptions:

- **Signal-timing optimization:** The 4th Street, Helmo Avenue and Bielenberg Drive corridors would operate with coordinated and interconnected signals, including transit-signal priority for BRT buses except at the Bielenberg Drive/Tamarack Road intersection
- **Hazel Street Station Option:** The station location for the Hazel Street Station Option does not affect traffic operations at any of the intersections; therefore, the Council did not model this option
- **Hudson Road One-Way Conversion:** The Project would convert Hudson Road from two-way traffic to one-way westbound traffic from Frank Street to Wilson Avenue
  - Existing daily traffic volumes on these segments of roadway are approximately 1,700 vehicles per day west of Earl Street and approximately 1,000 vehicles per day east of Earl Street
  - Conversion to one-way traffic would divert all eastbound traffic, or approximately 500-750 vehicles per day, to other streets in the area
  - Other streets in the area have traffic volumes less than 1,000 vehicles per day compared with capacities of approximately 7,000 to 8,000 vehicles per day
  - Conversion to one-way traffic likely would affect the convenience of access to and from properties on Hudson Road, and the diverted traffic would increase vehicle traffic on some residential streets
  - Estimated maximum volume of diverted traffic on residential streets would be less than 100 vehicles per hour (less than two vehicles per minute)
  - Diverted traffic would not have an impact on traffic capacity or operations, therefore the Council did not model the diverted traffic
- **Operations and Maintenance Facility (OMF):** The Project OMF would utilize the existing Metro Transit East Metro Garage building, 820 L'Orient Street in Saint Paul; the Council does not anticipate Project-related traffic impacts from use of the garage for the OMF, and it did not conduct a traffic analysis for buses traveling between the OMF and the Project alignment due to the following facts and assumptions:

- Approximately 400 drivers and 90 mechanics staff the East Metro Garage, which services more than 30 routes and houses more than 200 buses;[7] the addition of the Project's total 13 buses would represent less than a 7 percent change in fleet service and storage at the garage
- Operator changes on the Project line would occur on the alignment and not at the OMF, as they do for the METRO Green Line, METRO Blue Line and A Line; these lines have service patterns similar to the Project, with less than 15-minute service between 6 a.m. and at least 7 p.m., and this frequency does not allow buses to travel back to the OMF between the AM and PM peak travel periods
- Bus traffic to and from the OMF and BRT bus operators' travel to and from work both would occur outside of peak hours (before 6 a.m. and after 7 p.m.), when traffic volumes are lower, and the surrounding streets and intersections have sufficient traffic capacity

Alignment A1 (Smith Avenue to Mounds Boulevard) for 2040 Build Alternative 1

For Alignment A1, the Council used Synchro/SimTraffic to model Intersection 6 and Vissim to model Intersections 1-5, consistent with the existing-conditions and 2040 No-Build Alternative analyses. The analysis anticipates that all the intersections would operate at LOS D or better, and it did not identify queuing issues. **Table 3.2-9** lists the 2040 Build Alternative 1 analysis results for the resource study area intersections for Alignment A1.

TABLE 3.2-9: ALIGNMENT A1 2040 AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
1. Sibley St/Kellogg Blvd	24.0	C	17.7	B
2. Sibley St/4th St	12.3	B	12.7	B
3. Sibley St/5th St	12.1	B	12.9	B
4. 5th St/Market St	18.9	B	27.5	C
5. 5th St/St. Peter St	8.7	A	9.4	A
6. Kellogg Blvd/Wacouta St[b]	5.1	A	6.8	A

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

[7] *Metro Transit. East Metro Garage. Available at: www.metrotransit.org/east-metro-transit-facility. Accessed October 10, 2018.*

Alignment B (Mounds Boulevard to White Bear Avenue) for 2040 Build Alternative 1

For Alignment B, the Council used Vissim to model Intersections 8-11 and Synchro/SimTraffic to model Intersections 12-15, consistent with the existing-conditions and 2040 No-Build Alternative analyses. The analysis anticipates that all the intersections would operate at LOS D or better, and it found the following queuing issue:

- **White Bear Avenue/Old Hudson Road:** For the northbound left-turn movement in the PM peak, the existing left-turn lane is only 50 feet long due to the proximity to the White Bear Avenue/I-94 westbound ramps intersection. This issue also occurs in the existing and 2040 No-Build Alternative conditions.

Table 3.2-10 lists the 2040 Build Alternative 1 analysis results for the resource study area intersections for Alignment B.

TABLE 3.2-10: ALIGNMENT B 2040 AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
8. Kellogg Blvd/Mounds Blvd	30.1	C	29.9	C
9. Mounds Blvd/I-94 WB off-ramp	24.3	C	16.5	B
10. Mounds Blvd/I-94 EB on-ramp	5.1	A	7.5	A
11. Earl St/Hudson Rd	13.3	B	11.9	B
12. White Bear Ave/Old Hudson Rd[b]	13.5	B	20.1	C
13. White Bear Ave/I-94 WB Ramps[b]	10.5	B	15.2	B
14. White Bear Ave/I-94 EB Ramps[b]	16.7	B	24.0	C
15. White Bear Ave/Suburban Ave[b]	14.6	B	15.9	B

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

Alignment C (White Bear Avenue to I-694) for 2040 Build Alternative 1

The Council used Vissim to model Intersections 24-26 and 30-31, and Synchro/SimTraffic to model Intersections 16-23 and 27-29, consistent with the existing-conditions and 2040 No-Build Alternative analyses. The analysis anticipates that all the intersections would operate at LOS D or better, and it found the following queuing issues:

- **Century Avenue/Hudson SR/I-94 westbound off-ramp:** Northbound left-turn movement queues through the I-94 eastbound ramps intersection in the AM peak due to heavy traffic volumes accessing I-94 westbound; this issue also occurs in the existing and 2040 No-Build Alternative conditions
- **Century Avenue/I-94 eastbound ramps:** Eastbound left-turn movement exceeds the lane storage length in the PM peak due to signal timing that favors the heavier southbound movements on Century Avenue; however, the queue does not reach the mainline freeway; the same issue occurs in the 2040 No-Build Alternative conditions

Table 3.2-11 lists the 2040 Build Alternative 1 analysis results for the resource study area intersections for Alignment C.

The station location for the Hazel Street Station Option would not affect traffic operations at any of the intersections; therefore, the Council did not model this option.

TABLE 3.2-11: ALIGNMENT C 2040 AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
16. Ruth St/Old Hudson Rd[b]	13.0	B	25.2	C
17. Ruth St/I-94 WB on-ramp[b]	2.5	A	11.2	B
18. Ruth St/I-94 EB off-ramp[b]	7.5	A	11.0	B
19. Pedersen St/Old Hudson Rd[b]	5.8	A	9.2	A
20. McKnight Rd/1st St[b]	2.9	A	3.6	A
21. McKnight Rd/Hudson SR[b]	2.3	A	20.6	C
22. McKnight Rd/Hudson Rd/I-94 WB on-ramp[b]	12.7	B	21.2	C
23. McKnight Rd/Burns Ave[b]	10.4	B	17.1	B
24. Hudson Rd/4th St	0.7	A	0.1	A
25. Hudson Rd/8th St	4.6	A	1.7	A
26. Hudson Rd/19th St	3.4	A	3.5	A
27. Century Ave/Hudson Rd/Hudson Blvd[b]	3.7	A	7.3	A
28. Century Ave/Hudson SR/I-94 WB off-ramp[b]	26.4	C	15.0	B
29. Century Ave/I-94 EB Ramps[b]	22.6	C	52.2	D
30. 4th St/Hadley Ave	17.5	B	38.04	D
31. 4th St/Hale Ave	3.6	A	7.7	A

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

Dedicated Guideway Option at Hadley Avenue and 4th Street for 2040 Build Alternative 1

This option would replace the 4th Street Bridge over I-694, and the Project would operate in a dedicated lane instead of in mixed traffic. The Council used Vissim to model these intersections. The analysis anticipates that all the intersections would operate at LOS D or better, and it did not identify queuing issues.

Table 3.2-12 lists the 2040 Build Alternative 1 analysis results for the resource study area intersections 30 through 36 that are within the Dedicated Guideway Option at Hadley Avenue and 4th Street.

TABLE 3.2-12: DEDICATED GUIDEWAY OPTION AT HADLEY AVENUE AND 4TH STREET 2040 AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
30. 4th St/Hadley Ave	17.5	B	25.2	C
31. 4th St/Hale Ave	12.2	B	12.7	B
32. 4th St/Hudson Blvd/Hayward Ave	13.1	B	13.3	B
33. Eastbound 4th St/BRT Guideway	2.5	A	16.5	B
34. 4th St/Helmo Ave	25.5	C	30.2	C
35. 3rd St/Helmo Ave	3.2	A	4.2	A
36. Helmo Ave/Hudson Blvd/2nd St	15.7	B	16.6	B

[a] *Delay measured in seconds per vehicle.*

Alignment D3 (I-694 to Woodbury 494 Park and Ride) for 2040 Build Alternative 1

The Council used Vissim to model Intersections 32-36 and Synchro/SimTraffic to model Intersections 37-44, consistent with the existing-conditions and No-Build Alternative analyses. The analysis showed that all intersections would operate at overall LOS D or better with the following exception:

- Bielenberg Drive/Tamarack Road would operate at LOS F in the PM peak due to heavy eastbound traffic. These failing traffic operations also occur in the 2040 No-Build Alternative conditions; the Project would not cause them

The analysis identified the following queuing issues in the 2040 Build Alternative 1 conditions:

- **Bielenberg Drive/Tamarack Hills:** The westbound, left-turn-movement 95th-percentile queue exceeds the lane storage length due to the congestion and spill-back from the Bielenberg Drive/Tamarack Road intersection. The same issue occurs in the 2040 No-Build Alternative conditions
- **Bielenberg Drive/Tamarack Road:** All eastbound movements, westbound left-turn and through, all northbound movements, and southbound through and right-turn movements exceed the lane storage length and operate at LOS E/F in the PM peak due to very heavy volumes at the intersection. The eastbound, left-turn-movement 95th percentile queue also exceeds the available lane storage. The same issues occur in the 2040 No-Build Alternative conditions

Table 3.2-13 lists the 2040 Build Alternative 1 analysis results for the resource study area intersections for Alignment D3.

TABLE 3.2-13: ALIGNMENT D3 2040 AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
32. 4th St/Hudson Blvd/Hayward Ave	12.1	B	16.2	B
33. EB 4th St/BRT Guideway	2.6	A	19.4	B
34. 4th St/Helmo Ave	24.8	C	28.7	C
35. 3rd St/Helmo Ave	3.8	A	3.9	A
36. Helmo Ave/Hudson Blvd/2nd St	16.2	B	16.2	B
37. Bielenberg Dr/Hudson Rd[b]	16.7	B	14.4	B
38. Bielenberg Dr/Hartford North Driveway[b]	3.1	A	4.6	A
39. Bielenberg Dr/Hartford South Driveway[b]	12.7	B	7.1	A
40. Bielenberg Dr/Tamarack Hills North[b]	14.5	B	21.1	C
41. Bielenberg Dr/Tamarack Hills[b]	16.7	B	33.8	C
42. Bielenberg Dr/Tamarack Rd[b]	37.5	D	100+	F
43. Bielenberg Dr/Nature Path[b]	7.4	A	17.4	B
44. Bielenberg Dr/Guider Dr[b]	11.5	B	11.5	B

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).* ***Attachment A-3-3*** *includes a complete table of 2040 Build Alternatives delay and LOS analysis results.*

2040 Build Alternative 1 Conditions Summary

The 2040 Build Alternative 1 analysis factored the following improvements to provide LOS D or better traffic operations at all intersections, and to provide safe and efficient traffic and BRT operations:

- **Alignment A1**
  - Reconstructed traffic signal and median opening at the Kellogg Boulevard/Wacouta Street intersection
- **Alignment B**
  - New traffic signal at the Mounds Boulevard/I-94 westbound off-ramp intersection
  - New traffic signal at the Earl Street/Hudson Boulevard intersection
- **Alignment C**
  - New traffic signal at the Hudson Road/4th Street intersection
  - New traffic signal at the Hudson Road/8th Street intersection
  - New traffic signal at the Hudson Road/19th Street intersection

- **Alignment C Dedicated Guideway Option at Hadley Avenue and 4th Street**
  - New traffic signal and turn lanes at the 4th Street/Hadley Avenue intersection
  - New traffic signal and turn lanes at the 4th Street/Hale Avenue intersection
- **Alignment D3**
  - New traffic signal and turn lanes at the 4th Street/Hayward Avenue/Hudson Boulevard intersection
  - New traffic signal on 4th Street between the Hayward Avenue/Hudson Boulevard and Helmo Avenue intersections
  - New traffic signal and turn lanes at the 4th Street/Helmo Avenue intersection
  - New traffic signal and turn lanes at the Helmo Avenue/Hudson Boulevard/2nd Street intersection
  - New traffic signal at the Bielenberg Drive/Hudson Road intersection
  - Second northbound through lane and new traffic signal at the Bielenberg Drive/Hartford North Driveway intersection
  - Second northbound through lane and new traffic signal at the Bielenberg Drive/Hartford South Driveway intersection
  - New traffic signal at the Bielenberg Drive/Tamarack Hills North intersection
  - Additional westbound left-turn lane at Bielenberg Drive/Tamarack Road intersection
  - New traffic signal at the Bielenberg Drive/Nature Path intersection
  - New traffic signal at the Bielenberg Drive/Guider Drive intersection

The 15% Concept Plans in **Appendix B** show all traffic signal modifications/reconstructions, grade crossings, one-way streets, and other infrastructure changes that are part of the Project.

With these improvements the Council anticipates that all intersections in the 2040 Build Alternative 1 AM and PM peak-hour conditions would operate at overall LOS D or better with the following exception:

- Bielenberg Drive/Tamarack Road in the 2040 Build Alternative 1 PM peak hour

Like the 2040 No-Build Alternative conditions, the poor operations at the Bielenberg Drive/Tamarack Road intersection in the 2040 Build Alternative 1 conditions are due to very high traffic volumes; they are not a result of the Project. The Project would improve operations at the Bielenberg Drive/Tamarack Hills and Bielenberg Drive/Guider Drive intersections, which would operate at LOS E or LOS F in the 2040 No-Build Alternative analysis. The improvement in operations at the Bielenberg Drive/Tamarack Hills intersection is due to the second left-turn lane constructed on Tamarack Road, which would allow retiming of the signal and reduce queues on Bielenberg Drive. The improvement in operations at the Bielenberg Drive/Guider Drive intersection is due to the construction of a new traffic signal.

The Council prepared **Attachment A-3-5** for the Federal Highway Administration (FHWA) that summarizes the analysis of traffic operations at interchange areas in the 2040 Build Alternative 1 conditions. This memorandum shows that the Project does not result in impacts to traffic operations or safety conditions on any interstate facilities within the Project study area. Queue lengths are not expected to extend onto the mainline interstate on any ramps within the study area, and all interstate ramp intersections are expected to operate at LOS D or better. Based on this analysis, FHWA determined that an Interchange Access Request is not needed for the Project.

2040 BUILD ALTERNATIVE 2 (A2-BC-D3)

As with the 2040 Build Alternative 1 analysis, the Council incorporated into its 2040 Build Alternative 2 traffic model several improvements that would control BRT bus movements at intersections safely and efficiently, and to provide adequate roadway infrastructure to accommodate buses, pedestrians and park-and-ride traffic near stations.

Attachment A-3-2 includes tables that show the geometrics and intersection control for the 2040 Build Alternative 2 conditions.

For Alignment A2, the Council used Synchro/SimTraffic to model this intersection, consistent with the existing-conditions and 2040 No-Build Alternative analyses. The analysis anticipates that this intersection would operate at LOS D or better, and it did not identify queuing issues.

Table 3.2-14 lists the 2040 Build Alternative 2 analysis results for the resource study area intersections for Alignment A2.

TABLE 3.2-14: ALIGNMENT A2 2040 AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
7. Kellogg Blvd/Broadway St[b]	12.0	B	11.5	B

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic.*

2040 Build Alternative 2 conditions for Alignments B, C and D3 would be the same as for the 2040 Build Alternative 1 conditions.

2040 Build Alternative 2 Conditions Summary

The 2040 Build Alternative 2 analysis factored the following improvements to provide LOS D or better traffic operations at all intersections, and to provide safe and efficient traffic and BRT operations:

- **Alignment A2**
  - No traffic improvements identified
- **Alignment B**
  - New traffic signal at Mounds Boulevard/I-94 Westbound Off-Ramp
  - New traffic signal at Earl Street/Hudson Boulevard
- **Alignment C**
  - New traffic signal at Hudson Road/4th Street
  - New traffic signal at Hudson Road/8th Street
  - New traffic signal at Hudson Road/19th Street
- **Alignment C Dedicated Guideway Option at Hadley Avenue and 4th Street**
  - New traffic signal and turn lanes at 4th Street/Hadley Avenue

  - New traffic signal and turn lanes at 4th Street/Hale Avenue

- **Alignment D3**
  - New traffic signal and turn lanes at the 4th Street/Hayward Avenue/Hudson Boulevard intersection
  - New traffic signal on 4th Street between the Hayward Avenue/Hudson Boulevard and Helmo Avenue intersections
  - New traffic signal and turn lanes at 4th Street/Helmo Avenue
  - New traffic signal and turn lanes at Helmo Avenue/Hudson Boulevard/2nd Street
  - New traffic signal at Bielenberg Drive/Hudson Road
  - Second northbound through lane and new traffic signal at Bielenberg Drive/Hartford North Driveway
  - Second northbound through lane and new traffic signal at Bielenberg Drive/Hartford South Driveway
  - New traffic signal at Bielenberg Drive/Tamarack Hills North
  - Additional westbound left-turn lane at Bielenberg Drive/Tamarack Road
  - New traffic signal at Bielenberg Drive/Nature Path
  - New traffic signal at Bielenberg Drive/Guider Drive

The 15% Concept Plans in **Appendix B** show all traffic signal modifications/reconstructions, grade crossings, one-way streets, and other infrastructure changes that are part of the Project.

With the improvements the Council anticipates that all intersections in the 2040 Build Alternative 2 AM and PM peak-hour conditions would operate at overall LOS D or better with the following exception:

- Bielenberg Drive/Tamarack Road in the 2040 Build Alternative PM peak

Like the 2040 No-Build Alternative conditions, the poor operations at the Bielenberg Drive/Tamarack Road intersection under the 2040 Build Alternative 2 conditions are due to very high traffic volumes; they are not a result of the Project. The Project would improve operations at the Bielenberg Drive/Tamarack Hills and Bielenberg Drive/Guider Drive intersections, which would operate at LOS E or LOS F in the 2040 No-Build Alternative analysis.

All of the intersections included in **Attachment A-3-5** analyzed for traffic operations at interchange areas in the 2040 Build Alternative 1 conditions are the same in the 2040 Build Alternative 2, therefore no additional analysis is included for the 2040 Build Alternative 2.

3.2.3.2. Construction Phase (Short-Term) Impacts

BUILD ALTERNATIVE 1 (A1-BC-D3)

For Build Alternative 1, Project construction would produce short-term impacts to traffic operations including lane, intersection and roadway closures, and detours that would cause localized increases in congestion. Similar construction-related impacts would occur for the Hazel Street Station Option and the Dedicated Guideway Option at Hadley Avenue and 4th Street.

BUILD ALTERNATIVE 2 (A2-BC-D3)

Build Alternative 2 generally would produce the same short-term impacts to traffic operations as Build Alternative 1; however, Alignment A2 would not construct any BRT stations in downtown Saint Paul other than at the Union Depot bus deck, resulting in less disruption to traffic operations in downtown Saint Paul.

3.2.4. Avoidance, Minimization and Mitigation Measures

Based on measures incorporated as part of the Project design, the FTA and the Council do not anticipate long-term impacts to traffic; therefore, they do not propose additional avoidance, minimization or mitigation measures for either Build Alternative 1 or Build Alternative 2. As part of its design, the Project would incorporate improvements to roadways and intersections to provide LOS D or better traffic operations at all intersections in the Project corridor, and to provide safe and efficient traffic and BRT operations. Both Build Alternatives would achieve an acceptable LOS D or better with these improvements in place.[8]

To address short-term impacts, the Council will develop a detailed construction staging plan for the Project. It will also develop maintenance of traffic (MOT) plans during the Engineering Phase to address construction phasing, traffic signal operations, and access through the work zone, road closures and traffic detours.

3.3. Transit

This section evaluates Project-related impacts to transit service. **Attachment A-3-4** provides a memo detailing the development, background and detailed results of the modeling the Council completed for the Project.

3.3.1. Regulatory Context and Methodology

The Council developed transit-demand forecasts using a horizon year of 2040 to evaluate the Build Alternatives. The analysis utilized a travel-demand model and ridership model to calculate travel time and ridership, respectively.

3.3.1.1. Travel-Demand Model

The Council travel-demand model has an activity-based model structure that it developed and adopted as part of its *Thrive MSP 2040*[9] regional development guide and 2040 TPP. The analysis used this model to estimate traffic growth in the Project corridor. The model's base year is 2015, its horizon year is 2040, and it covers the Council's seven-county service area and the area's 12 surrounding counties.

The Council coordinated with the cities of Oakdale and Woodbury to adjust a few of the model's inputs. These adjustments included land use forecasts the Council released in April 2018, and redistricted 2040 household, population and employment data.

3.3.1.2. Ridership Model

The Council used the FTA's Simplified Trips on Project Software (STOPS) to forecast Project ridership for the analysis. The model, which the Council developed specifically for the Project, includes data for the seven-county Twin Cities Metropolitan Area and adjacent counties in Minnesota and western Wisconsin.

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[8] *As discussed in **Section 3.2.3**, the Bielenberg Drive/Tamarack Road intersection would operate at LOS F in the PM peak due to heavy eastbound traffic. These failing traffic operations also occur in the 2040 No-Build Alternative conditions; they are not caused by the Project.*

[9] *Metropolitan Council.* Thrive MSP 2040: One Vision, One Metropolitan Region. *Adopted May 28, 2014. Available at: https://metrocouncil.org/Planning/Projects/Thrive-2040/Thrive-MSP-2040-Plan.aspx?source=child. Accessed October 2018.*

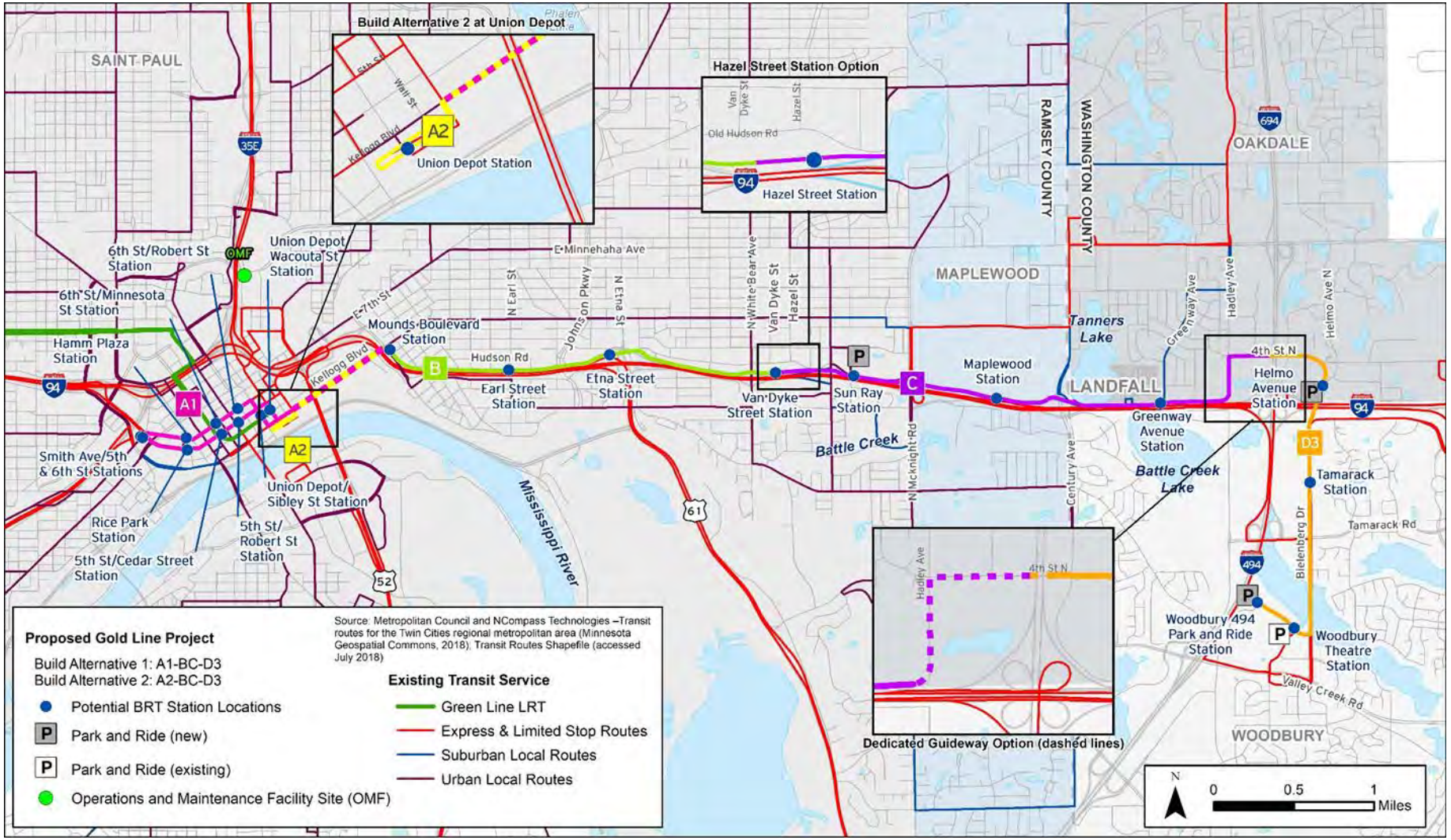
The model forecasts transit travel data within the Twin Cities Metropolitan Area transit system. It includes the network of existing transit services offered by Metro Transit, the Council, City of Maple Grove, SouthWest Transit, Minnesota Valley Transit Authority, Plymouth Metrolink, and the University of Minnesota. The model utilizes the 2016 systemwide transit onboard survey,[10] and it factors service frequencies (how often trains and buses arrive at a transit stop), routes, modes, travel times, and population and employment data. The Council travel-demand model supplied the travel times and distances related to highway data. The model uses these inputs to generate transit-ridership demand data, including passenger-boarding estimates on all existing and proposed routes.

3.3.2. Affected Environment

The Project would provide a vital link in Metro Transit's BRT service and route circulation. The Project will operate in dedicated guideway and mixed traffic lanes. I-94 between downtown Saint Paul on the west and the City of Woodbury on the east generally defines the Project area. The area currently includes local, limited-stop and express bus service, which is oriented toward downtown Saint Paul and downtown Minneapolis during peak travel times. **Figure 3.3-1** shows the area's existing transit service, which the *Purpose and Need Technical Report* in **Appendix A** describes in detail.

[10] *Minnesota Geospatial Commons. "Travel Behavior Inventory (TBI) 2016 Transit On Board Survey". Available at https://gisdata.mn.gov/dataset/us-mn-state-metc-society-tbi-transit-onboard2016. Last Modified: March 2018. Accessed May 2018.*

FIGURE 3.3-1: EXISTING TRANSIT SERVICE IN TWIN CITIES METROPOLITAN AREA SYSTEM



3.3.3. Environmental Consequences

This section discusses potential changes to the region's transit network that could result from Project implementation. These changes are for planning purposes only, and the Council may refine them through further analysis and public engagement as the Project advances through Project Development and Engineering phases.

The travel-demand forecast for the Build Alternatives modeled existing, modified and new transit service, and reflected changes in routes, frequencies and travel times. The model modified existing bus service to connect people with the Project's proposed BRT service. The travel-demand model assumed six new local bus routes that would provide connections to BRT service at stations. The model also assumed modifications to the existing 3M Campus Circulator route, in coordination with 3M.

- **Connecting Bus Route 72:** Would provide service between the Etna Street Station and the Maplewood Mall Transit Center via Johnson Parkway, Phalen Boulevard, Hazelwood Street, Prosperity Road, Larpenteur Avenue, English Street, Beam Avenue; service would operate every 30 minutes during weekdays and Saturday
- **Connecting Bus Route 215:** Would provide service crosstown between the Sun Ray Transit Center and the Maplewood Mall Transit Center via McKnight Road, Lydia, White Bear and Beam avenues; service would operate every 30 minutes during the peak travel times, and every 60 minutes during off-peak travel times and weekends
- **Connecting Bus Route 221:** Would provide service between Oakdale and Greenway Station. New all-day service between the Greenway Avenue Station and the 3M Foundation Project mixed housing project in Oakdale via Hadley Avenue; service would operate every 30 minutes during the peak travel times, and every 60 minutes during off-peak travel times and weekends
- **Connecting Bus Route 300:** Would provide service between Woodland Pointe/Ashwood Ponds apartments and Lake View Drive (Walmart/CityWalk apartments) via Weir Drive, Tamarack Road, Bielenberg Drive, Hudson Road, and have a connection to the I-94 and Manning Avenue Park-and-Ride; service would operate every 20 minutes during daytime weekday peak travel times, every 30 minutes during off-peak travel times, and every 30 minutes during weekend daytime service; it would operate on weekends every 30 minutes during peak travel times, and every 60 minutes during off-peak travel times
- **Connecting Bus Route 301:** Would provide service between the Woodbury Theatre Station and the City Centre area of Woodbury via Valley Creek Road; service would operate every 60 minutes during weekdays and weekends
- **Connecting Bus Route 302:** Would provide an east-west circulator service that would complement Connecting Bus Route 300. Service would mostly be north of the Project along Hudson Boulevard from the planned Manning Avenue Park-and-Ride to the Helmo Avenue Station; service would operate every 30 minutes during the peak and 60 minutes off-peak and weekends
- **3M Campus Circulator:** Would connect the 3M campus with the proposed BRT service; the campus currently provides a circulator and on-demand van service; this proposed circulator would modify the existing circulator route; the model assumed 10-minute service frequencies during weekdays, and it assumed the span of service from 6 a.m. to 6 p.m. during weekdays only

The travel-demand model also included the following planned and potential modifications to existing bus service:

- Planned Route 63 connections at Mounds Boulevard and Sun Ray stations would increase weekday and weekend frequency to every 15 minutes during rush hours and midday, and every 20 minutes in late evenings; these planned Route 63 improvements are independent of the Project

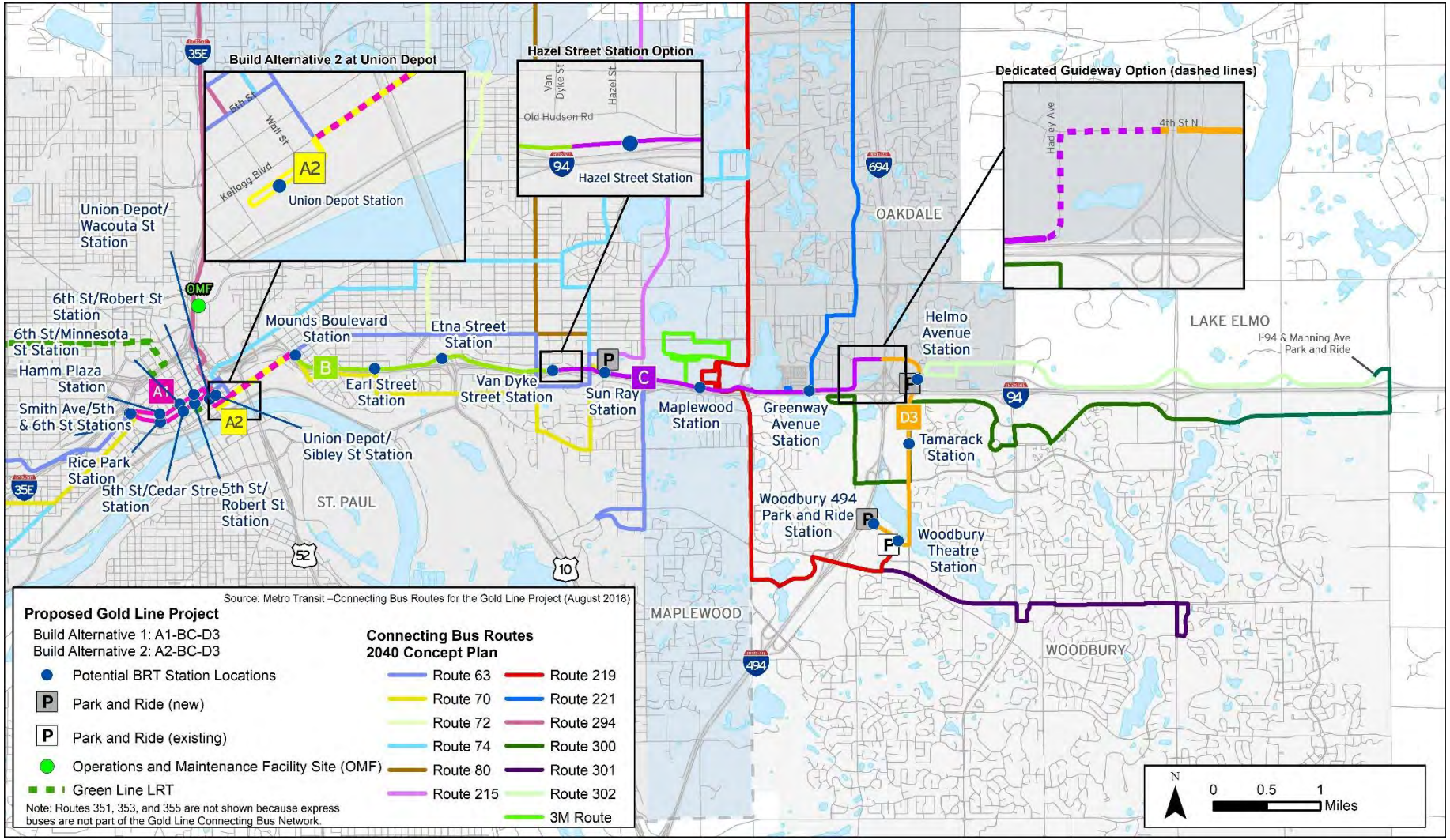
- Proposed Route 70 connections at Earl Street and Sun Ray stations
- Proposed Route 74 connection at Sun Ray Station
- Proposed Route 80 connection at Sun Ray Station
- Proposed Route 219 connections at Maplewood and Woodbury 494 Park-and-Ride stations
- Proposed Route 294 eliminates connections routing through Lake Elmo, Oakdale, Maplewood (3M) and along I-94 and re-route via Highway 36 and I-35E to downtown Saint Paul
- Proposed Route 351 connections at Woodbury Theatre and Woodbury 494 Park and Ride stations
- Proposed Route 353 connections at Woodbury Theatre and Woodbury 494 Park and Ride stations
- Proposed Route 355 connections at Woodbury Theatre and Woodbury 494 Park and Ride stations
- Proposed Route 381 future express route from Manning Park and Ride to downtown Saint Paul
- Proposed Route 385 future express route from Manning Park and Ride to downtown Minneapolis

Figure 3.3-2 shows a map for the connecting bus network that was developed for the Gold Line Project to forecast ridership. The bus routes shown in the map are Routes 60, 70, 72, 74, 80, 215, 219, 221, 294, 300, 301, 302, and the 3M Circulator.

Routes 351, 353 and 355 are noted above but are not shown in **Figure 3.3-2** because passengers of express buses will not transfer to the METRO Gold Line connecting bus network. Routes 351, 353 and 355 are express buses that, as part of the connecting bus network, would share platforms with the BRT service only at the Woodbury Theatre and Woodbury 494 Park and Ride stations.

The model also includes Rush Line BRT and Riverview Modern Streetcar that were amended into the 2040 TPP in October 2018 and February 2019, respectively. The proposed Rush Line BRT is a 14-mile route that connects downtown Saint Paul with downtown White Bear Lake and would operate at a frequency of 10 minutes during the peak period and 15 minutes during the mid-day period. The proposed Riverview Modern Streetcar is a 12-mile route that would connect downtown Saint Paul with Minneapolis-St. Paul International Airport and Mall of America and would operate at a frequency of 10 minutes during both the peak and mid-day time periods.

FIGURE 3.3-2: POTENTIAL NEW LOCAL CONNECTING BUS ROUTES



Travel time is an important factor when forecasting travel. **Table 3.3-1** shows the one-way travel time for the Build Alternatives.

TABLE 3.3-1: ONE-WAY PEAK-HOUR TRAVEL TIME FOR BUILD ALTERNATIVES 1 AND 2

Build Alternative	Direction	From	To	Travel Time (Min:Sec)
1	Eastbound	Smith Avenue Transit Center	Woodbury 494 Park and Ride	34:10
	Westbound	Woodbury 494 Park and Ride	Smith Avenue Transit Center	36:19
2	Eastbound	Union Depot	Woodbury 494 Park and Ride	27:59
	Westbound	Woodbury 494 Park and Ride	Union Depot	28:36

Table 3.3-2 shows the planned weekday operating frequency, or how often a bus serves a station, used for ridership forecasting.

TABLE 3.3-2: BUILD ALTERNATIVES WEEKDAY OPERATING FREQUENCIES

Day of the Week	Period	Operating Frequency
Weekday	Early morning (5-6 a.m.)	30 minutes
Weekday	Peak (6-9 a.m. and 3-6 p.m.)	10 minutes
Weekday	Midday (9 a.m.-3 p.m.) and evening (6-8 p.m.)	15 minutes
Weekday	Late (8 p.m.-12 a.m.)	30 minutes

3.3.3.1. Operating Phase (Long-Term) Impacts

The Council evaluated the potential long-term Project-related impacts to transit service using two sets of performance factors: transit ridership and automobile VMT. The travel-demand forecast model the Council used to prepare this information addresses the average weekday travel market only; the model does not account for weekends. Annual ridership estimates account for the effect of local special events such as concerts, festivals or sporting events.

The Hazel Street Station and Dedicated Guideway at Hadley Avenue and 4th Street options do not affect traffic operations; therefore, the Council did not model these options.

TRANSIT RIDERSHIP

The Council analyzed transit ridership with STOPS, a standalone software that applied a set of travel models to predict detailed transit travel patterns for the Build Alternatives; to quantify the trips-on-Project measure for all travelers and for transit-dependent populations; and to calculate the change in automobile VMT based on the overall change in transit ridership between the alternatives.

The Council based its ridership evaluation on three performance criteria: the number of corridor transit rides, ridership characteristics and new transit trips.

CORRIDOR TRANSIT RIDERSHIP

Table 3.3-3 shows the total ridership for the No-Build and Build Alternatives in the horizon year 2040. Compared with the September/October 2016[10] levels, the Council anticipates that transit ridership in the Project area would increase 66 percent by the year 2040 under the No-Build Alternative.

TABLE 3.3-3: TRANSIT RIDERSHIP SUMMARY BY ALTERNATIVE (2040)

Mode	2016 (Riders)	2040 No-Build Alternative (Riders)	2040 Build Alternative 1 (Riders)	2040 Build Alternative 2 (Riders)
Local Bus[a]	5,500	9,100	6,100	6,450
Limited-Stop/Express Bus[b]	800	1,350	200	250
METRO Gold Line BRT	–	–	7,100	6,350
Total Corridor Rides	**6,300**	**10,450**	**13,400**	**13,050**

[a] *Includes existing Routes 63 and 70, and future Routes 300, 301 and 302 (feeder routes).*

[b] *Includes existing Routes 294, 350 and 351, and future Route 381 (Manning Avenue Park-and-Ride Express bus to downtown Saint Paul)*

Build Alternative 1 (A1-BC-D3)

For Build Alternative 1, which would serve downtown Saint Paul stations, the Council anticipates the Project would carry 7,100 riders per day in 2040. Including local bus and limited-stops/express bus lines that would connect to the Project, the Council anticipates that Build Alternative 1 would serve 13,400 riders per day by the 2040 horizon year, representing a 28 percent increase when compared with the 2040 No-Build Alternative. Overall, the corridor ridership in the Project corridor in 2040 would more than double from 2016 existing ridership, and ridership for Build Alternative 1 would increase by approximately 28 percent from the forecasted 2040 No-Build Alternative ridership.

Build Alternative 2 (A2-BC-D3)

For Build Alternative 2, which includes Alignment A2 terminating at Union Depot, the Council anticipates the Project would carry 6,350 riders per day in 2040. Including local bus and limited-stops/express bus lines that would connect to the Project, the Council anticipates that Build Alternative 2 would serve 13,050 riders per day by the 2040 horizon year, representing a 25 percent increase when compared with the 2040 No-Build Alternative. Compared with Build Alternative 1, Build Alternative 2 would see 350 fewer rides in the corridor across all transit modes. Overall, ridership in the Project corridor in 2040 would more than double from 2016 existing ridership and Build Alternative 2 would increase by approximately 25 percent from the forecasted 2040 No-Build Alternative ridership.

The 750 fewer riders on Gold Line BRT per day under Build Alternative 2 compared with Build Alternative 1 would be a result of riders having to transfer in Alignment A2 at Union Depot to complete the trip to downtown Saint Paul which is available as a one-seat BRT ride under Alignment A1. Also, riders making short trips between downtown stations under Alignment A1 would have to look for other options in Alignment A2. Some of these riders would move to local and limited stop/express buses within the Project area, as seen by an increase in the ridership on these buses (6,100 versus 6,450 on local buses, and 200 versus 250 on limited stop/express buses). Therefore, the loss of 750 riders on Gold Line BRT under Build Alternative 2 is partially offset by an increase of 400 trips on

the local and limited stop/express buses. The resulting change in the corridor ridership (BRT plus local plus limited stop/express buses) equals a net loss of 350 riders.

RIDERSHIP CHARACTERISTICS

Table 3.3-4 summarizes select Project ridership characteristics including access mode, no-vehicle household trips and work trips by Build Alternative. These characteristics help explain how and via what types of transit users might utilize the Project service. Build Alternatives 1 and 2 have similar ridership characteristics.

TABLE 3.3-4: PROJECT RIDERSHIP CHARACTERISTICS (2040)

Characteristic	2040 Build Alternative 1	2040 Build Alternative 2
Total Daily BRT Trips	7,100	6,350
Trips for Work	67%	67%
Trips by Riders from No-Car Households	26%	23%
Access by Walking	58%	45%
Access by Driving	10%	12%
Access by Drop-Off	6%	4%
Access by Transferring	26%	39%

Build Alternative 1 (A1-BC-D3)

For Build Alternative 1 in 2040, the Council anticipates that 67 percent of BRT rides would be for work trips, approximately 67 percent of which are to or from employment opportunities in downtown Saint Paul and 33 percent are to or from other locations in the corridor. This percentage of work trips on the Project is higher than the 50 percent share of work trips using the existing transit system. Further, riders from no-vehicle households would constitute approximately 26 percent of the BRT ridership; which is lower than the 34 percent share of no-vehicle-households riders using the existing transit system. Given that the BRT would connect downtown Saint Paul to eastern parts of the region with growing populations, this discrepancy could result from riders with cars switching to transit, which would reflect a lower percentage of trips by riders from no-car households utilizing the proposed BRT than the rest of the transit system. Almost 60 percent of the Project-users would access the system by walking to the stations, and the remaining 40 percent either would drive to access the system or transfer from another transit route. Of that 40 percent, 10 percent would access the system by utilizing the park-and-rides and an additional 6 percent would access the system by drop-off at a park-and-ride lot.

Build Alternative 2 (A2-BC-D3)

For Build Alternative 2 in 2040, the Council anticipates that ridership characteristics will be similar to Build Alternative 1. Sixty-seven percent of BRT rides would be for work trips, approximately 67 percent of which are to or from employment opportunities in downtown Saint Paul and 33 percent are to or from other locations in the corridor. Riders from no-vehicle households would take approximately 23 percent of the trips. Almost 45 percent of the Project-users would access the system by walking to the stations, and the remaining 55 percent either would drive to access the system or transfer from another transit route. Of that 55 percent, 12 percent would access the system by utilizing the park-and-rides and an additional 4 percent would access the system by drop-off at a park-and-ride. The transfer trips are higher than in Build Alternative 1 (39% versus 26%) because this

alternative does not serve all of the downtown Saint Paul stations, and riders will have to transfer to other routes to complete their trip.

NEW TRANSIT TRIPS

The No-Build Alternative analysis forecasts regional transit-ridership growth would occur between 2016 and 2040. Improvements associated with the Project would produce the additional new transit trips the analysis forecasts for the Build Alternatives. A "linked" trip is one trip that a transit rider makes between an origin and a destination regardless of the number of transfers. The term "new transit trips" represents the collective net, regional increase of linked trips. Each new transit trip reduces one or more vehicular trips on the roadway network; thus, the criterion is essential to alternatives evaluation. **Table 3.3-5** summarizes use of the regional transit system by Build Alternative.

TABLE 3.3-5: REGIONAL LINKED AND NEW TRANSIT TRIPS

	2016	2040 No-Build Alternative	2040 Build Alternative 1	2040 Build Alternative 2
Average Weekday Linked Trips in September/October	272,150	335,900	339,200	338,850
Difference Compared with 2040 No-Build Alternative	–	–	+3,300	+2,950
Percent Change Compared with 2040 No-Build Alternative	–	–	+1.0%	+0.9%

Build Alternative 1 (A1-BC-D3)

The Council anticipates Build Alternative 1 in 2040 would attract approximately 3,300 additional new transit trips each weekday compared with the No-Build Alternative, or approximately a 1.0 percent increase in linked trips.

Build Alternative 2 (A2-BC-D3)

The Council anticipates Build Alternative 2 in 2040 would attract approximately 350 fewer new transit trips each weekday in comparison with Build Alternative 1. This is due to Build Alternative 2 terminating at Union Depot as compared to serving all of the downtown Saint Paul stations within Build Alternative 1.

Automobile Daily Vehicle Miles Traveled

The Project would impact the region's daily VMT by decreasing the amount of VMT by 15,750-17,600 miles per day when compared with the No-Build Alternative. Each new transit trip due to the Project would on an average result in a 5.3-mile decrease in daily VMT. The Council used the STOPS software to model the Project-related change in daily VMT. **Table 3.3-6** shows the decrease in the amount of regional automobile VMT due to the Build Alternatives.

TABLE 3.3-6: IMPACTS TO VEHICLE MILES TRAVELED BY BUILD ALTERNATIVE (2040)

	Build Alternative 1	Build Alternative 2
Daily VMT Change Compared with No-Build Alternative	-17,600	-15,750
New Linked Trips	3,300	2,950

	Build Alternative 1	Build Alternative 2
Daily VMT Change per New Linked Trip	-5.3	-5.3

Build Alternative 1 (A1-BC-D3)

In 2040, the Council anticipates that Build Alternative 1 would decrease the region's average weekday VMT by 17,600 vehicle miles per weekday compared with the No-Build Alternative. Each new transit trip under Build Alternative 1 would produce a 5.3-mile decrease in daily VMT.

Build Alternative 2 (A2-BC-D3)

In 2040, the Council anticipates that Build Alternative 2 would decrease the region's average weekday VMT by 15,750 vehicle miles per day compared with the No-Build Alternative. Build Alternative 2 would produce a difference of 1,850 less vehicle miles per day than Build Alternative 1. Each new transit trip under Build Alternative 2 would produce the same decrease in daily VMT as Build Alternative 1.

3.3.3.2. Construction Phase (Short-Term) Impacts

BUILD ALTERNATIVE 1 (A1-BC-D3)

Build Alternative 1 would produce intermittent impacts to transit service on routes within the construction area. These impacts could include temporary stop relocations, or route closures or detours.

BUILD ALTERNATIVE 2 (A2-BC-D3)

Build Alternative 2 would produce the same short-term impacts to transit service as Build Alternative 1; however, Alignment A2 would not construct in downtown Saint Paul other than at the Union Depot bus deck, resulting in less disruption to transit service in downtown Saint Paul.

3.3.4. Avoidance, Minimization and Mitigation Measures

The FTA and the Council do not anticipate long-term impacts to transit; therefore, they do not propose avoidance, minimization or mitigation measures for either Build Alternative 1 or Build Alternative 2.

To minimize the short-term impacts to bus operations during construction, before temporary stop closures and detours go into effect, the Council and its Metro Transit division would inform riders about the temporary service changes by posting information at bus stops and publishing details on its website and in its onboard "Connect" brochure.

3.4. Parking and Driveways

This section evaluates Project-related impacts to parking and driveways.

3.4.1. Regulatory Context and Methodology

The Project is consistent with the Council's 2040 TPP and the plan's goal to partner with municipalities to promote alternatives to single-occupant-vehicle travel on congested highway corridors and corridors served by regional transit service. Local municipalities' comprehensive plans and zoning codes may include parking requirements; however, no federal laws or agencies regulate impacts to parking.

The Project's potential limits of disturbance comprised the resource study area, which captures potential loss of and changes to parking around the Project corridor and stations, and potential Project-related impacts to driveways.

3.4.2. Affected Environment

The Project would operate through neighborhoods, business districts, shopping hubs, job centers, and industrial areas. Three types of parking comprise the Project parking supply: on-street (curbside) spaces; public off-street spaces; and private off-street spaces.

- **On-street spaces** collectively represent metered spaces, accessible spaces for drivers/passengers with disabilities, and unrestricted spaces. In the resource study area, the public pays for on-street, metered parking. Unmetered, unpaid parking is available to the public, but these spaces often have time restrictions, usually indicated by curbside signage.
- **Public off-street spaces** are park-and-ride facilities that are generally open to the public but also encourage associated transit use
- **Privately owned off-street spaces** may not be available to the public

The following categories comprise the total of 3,009 existing spaces along Build Alternative 1, and 2,815 existing spaces along Build Alternative 2:

- On-street spaces: 630 (Build Alternative 1), 436 (Build Alternative 2)
- Off-street spaces in eight private facilities: 1,727
- Off-street spaces in one public facility: 652

On-street parking exists within the resource study area that includes the following alignments:

- Metered on-street parking in Alignment A1 in downtown Saint Paul on:
  - Wacouta Street
  - Sibley Street
  - 6th Street
  - 5th Street
  - Kellogg Boulevard
- Unmetered on-street parking in Alignment A1 in downtown Saint Paul on:
  - 5th Street between Robert and Jackson Streets

- Designated on-street parking in Alignments B and C on the following roadways:
  - Hudson Road between Maria Avenue and Griffith Street
  - Hudson Road between Old Hudson Road and Kennard Street
  - Hudson Boulevard between Geneva Avenue and Greenway Avenue
- Alignment D3 has no on-street parking

The Build Alternatives' alignments include the following off-street parking facilities:

- Large surface lots near Union Depot in Alignments A1 and A2
- Parking for single-family and multifamily residential, neighborhood retail facilities, restaurants, office buildings and retirement homes along Alignment B
- Parking for shopping centers (including the Sun Ray Shopping Center), the 3M campus and retail facilities along Alignment C
- Parking for commercial uses in Oakdale and Woodbury along Alignment D3

Table 3.4-1 summarizes existing on-street and off-street parking facilities[11] along the alignments.

TABLE 3.4-1: QUANTITIES OF EXISTING ON- AND OFF-STREET PARKING FACILITIES

Location[a]	Description	Number and Types of Parking Spaces
Alignment A1		
Downtown Saint Paul	From Smith Avenue to Mounds Boulevard	193 on-street, metered and 13 on-street, unmetered
	Alignment A1 Total:	**206 spaces**
Alignment A2		
Downtown Saint Paul	From Union Depot to Mounds Boulevard	12 on-street, metered
	Alignment A2 Total:	**12 spaces**
Alignment B		
Hudson Road	From Maria Avenue to Earl Street	173 on-street[b]
Hudson Road	From Earl Street to Griffith Street	43 on-street
Hudson Road	From Old Hudson Road to its dead-end past Kennard Street	188 on-street
Grace Lutheran Church	Hudson Road west of White Bear Avenue interchange with I-94	21 off-street
	Alignment B Total:	**425 spaces**

[11] ***Table 3.4-1*** *includes only off-street parking facilities that the Project would impact.*

Location[a]	Description	Number and Types of Parking Spaces
Alignment C		
St. Paul Youth Services	Southeast corner of Pedersen Street and Wilson Avenue	68 off-street
Sun Ray Shopping Center	Northwest corner of McKnight Road interchange with I-94	973 off-street
Marina/Boat Repair	Southwest corner of Tanners Lake	27 off-street
Harley-Davidson	From Century Avenue and Birch Lane	136 off-street
Hudson Road	From Geneva Avenue to Greenway Avenue	20 on-street
Apostolic Bible Institute	Northwest corner Hudson Boulevard and Hadley Avenue	118 off-street
	Alignment C Total:	**1,342 spaces**
Alignment D3		
Commercial Development	Helmo Avenue and Hudson Boulevard	156 off-street
HOM Furniture	Hudson Road and Landau Drive	228 off-street
Woodbury Theatre	Guider Drive and Queens Drive	652 off-street
	Alignment D3 Total:	**1,036 spaces**

[a] ***Table 3.4-1*** *includes only off-street parking facilities that the Project would impact.*

[b] *Number includes six parking spaces in the cul-de-sacs on Conway Street, Surrey Avenue and Euclid Street.*

3.4.3. Environmental Consequences

3.4.3.1. Operating Phase (Long-Term) Impacts

Table 3.4-2 summarizes the Project-related long-term impacts to parking by Build Alternative.

TABLE 3.4-2: LONG-TERM PARKING IMPACTS BY ALTERNATIVE

Alternative	Existing Spaces	Spaces Eliminated	Spaces Added	Net Parking Impact (Spaces)	Percent Change
Build Alternative 1 (A1-BC-D3)	**3,009**	**603**	**450**	**-153**	**-5%**
With Hazel Street Station Option	*3,009*	*603*	*450*	*-153*	*-5%*
With Dedicated Guideway Option at Hadley Avenue and 4th Street	*3,009*	*603*	*450*	*-153*	*-5%*
Build Alternative 2 (A2-BC-D3)[a]	**2,815**	**576**	**450**	**-126**	**-4.4%**
With Hazel Street Station Option	*2,815*	*576*	*450*	*-126*	*-4.4%*

Alternative	Existing Spaces	Spaces Eliminated	Spaces Added	Net Parking Impact (Spaces)	Percent Change
With Dedicated Guideway Option at Hadley Avenue and 4th Street	*2,815*	*576*	*450*	*-126*	*-4.4%*

[a] ***Section 3.4.3.1*** *subsection* ***Build Alternative 2 (A2-BC-D3)*** *and* ***Section 3.4.3.2*** *subsection* ***Build Alternative 2 (A2-BC-D3)*** *summarize the long- and short-term parking impacts, respectively, under Build Alternative 2.*

All the added parking proposed as part of the Project would occur in park-and-ride lots. Alignment A1 has sufficient parking available in the peak and off-peak periods. Alignment B and C parking loss is associated with underutilized parking or replacement parking would be provided per city parking code; therefore, sufficient parking will be available. Most of the Alignment D3 private parking loss is related to the acquisition of Crossroads Properties, Inc. to accommodate the park-and-ride at Helmo Avenue Station.

BUILD ALTERNATIVE 1 (A1-BC-D3)

Build Alternative 1 would eliminate 603 parking spaces and add 450 parking spaces, with a net loss of 153 parking spaces (5 percent). **Table 3.4-3** summarizes all Project-related on- and off-street parking impacts associated with Alignments A1, B, C and D3.

TABLE 3.4-3: BUILD ALTERNATIVE 1 LONG-TERM PARKING IMPACTS BY ALIGNMENT

Alignment	Existing Spaces	Parking Spaces Eliminated	Parking Spaces Added	Net Parking Impact (Spaces)	Percent Change
Alignment A1	206	27	0	-27	-13%
Alignment B	425	145	0	-145	-34%
Alignment C[a]	1,342	218	150	-68	-5%
With Hazel Street Station Option	*1,342*	*218*	*150*	*-68*	*-5%*
With Dedicated Guideway Option at Hadley Avenue and 4th Street	*1,342*	*218*	*150*	*-68*	*-5%*
Alignment D3[b]	1,036	213	300	+87	+8%

[a] *The Project would fully acquire and relocate the business that includes 27 of the 218 spaces eliminated.*

[b] *The Project would fully acquire and relocate the business that includes 156 of the 213 spaces eliminated.*

Build Alternative 1 alignments would produce the following impacts to parking and driveways:

- **Alignment A1** (net parking loss of 27 spaces (13 percent))
  - Would eliminate four on-street spaces on the east side of Sibley Street between 4th and 5th streets
  - Would eliminate three on-street spaces on the south side of 6th Street between Washington and 7th streets

- Would eliminate 13 on-street spaces on the south side of 5th Street between Robert and Jackson streets
- Would eliminate four on-street spaces on the east side and three on-street spaces on the west side of Wacouta Street between 5th and 4th streets

The Project impacts would result from the configuration of the BRT station platforms with bump-outs to allow for combined pull-out and in-lane stopping. Surface lots and structured parking exist throughout the downtown corridor, therefore, there is sufficient parking spaces to accommodate parking need and the parking loss due to the Project is not anticipated to impact overall parking needs. The Council coordinated with Ramsey County, the City of Saint Paul and businesses and will continue to coordinate efforts to minimize parking impacts as the Project advances through the Project Development and Engineering phases.

- **Alignment B** (net parking loss of 145 spaces (34 percent))
  - Would eliminate 29 on-street spaces on the north side of Hudson Road from Maria Avenue to Maple Street
  - Would eliminate 116 on-street spaces on the south side of Hudson Road to its dead-end past Kennard Street
    - This segment of road has low volume traffic with residential homes and parking is allowed on both sides of Hudson Road.
    - Because the Project would operate in mixed traffic, on-street parking only would be removed on the south side, where the parking runs parallel to the noise barrier along I-94
    - Based on site visits, parking on the south side has low parking utilization because the majority of cars are parked in a driveway; for some homes, additional access is available along Old Hudson Road that runs parallel to Hudson Road
  - No impacts to on-street parking would occur along the north side of Hudson Road between Old Hudson Road and the dead-end past Kennard Street.

  Therefore, there are sufficient parking spaces to accommodate parking need, and the parking loss due to the Project is not anticipated to impact overall parking needs along Alignment B.

  Alignment B would impact one driveway for construction of the dedicated guideway and associated infrastructure. The driveway impact would be for Leo's Chow Mein located on the northeast corner of Earl Street and Hudson Road. Leo's Chow Mein has two existing access points: one driveway on Earl Street and one driveway on Hudson Road. The Project would maintain the driveway located on Earl Street and would permanently remove the driveway on Hudson Road. The removal of the driveway on Hudson Road is due to the construction of the dedicated guideway and new signalized intersection with pedestrian accommodations at Earl Street and Hudson Road. The construction of the pedestrian accommodations includes a pedestrian refuge and bump-outs at the northwest and northeast corners. These improvements do not allow replacement of the driveway on Hudson Road.

  The Project coordinated with Ramsey County, the City of Saint Paul and residents and will continue to coordinate efforts to minimize parking impacts as the Project advances through the Project Development and Engineering phases.

- **Alignment C** (net parking loss of 68 spaces (5 percent))
  - Would remove 27 off-street spaces at St. Paul Youth Services, 2100 Wilson Ave. in Saint Paul

    - » The new surface park-and-ride at Sun Ray Station would provide a total of 150 spaces for Project-users. The Council will coordinate with St. Paul Youth Service in the acquisition of property for the park-and-ride
  - Would remove 132 off-street spaces at Sun Ray Shopping Center
    - » The Council reviewed the City of Saint Paul existing parking supply per city parking code requirements and reported that the existing supply is greater than required by city parking code requirements
    - » These spaces are located near the guideway along Old Hudson Road, which is the farthest walking distance to the entrances to the shopping center
  - Would remove 27 off-street spaces at the Crossroads Properties, Inc. property near Tanners Lake; the Project would fully acquire this property
  - Would remove eight off-street spaces near Harley-Davidson in the public right-of-way
  - Would remove 16 on-street spaces on Hudson Boulevard in front of Harley-Davidson.
  - Would remove eight off-street spaces at Apostolic Bible Institute; due to the roadway geometry
  - Neither the Hazel Street Station Option nor the Dedicated Guideway Option at Hadley Avenue and 4th Street would produce long-term impacts to parking or driveways.

Alignment C would impact the following three driveways for construction of the dedicated guideway and associated infrastructure:

- Would remove two driveways at St. Paul Youth Services in Saint Paul for construction of the Sun Ray park-and-ride lot
- Would relocate one driveway at Apostolic Bible Institute in Oakdale for construction of guideway.

St. Paul Youth Services has three existing access points on Pedersen Street and one on Wilson Avenue. Construction of the new surface park-and-ride lot would require the removal of two existing driveways to optimize parking and circulation within the new surface park-and-ride. Additional access for St. Paul Youth Services would be provided within the new park-and-ride.

Apostolic Bible Institute has three existing access points and all access points will be maintained. The Project would relocate one of the driveways at the corner of Hudson Road and Hadley Avenue due to its location in relation to the addition of new bus traffic. This driveway would be replaced with a new driveway about 180 feet to the north.

The Council coordinated with businesses and property owners on the impacts to parking within Alignment C including St. Paul Youth Services, Sun Ray Shopping Center, Harley-Davidson, and Apostolic Bible Institute. The Council will continue coordination efforts to minimize parking impacts during the Project Development and Engineering phases.

- **Alignment D3** (net parking gain of 87 spaces (8 percent))
  - Would remove 156 off-street spaces in the Crossroads Properties Inc. property at the planned Helmo Avenue Station location; the Project would fully acquire and relocate the Crossroads Properties Inc. property, where it would then construct the station and 100-space park-and-ride
  - Would remove 57 spaces within the back of the parking lot at HOM Furniture, all of which are located within the public right-of-way
  - Would use 150 spaces at the existing Woodbury Theatre Park-and-Ride

- Construct 200-spaces for the new surface park-and-ride lot at the Woodbury 494 Park and Ride Station at the intersection of Woodlane and Guider drives

The majority of Alignment D3 parking loss is related to the acquisition of Crossroads Properties, Inc. to accommodate the park-and-ride at Helmo Avenue Station. Therefore, there are sufficient parking spaces to accommodate parking need and the parking loss due to the Project is not anticipated to impact overall parking needs along Alignment D3. The Council coordinated with Crossroads Properties Inc. and HOM Furniture and will continue these coordination efforts to minimize parking impacts during the Project Development and Engineering phases.

BUILD ALTERNATIVE 2 (A2-BC-D3)

Alignment A2 would not operate in downtown Saint Paul, other than at the Union Depot Station; therefore, Build Alternative 2 would produce fewer long-term impacts to parking compared with Build Alternative 1. Build Alternative 2 would eliminate 576 existing parking spaces and would produce an overall net parking supply loss of 126 spaces (4.4 percent).

Table 3.4-4 summarizes on- and off-street parking impacts associated with Alignments A2, B, C and D3. Driveway impacts would be the same as for Build Alternative 1.

TABLE 3.4-4: BUILD ALTERNATIVE 2 LONG-TERM PARKING IMPACTS BY ALIGNMENT

Alignment	Existing Spaces	Parking Spaces Eliminated	Parking Spaces Added	Net Parking Impact (Spaces)	Percent Change
Alignment A2[a]	12	0	0	0	0%
Alignment B	425	145	0	-145	-34%
Alignment C[b]	1,342	218	150	-68	-5%
With Hazel Street Station Option	*1,342*	*218*	*150*	*-68*	*-5%*
With Dedicated Guideway Option at Hadley Avenue and 4th Street	*1,342*	*218*	*150*	*-68*	*-5%*
Alignment D3[c]	1,036	213	300	+87	+8%

[a] *Number of on-street, metered spaces from Union Depot to Mounds Boulevard.*

[b] *The Project would fully acquire and relocate the commercial parcel that includes 27 of the 218 spaces eliminated.*

[c] *The Project would fully acquire and relocate the commercial parcel that includes 156 of the 213 spaces eliminated.*

3.4.3.2. Construction Phase (Short-Term) Impacts

BUILD ALTERNATIVE 1 (A1-BC-D3)

Build Alternative 1 would remove 862 parking spaces during the construction activities, and 603 of these are permanent impacts identified under **Table 3.4-2. Table 3.4-5** summarizes the short-term Project-related impacts to parking by Build Alternative.

TABLE 3.4-5: SHORT-TERM PARKING IMPACTS BY ALTERNATIVE

Alternative	Parking Spaces Eliminated During Construction
Build Alternative 1 (A1-BC-D3)	862 total; 259 temporarily removed
With Hazel Street Station Option	*862 total; 259 temporarily removed*
With Dedicated Guideway Option at Hadley Avenue and 4th Street	*862 total; 259 temporarily removed*
Build Alternative 2 (A2-BC-D3)[a]	835 total; 259 temporarily removed
With Hazel Street Station Option	*835 total; 259 temporarily removed*
With Dedicated Guideway Option at Hadley Avenue and 4th Street	*835 total; 259 temporarily removed*

[a] *See the Build Alternative 2 (A1-BC-D3) section under Section 3.4.3.1 for a summary of impacts for Build Alternative 2.*

Short-term parking impacts for Alignments A1, C and D3 would be the same as the long-term impacts identified in **Table 3.4-3**.

Alignment B would include an additional temporary removal of 259 on-street parking spaces to facilitate construction. Depending on the construction phasing the Council implements, Project construction would restrict or close all existing on-street parking on Hudson Road.

Table 3.4-6 summarizes the Project-related impacts to parking by Alignment.

TABLE 3.4-6: SHORT-TERM PARKING IMPACTS BY ALIGNMENT

Alignment	Parking Spaces Eliminated During Construction
Alignment A1	27 total; 0 temporarily removed
Alignment A2[a]	0 total; 0 temporarily removed
Alignment B	404 total; 259 temporarily removed
Alignment C	218 total; 0 temporarily removed
Alignment D3	213 total; 0 temporarily removed

[a] *See the Build Alternative 2 (A1-BC-D3) section under Section 3.4.3.1 for a summary of impacts for Build Alternative 2.*

For all alignments, the Agencies anticipate construction would produce disruptions to some driveway access points. The construction staging plan would identify driveway conflicts and measures to minimize these impacts. The Council would further identify before construction begins opportunities to reduce short-term parking loss and duration.

Neither the Hazel Street Station Option nor the Dedicated Guideway Option at Hadley Avenue and 4th Street would produce short-term impacts to parking or driveways.

BUILD ALTERNATIVE 2 (A2-BC-D3)

Alignment A2 would not operate in downtown Saint Paul, other than at the Union Depot Station; therefore, Build Alternative 2 would not produce a loss of downtown parking. Short-term parking impacts for Alignments B, C and D3 would be the same as the long-term impacts (see **Table 3.4-4**).

3.4.4. Avoidance, Minimization and Mitigation Measures

Avoidance, minimization and mitigation measures apply to both Build Alternative 1and Build Alternative 2. The analysis identified long-term impacts to parking in Saint Paul, Oakdale and Woodbury. The Council will coordinate with these cities, impacted residents and business to businesses to further minimize parking impacts as the Project advances through the Project Development and Engineering phases.

In areas where the Project would result in impacts to parking, the Council would compensate property owners in accordance with the Uniform Relocation Act and Minnesota Statutes Chapter 117.

The analysis identified long-term impacts to four driveways. The impacted driveway at Apostolic Bible Institute would be relocated approximately 180 feet to the north. Two of the driveways at St. Paul Youth Services and one of the driveways at Leo's Chow Mein will not be relocated, therefore the Council will compensate property owners in accordance with the Uniform Relocation Act and Minnesota Statutes Chapter 117.

Short-term mitigation strategies could include providing signage that directs business patrons to streets where parking is available and implementing an ongoing outreach program that informs business owners and residents about construction activities in the neighborhood. Additionally, the Council would implement staged construction activities to minimize short-term impacts to the greatest extent possible. The construction contractor would implement the staging plan and would reduce the loss of parking spaces during construction to the extent possible. The construction staging plan will address these areas to minimize the duration and frequency of these impacts. The construction staging would be developed .as the design of the Project advances during the Engineering phase and prior to the start of construction.

The Council would develop MOT plans during the Engineering Phase and prior to construction and submit for approval to the roadway authorities. The MOT plans would address construction phasing, maintenance of traffic, traffic signal operations, access through the work zone, any road closures, and any traffic detours.

3.5. Pedestrian and Bicycle Facilities

This section evaluates Project-related impacts to pedestrian and bicycle facilities and connections, and the people who use them. The term "facilities" represents nonmotorized pedestrian and bicycle trails, bikeways, sidewalks, crossings, and other infrastructure the Project would construct.

3.5.1. Regulatory Context and Methodology

The resource study area includes the potential limits of disturbance, facilities adjacent to the Build Alternatives, alternate routes within a ½-mile of the Build Alternatives, and nearby connections to the regional bicycle system. Transit planners commonly use a ½-mile radius to represent the distance transit-users are willing to walk to access a station. The Council identified these facilities by reviewing trail and comprehensive plan maps, aerial photography and visiting sites, and it used the Project's 15% Concept Plans (see **Appendix B**) and the potential limits of disturbance to determine the number and magnitude of anticipated impacts.

Operating phase (long-term) impacts are permanent closures of the facilities. Some areas would require realignment of existing facilities, but because the Project would restore these facilities to the same functionality as their current state, the analysis does not count these realignments as long-term impacts.

The *Draft Section 4(f) and Section 6(f) Evaluation* in **Appendix A** addresses publicly owned facilities subject to protection under Section 4(f) of the Department of Transportation Act.

The analysis identified and evaluated impacts on facilities due to their intersections with the dedicated guideway and associated crossing restrictions. The analysis includes measures to improve pedestrian and bicycle safety, and it addresses the locations and types of existing facilities relative to connectivity and nonmotorized access to and from stations.

3.5.2. Affected Environment

Regional facilities exist in the vicinity of Alignments A1, A2 and B and include Sam Morgan, Saint Paul Mississippi River West Bank, Trout Brook, and Bruce Vento Regional trails. In addition, the Project corridor includes several planned future facilities and the Regional Bicycle Transportation Network corridors, which the 2040 TPP identifies.

Future facilities would provide connections to stations in downtown Saint Paul, as well as stations at Union Depot, Mounds Boulevard, Earl Street, Etna Street, Greenway Avenue, Helmo Avenue, Tamarack Road and Woodbury Theatre. These facilities would provide access to other nearby facilities.

The number and conditions of existing facilities in the study area vary by location and alignment. The study area has limited bicycle facilities. On-street bicycle lanes intersect at Johnson Parkway and Ruth Street in Saint Paul. Multiuse trails run adjacent to Helmo Avenue and 4th Street in Oakdale and along Hudson Road (between I-494 and slightly east of Woodbury Drive) in Woodbury. The study area has a fairly complete pedestrian network in Saint Paul, Maplewood, Landfall, and Oakdale. Sidewalks in the developing area of Woodbury are less complete. South of I-94, an existing trail is located on the east side of Bielenberg Drive between Valley Creek Road and the Tamarack Hills Northern Access. A private trail is located at 500 Bielenberg Drive on the west side of the roadway.

Figure 3.5-1 and **Figure 3.5-2** show existing and planned bike lanes and trails for each alignment within the Build Alternatives.

FIGURE 3.5-1: EXISTING AND PLANNED BIKEWAYS AND TRAILS FOR ALIGNMENTS A1, A2 AND B

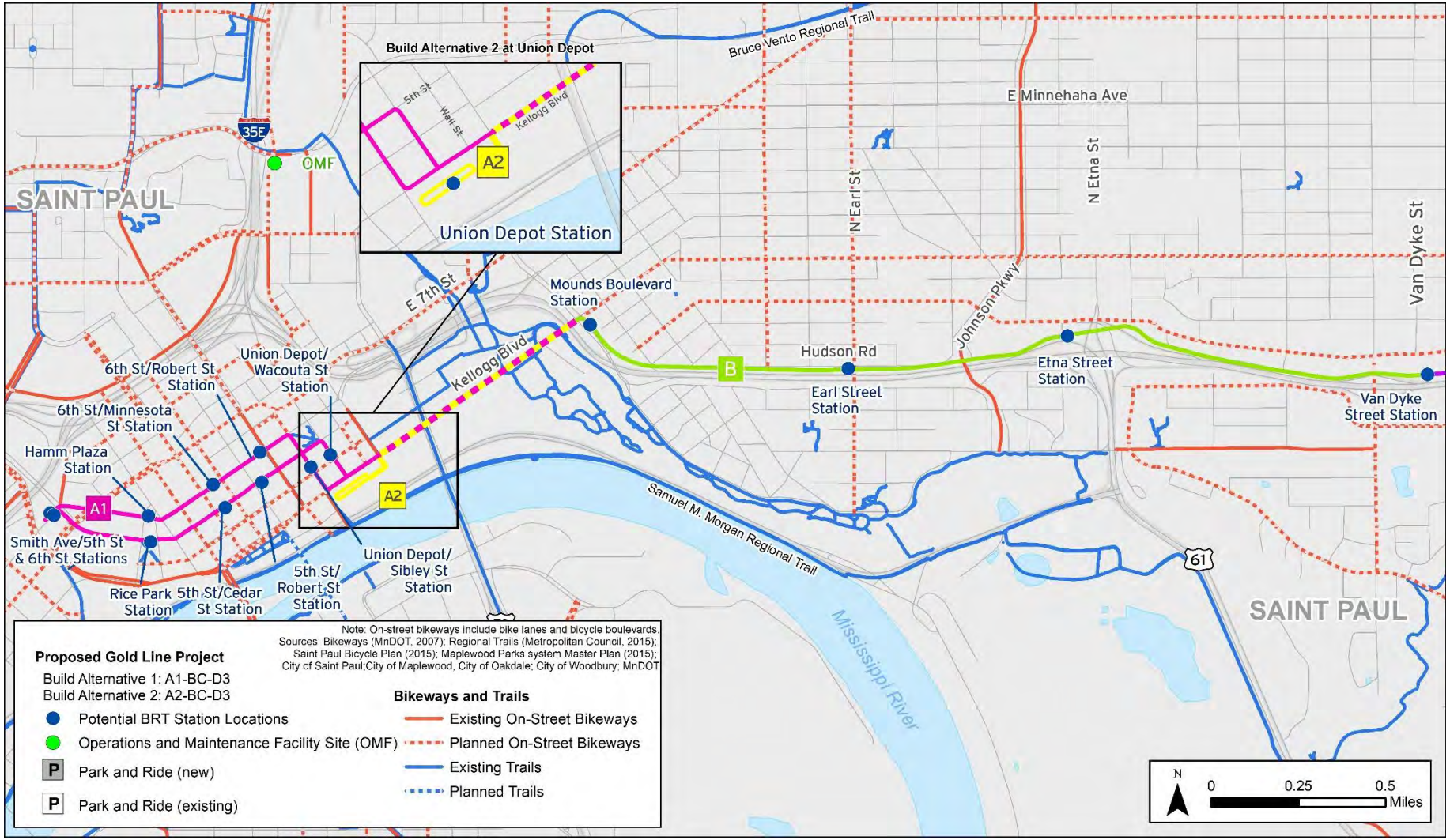
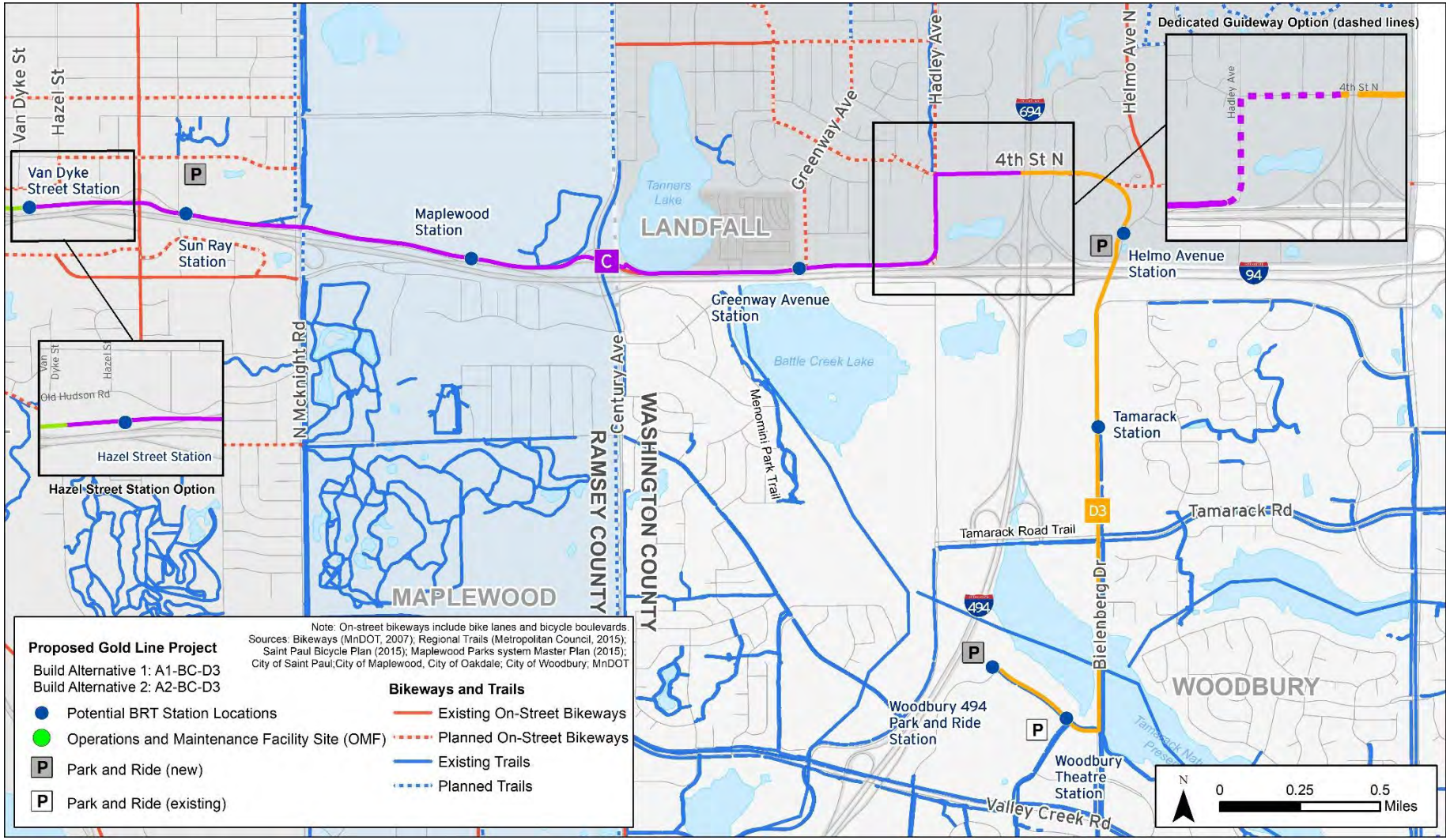


FIGURE 3.5-2: EXISTING AND PLANNED BIKWAYS AND TRAILS FOR ALIGNMENTS C AND D3



3.5.3. Environmental Consequences

3.5.3.1. Operating Phase (Long-Term) Impacts

BUILD ALTERNATIVE 1 (A1-BC-D3)

The Project is not anticipated to negatively impact pedestrians and bicycles. The Project is expected to benefit pedestrians and bicyclists by providing new pedestrian and bike facilities. Approximately 1.4 miles of existing sidewalks and 1.4 miles of existing trails adjacent to the corridor will be reconstructed as a part of the Project. The pedestrian and bike connections would be ADA-compliant, and all stop platforms would be aligned with crosswalks for pedestrian safety.

Neither of the Build Alternative 1 alignments or their corresponding design options would permanently close any facilities. The analysis focused on local and regional connections to existing and proposed facilities, and the following sections describe facilities that the Project would construct or modify. The 15% Concept Plans in **Appendix B** show new facilities.

Alignment A1 (Smith Avenue to Mounds Boulevard)

Stations in downtown Saint Paul would connect to a dense grid of existing sidewalks and a system of existing and planned facilities. This Project would include constructing sidewalk bump-outs that would provide more space for station elements and pedestrians at the following stations: Smith Avenue/5th Street, Hamm Plaza, 5th Street/Robert Street, Union Depot/Sibley Street and Union Depot/Wacouta Street.

Alignment B (Mounds Boulevard to White Bear Avenue)

This alignment would include constructing facilities along the northern edge of the dedicated guideway between 3rd and Euclid streets to provide walk-up access to the Mounds Boulevard Station. Sidewalk bump-outs constructed at the Earl Street Station would reduce the crossing distance for pedestrians and extend into the parking lane. A center refuge constructed at the Earl Street Station would provide for station access. Hudson Road between Wilson Avenue and Griffith Street would be reconstructed to accommodate the guideway, and it would move sidewalks slightly north of their existing locations as part of this roadway reconstruction.

At Johnson Parkway, the Council may construct a facility on the south side of Wakefield Avenue between Johnson Parkway and Griffith Street and along the west side of Griffith Street and would connect to a reconstructed existing facility along Hudson Road.[12] The *Draft Section 4(f) and Section 6(f) Evaluation* in **Appendix A** addresses Project-related impacts to facilities associated with Johnson Parkway.

Near the Trunk Highway (TH) 61 interchange with I-94, Alignment B proposes new facilities on the east side of TH 61 to connect to the Etna Street Station. These facilities would connect to existing crosswalks and sidewalks near the TH 61/Burns Avenue intersection. The Council may construct a pedestrian underpass (under the ramp from I-94 to southbound TH 61) and facilities on the west side of TH 61.[13]

[12] *These infrastructure improvements are potential work that may be constructed with the Project, pending further review by the Council and Project funding partners.*

[13] *These infrastructure improvements are potential work that may be constructed with the Project, pending further review by the Council and Project funding partners.*

A planned bike lane along Earl Street would provide bike access to the north and south of the Earl Street Station.

The Council may also reconstruct a pedestrian bridge over I-94 at Maple Street. The Project would decommission and deconstruct the existing bridge and build the new facility.[14]

Alignment C (White Bear Avenue to I-694)

This alignment would include constructing a facility from the Van Dyke Street Station to Old Hudson Road. This facility would better connect transit with the proposed Ruth Street Bicycle Boulevard included in the *Saint Paul Bicycle Plan.*[15]

The alignment would impact existing facilities on either side of Pedersen Street due to the Old Hudson Road realignment near the Sun Ray Shopping Center. The Project would place facilities on the north side of a realigned Old Hudson Road from Pedersen Street to the east side of the Sun Ray Shopping Center. Modified facilities would connect the Sun Ray Park-and-Ride to the Sun Ray Station. The Council may widen the existing sidewalk west of Pedersen Street to Ruth Street and east of the Sun Ray Shopping Center to McKnight Road.[16]

New facilities would connect the Maplewood Station with the 3M campus and connect the station to McKnight Road and Century Avenue. This alignment would include realigning two privately owned existing facilities on the 3M campus to accommodate the BRT guideway. These adjustments would further increase the walkability and bikeability of the campus by providing direct access from the campus to transit, as well as providing public access to the Maplewood Station. The Council may include grade-separate facilities with the construction of the BRT-exclusive bridges over McKnight Road and Century Avenue.[17]

The Council may construct facilities on the north side of Hudson Road from the Century Avenue/Hudson Boulevard intersection to the Hudson Boulevard/Hadley Avenue intersection and along the west side of Century Avenue under the existing I-94 bridge to provide connections to the Greenway Avenue Station.[18] Based on the Council's regional bicycle network[19], a planned future facility along Greenway Avenue would provide greater bicycle connectivity to areas north of the station.

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[14] *These infrastructure improvements are potential work that may be constructed with the Project, pending further review by the Council and Project funding partners.*

[15] *City of Saint Paul.* Saint Paul Bicycle Plan. *Adopted March 2015. Last modified July 2017. Available at: https://www.stpaul.gov/sites/default/files/Media%20Root/Public%20Works/Saint%20Paul%20Bicycle%20Plan.pdf. Accessed May 2018.*

[16] *These infrastructure improvements are potential work that may be constructed with the Project, pending further review by the Council and Project funding partners.*

[17] *These infrastructure improvements are potential work that may be constructed with the Project, pending further review by the Council and Project funding partners.*

[18] *These infrastructure improvements are potential work that may be constructed with the Project, pending further review by the Council and Project funding partners.*

[19] *Metropolitan Council. "Regn'l Bicycle Transportation Network". Available at https://giswebsite.metc.state.mn.us/mcviewer/?cfg=rbtn. Last modified 2017. Accessed May 2018.*

Hazel Street Station Option

This option would include constructing a facility from the Hazel Street Station to Old Hudson Road. The Council may also construct a facility along the north side of the dedicated guideway from the Hazel Street Station to Ruth Street, enabling a secondary pedestrian connection to the station.

Dedicated Guideway Option at Hadley Avenue and 4th Street

The option would extend new facilities from the Apostolic Bible Institute, 6944 Hudson Blvd., across the new bridge built over I-694 to the intersection of 4th Street to improve the pedestrian connection to the Helmo Avenue Station, increasing walkability and access to the station. This option would place facilities on the east and west sides of Hadley Avenue to extend to the Helmo Avenue Station. On 4th Street, the facility would extend to Hayward Avenue on the north side and end at Hale Avenue on the south side.

Alignment D3 (I-694 to Woodbury 494 Park and Ride)

The Council may construct facilities between Hayward Avenue North and 4th Street Lane to connect the existing gap and between 4th Street North and the Helmo Avenue Station to connect to the existing trail in transportation right-of-way on the north side of 4th Street.[20]

The new bridge over I-94 would include a facility on the east side, which would continue along Helmo Avenue and connect to the existing trail in transportation right-of-way that starts on the east side of Helmo Avenue south of 3rd Street.

Alignment D3 would construct pedestrian and bicycle connections south of I-94 to create a continuous trail on both sides of Bielenberg Drive between Nature Path and the north access of Tamarack Hills. The Council may also construct a new facility along Bielenberg Drive that would connect to an existing trail that starts at Hudson Road and Landau Drive (east of Bielenberg Drive).[21] The *Draft Section 4(f) and Section 6(f) Evaluation* in **Appendix A** addresses Project-related impacts to the trail along Bielenberg Drive.

BUILD ALTERNATIVE 2 (A2-BC-D3)

Alignment A2 would not construct additional facilities to the station proposed at the Union Depot bus deck, and Alignments B, C and D3 would produce the same impacts for both Build Alternatives. Approximately 1.3 miles of existing sidewalks and 1.4 miles of existing trails adjacent to the corridor will be reconstructed as a part of the Project.

3.5.3.2. Construction Phase (Short-Term) Impacts

BUILD ALTERNATIVE 1 (A1-BC-D3)

Build Alternative 1 construction would produce short-term impacts to the pedestrian and bicycle facilities described in **Section 3.5.2**. The FTA and the Council anticipate that temporary closures or detours would affect users of these facilities, and short-term impacts to the facilities themselves would include intersection modifications and detours. Additionally, the construction of a stormwater facility in Menomini Park, directly to the

[20] *These infrastructure improvements are potential work that may be constructed with the Project, pending further review by the Council and Project funding partners.*

[21] *These infrastructure improvements are potential work that may be constructed with the Project, pending further review by the Council and Project funding partners.*

south of I-94, would temporarily impact an existing trail. The *Draft Section 4(f) and Section 6(f) Evaluation* in **Appendix A** addresses Project-related impacts to this trail.

Neither the Hazel Street Station Option nor the Dedicated Guideway Option at Hadley Avenue and 4th Street would produce short-term impacts to pedestrian or bicycle facilities.

BUILD ALTERNATIVE 2 (A2-BC-D3)

Alignment A2 would produce fewer impacts than Alignment A1 because it would terminate at the existing Union Depot, not impacting the downtown pedestrian and bicycle network. Alignments B, C and D3 would produce the same impacts for both Build Alternatives.

3.5.4. Avoidance, Minimization and Mitigation Measures

Avoidance, minimization and mitigation measures apply to both Build Alternative 1 and Build Alternative 2. The Council will continue to evaluate pedestrian and bicycle safety during the Project Development and Engineering phases to identify design solutions that the Project could implement to improve safety, access and mobility at crossing locations.

The Project would maintain facilities during construction, where feasible. Construction phasing plans would include safe access for nonmotorized users inconvenienced due to detours and closures during construction. Safety components could include special facilities such as handrails, fences, barriers, ramps, walkways, and bridges at some locations.

If construction temporarily closes crosswalks, signage would direct pedestrians to use alternate crossings nearby. The Council would make efforts not to close adjacent crosswalks at the same time, so pedestrian movement would continue across streets. The Project would construct all sidewalks and crosswalks according to minimum standards for accessibility, and they would be free of slipping and tripping hazards.

3.6. Freight Rail

This section evaluates Project-related impacts to freight rail.

3.6.1. Regulatory Context and Methodology

This evaluation focuses on rail lines in the freight rail study area on either side of the Project alignments. The evaluation identifies whether and how the Project could impact existing at-grade freight rail-roadway crossings and freight rail operations.

3.6.2. Affected Environment

Within the study area, freight rail operates on track underneath the Kellogg Boulevard Bridge. This section of track is the BNSF Railway-owned St. Paul Subdivision, and it connects to Union Pacific and Canadian Pacific freight tracks. The St. Paul Subdivision tracks carry significant numbers of freight vehicles per day; however, this does not affect Kellogg Boulevard Bridge traffic because the trains pass under the bridge.

Freight rail and passenger rail tracks exist south of the Project's main terminus at Union Depot, a multimodal transportation hub that serves Amtrak and METRO Green Line. The Ramsey County Regional Railroad Authority owns Union Depot, which also provides service for non-freight companies such as Jefferson Lines, Greyhound Lines and Megabus.

3.6.3. Environmental Consequences

3.6.3.1. Operating Phase (Long-Term) Impacts

BUILD ALTERNATIVE 1 (A1-BC-D3)

In the study area, BRT would operate in both mixed traffic and bus only lanes in downtown Saint Paul, with multiple stops in the downtown area. The BRT would stop at the front of Union Depot and continue on the Kellogg Boulevard Bridge over the BNSF Railway freight track. Build Alternative 1 would not affect the freight rail infrastructure under the bridge. It would also avoid the freight rail tracks near Union Depot; therefore, long-term impacts to freight rail are not anticipated for the Project.

Neither the Hazel Street Station Option nor the Dedicated Guideway Option at Hadley Avenue and 4th Street would produce long-term impacts to freight rail.

BUILD ALTERNATIVE 2 (A2-BC-D3)

Alignment A2 does not impact the freight tracks near Union Depot; therefore, Build Alternative 2 would not produce long-term impacts to freight rail.

3.6.3.2. Construction Phase (Short-Term) Impacts

BUILD ALTERNATIVE 1 (A1-BC-D3)

Build Alternative 1 would not produce short-term impacts to freight rail.

Neither the Hazel Street Station Option nor the Dedicated Guideway Option at Hadley Avenue and 4th Street would produce short-term impacts to freight rail.

BUILD ALTERNATIVE 2 (A2-BC-D3)

Build Alternative 2 would not produce short-term impacts to freight rail.

3.6.4. Avoidance, Minimization and Mitigation Measures

The FTA and the Council do not anticipate impacts to freight rail infrastructure; therefore, they do not propose avoidance, minimization and mitigation measures for either Build Alternative 1 or Build Alternative 2.

3.7. Aviation

This section evaluates Project-related impacts to aviation facilities. This evaluation addresses aviation facilities within a 5-mile study area of the Project, and it identifies whether and how the Build Alternatives could impact those facilities in the long term (operating phase impacts) and short term (construction phase impacts). This section also discusses measures to avoid, minimize or mitigate potential impacts.

3.7.1. Regulatory Context and Methodology

Three organizations generally govern airports in the Twin Cities Metropolitan Area: the Federal Aviation Administration (FAA), Metropolitan Airports Commission (MAC) and MnDOT.

FAA Orders 1050.1E and 5050.4B require that projects avoid impacting airport-owned property, which in turn changes an airport's layout plan. As part of FAA Advisory Circular 150/5300-13A, FAA regulates particular activities and projects within an airport's runway protection zone (RPZ), which is a trapezoidal area off the end of a runway that helps protect people and property on the ground if an aircraft lands or crashes beyond the runway end.[22] Also, FAA recommends that land use planners and developers of projects, facilities and activities on or near airports refer to Advisory Circular 150/5200-33B (2007 Revision). This circular provides guidance about whether a proposed land use – particularly retention ponds, stormwater treatment facilities, artificial marshes and constructed wetlands – could increase wildlife hazards for airport facilities. FAA recommends a separation distance of 5,000-10,000 feet and 5 miles based on the presence of either piston-powered or turbine-powered aircraft to protect the approach, departure and circling of airspace, respectively.

Construction near an airport could affect aviation safety and the safety of people and property on the ground. MnDOT uses the nontechnical term "airport influence area" to define the area 10,000 feet from the runway end that is essential in preventing height hazards in the path of approaching and departing aircraft.[23]

Minnesota Rule Part 8800.2400 establishes land use safety zones and other airport zoning standards. Safety zones are intended to restrict land uses that may be hazardous to the operational safety of aircraft using the airport, and to protect the safety of people and property on the ground area near the airport. The rule establishes three safety zones for each runway: Safety Zones A, B and C.

Safety Zone A does not allow buildings, temporary structures, exposed transmission lines or other uses that assemble groups of people; uses that interfere with radio or electronic communications between the airport and aircraft; or lighting that makes it difficult for pilots to distinguish airport lights, results in glare in pilots' eyes, or impairs visibility in the airport vicinity.

Safety Zone B does not allow building near the following areas: sites less than 3 acres; sites with more than 15 people per acre; or churches, hospitals, schools, theaters, stadiums, hotels and motels, trailer courts, campgrounds and other places of public assembly. Safety Zone B prohibits uses that interfere with radio or electronic communications between the airport and aircraft; interfere with an airport's radio or electronic facilities; and lighting that makes it difficult for pilots to distinguish airport lights, results in glare in pilots' eyes, or impairs visibility in the airport vicinity.

Safety Zone C is circular and typically follows FAA's Federal Aviation Regulation Part 77 horizontal surface, which is a horizontal plane 150 feet above the established airport elevation. Safety Zone C does not allow uses that interfere with airport radio or electronic facilities, or with radio or electronic communications between the airport and aircraft; or lighting that makes it difficult for pilots to distinguish airport lights, results in glare in pilots' eyes, or impairs visibility in the airport vicinity.

3.7.2. Affected Environment

The Project is located within 5 miles of St. Paul Downtown Airport (Holman Field), which MAC operates, and portions of the Project are located within the airport influence area 10,000 feet from where the runway ends. The Project does not fall within a designated RPZ, but it is located on the border between the areas designated as Safety Zone A and Safety Zone B for one runway.

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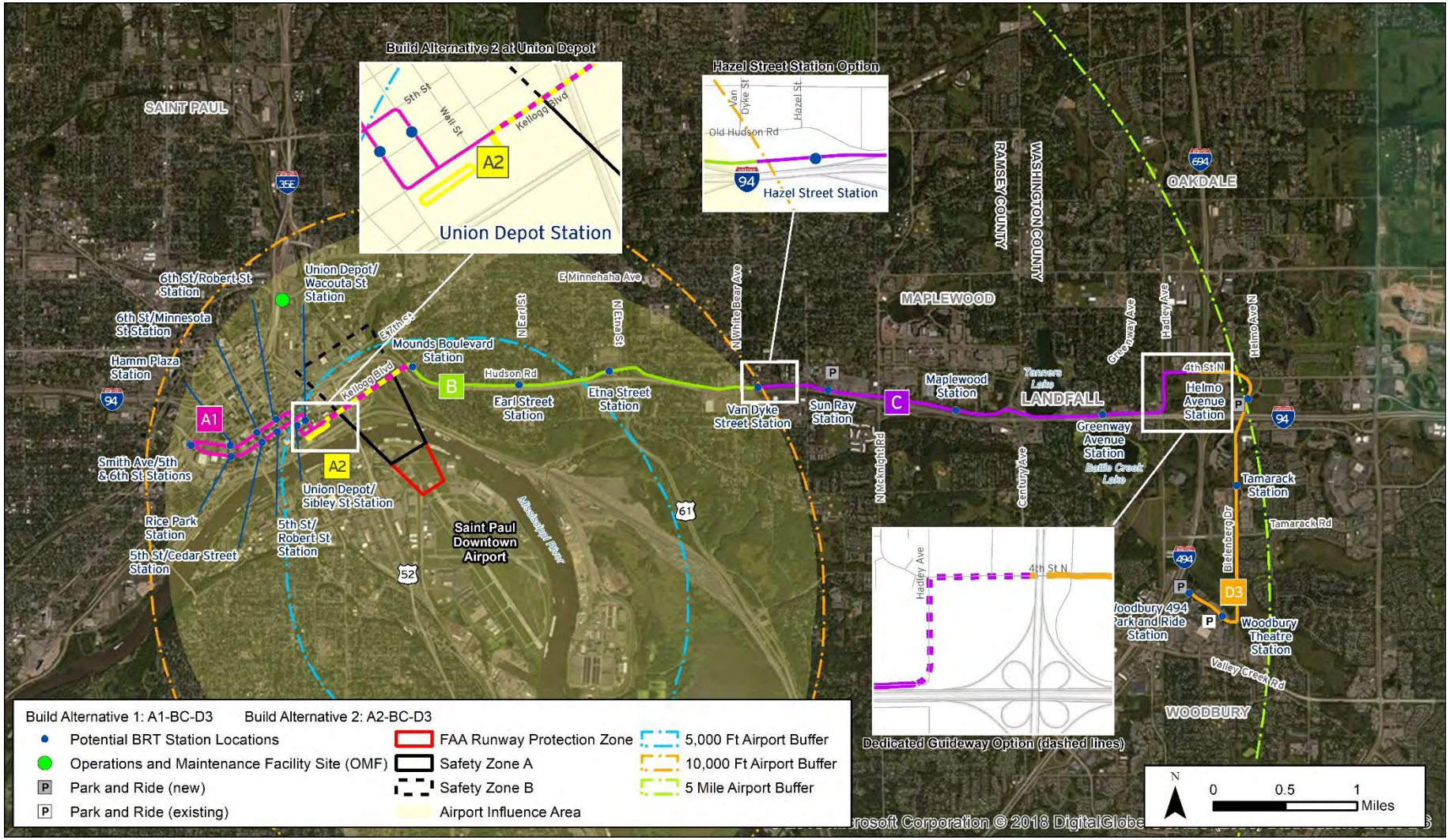
[22] *Federal Aviation Administration. "Runway Protection Zones". Available at http://portal.hud.gov/hudportal/documents/huddoc?id=airportdivision.pdf. Accessed October 2018.*

[23] *Minnesota Department of Transportation Office of Aeronautics. "Airport Influence Areas." Available at: http://www.dot.state.mn.us/aero/airportinfluencemaps.html. Accessed October 2018.*

Figure 3.7-1 shows the locations of the RPZ and Safety Zones A and B in relation to the Project. St. Paul Downtown Airport services single-engine and multi-piston aircraft, turboprops, business jets and helicopters.

FIGURE 3.7-1: SAINT PAUL DOWNTOWN AIRPORT PROTECTION ZONES



3.7.3. Environmental Consequences

3.7.3.1. Operating Phase (Long-Term) Impacts

BUILD ALTERNATIVE 1 (A1-BC-D3)

Build Alternative 1 would not directly affect any airport-owned property; however, portions of the Project are located within Safety Zones A and B.

Alignment A1 would pass through Safety Zones A and B on Kellogg Boulevard. Within the Safety Zones A and B, BRT would operate on the existing roadway in mixed traffic (not in a dedicated lane). The Project would not construct new stations within Safety Zones A and B. Transportation and passenger facilities, parking uses and utilities are compatible within Safety Zone C;[24] therefore, the Project would conform with safety zone requirements.

The Project includes elevated pedestrian and guideway structures within the airport influence area and within 5 miles of St. Paul Downtown Airport. The Project also includes stormwater detention facilities to mitigate additional impervious coverage that would result from constructing Build Alternative 1. **Appendix B** includes the 15% Concept Plans that illustrate the proposed locations of these facilities. The Council has not completed the design of these stormwater detention facilities yet, but it would develop them according to the FAA guidance[25] for designing facilities that could potentially attract hazardous wildlife on or near public-use airports.

The Project's OMF would be located within the airport influence area; however, the FTA and the Council do not anticipate Project-related impacts because the OMF would be in an existing structure shielded by permanent and substantial structures in a built-up urban area of Saint Paul, where it would not adversely affect aviation.

Neither the Hazel Street Station Option nor the Dedicated Guideway Option at Hadley Avenue and 4th Street would produce long-term impacts to aviation.

BUILD ALTERNATIVE 2 (A2-BC-D3)

Build Alternative 2, and Alignment A2, would produce the same long-term impacts to aviation as Build Alternative 1.

3.7.3.2. Construction Phase (Short-Term) Impacts

BUILD ALTERNATIVE 1 (A1-BC-D3)

Build Alternative 1 would not produce short-term impacts to aviation.

Neither the Hazel Street Station Option nor the Dedicated Guideway Option at Hadley Avenue and 4th Street would produce short-term impacts to aviation.

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[24] *Minnesota Department of Transportation Office of Aeronautics. "Table 3-7: Compatible Land Uses Within Airport Safety Zones."* Airport Land Use Compatibility Manual. *September 2006. Available at: http://www.dot.state.mn.us/aero/planning/landuse-compatibility-manual.html. Accessed October 2018.*

[25] *Federal Aviation Administration. "Advisory Circular 150/5200-33B – Hazardous Wildlife Attractants On or Near Airports". Available at: https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentNumber/150_5200-33. Accessed October 2018.*

BUILD ALTERNATIVE 2 (A2-BC-D3)

Build Alternative 2 would not produce short-term impacts to aviation.

3.7.4. Avoidance, Minimization and Mitigation Measures

Avoidance, minimization and mitigation measures apply to both Build Alternative 1 and Build Alternative 2. The Council will coordinate with MnDOT and MAC as the Project design advances so that the Project conforms with airport operations. If MAC modifies the St. Paul Downtown Airport RPZ or safety zones in the future, the Council would coordinate with MAC, FAA and the City of Saint Paul to review potential Project-related impacts.

FAA strongly recommends that stormwater detention pond construction should not create aboveground standing water; the ponds should have a maximum 48-hour detention period and should remain completely dry between storms. FAA prefers the use of steep-sided, riprap-lined, narrow, linearly shaped water detention basins, and it recommends that entities consider physical barriers including bird balls, wires, pillow or netting.[26]

The Council would use best management practices to avoid constructing habitat that could attract wildlife and to comply with FAA's requirements and recommendations. The Council would coordinate all required mitigation measures with MAC or FAA throughout the Project's design and construction.

METRO Gold Line

BUS RAPID TRANSIT PROJECT ENVIRONMENTAL ASSESSMENT

Appendix A: Environmental Assessment Technical Reports

Attachment A-3-1:
Traffic Volumes

May 2019

2018 Existing AM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
	Alignment A1												
1	Sibley St & Kellogg Blvd	540	400	120	--	--	--	95	225	--	--	745	65
2	Sibley St & 4th St	55	500	--	--	--	--	--	--	--	--	55	10
3	Sibley St & 5th St	--	460	55	--	--	--	65	195	--	--	--	--
4	5th St & Market St	--	185	175	5	25	--	25	700	70	--	--	--
5	5th St & St. Peter St	--	--	--	240	175	--	--	725	150	--	--	--
6	Kellogg Blvd & Wacouta St	--	--	--	--	--	45	--	310	--	--	600	15
	Alignment A2												
7	Kellogg Blvd & Broadway St	10	20	25	30	30	10	15	200	25	15	625	60
	Alignment B												
8	Kellogg Blvd & Mounds Blvd	735	830	30	75	195	125	130	105	35	20	390	275
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	160	--	--	250	--	--	--	--	177	1440	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	160	105	200	225	--	--	--	--	--	--	--
11	Earl St & Hudson Road	10	15	15	5	10	10	5	15	5	10	15	5
12	White Bear Ave & Old Hudson Rd	75	625	50	15	575	15	15	25	100	150	55	85
13	White Bear Ave & I-94 Westbound Ramps	100	500	--	--	375	450	--	--	--	100	85	250
14	White Bear Ave & I-94 Eastbound Ramps	--	300	80	175	300	--	300	5	120	--	--	--
15	White Bear Ave & Suburban Ave	10	170	50	145	215	60	60	20	10	180	15	150
	Alignment C												
16	Ruth St & Old Hudson Rd	70	190	25	15	230	15	10	20	30	150	210	75
17	Ruth St & I-94 Westbound On-Ramp	140	285	--	--	175	235	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	325	--	--	175	--	100	--	90	--	--	--
19	Pedersen St & Old Hudson Rd	--	--	--	15	--	20	20	85	--	--	100	15
20	McKnight Rd & 1st St	--	860	25	100	620	--	--	--	--	0	--	5
21	McKnight Rd & Hudson Service Rd	--	855	680	--	570	50	30	--	40	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	210	1425	--	--	355	255	--	--	--	45	45	110
23	McKnight Rd & Burns Ave	35	585	55	115	335	45	50	45	30	5	5	10
24	Hudson Rd & 4th St	--	--	--	--	--	5	--	--	--	--	195	50
25	Hudson Rd & 8th St	--	--	--	--	--	10	--	--	--	--	235	475
26	Hudson Rd & 19th St	--	--	--	--	--	30	--	--	--	--	625	555
27	Century Ave & Hudson Rd / Hudson Blvd	--	1295	165	15	305	220	--	--	--	--	--	100
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	465	755	--	--	300	5	--	--	--	85	490	705
29	Century Ave & I-94 Eastbound Ramps	--	1005	75	105	280	--	215	0	175	--	--	--
30	4th St & Hadley Ave	5	70	75	175	35	10	20	20	5	70	15	90
31	4th & Hale Ave	--	--	--	10	--	5	20	250	--	--	170	55
	Alignment D3												
32	4th St & Hudson Blvd / Hayward Ave	10	5	5	5	10	10	35	155	70	35	205	15
33	Eastbound 4th St & BRT Guideway	--	--	--	--	--	--	--	165	--	--	255	--
34	4th St & Helmo Ave	5	5	10	75	55	30	5	135	25	15	220	70
35	3rd St & Helmo Ave	--	15	0	55	40	--	--	--	--	0	--	5
36	Helmo Ave & Hudson Blvd / 2nd St												
37	Bielenberg Dr & Hudson Rd	--	--	120	--	--	--	--	--	--	230	--	--
38	Bielenberg Dr & Hartford North Driveway	20	120	5	5	175	50	0	0	0	0	0	0
39	Bielenberg Dr & Hartford South Driveway	275	145	5	5	165	5	0	0	5	5	0	0
40	Bielenberg Dr & Tamarack Hills North	30	415	30	25	125	25	5	0	5	5	0	5
41	Bielenberg Dr & Tamarack Hills	90	465	120	10	115	10	5	5	45	15	5	5
42	Bielenberg Dr & Tamarack Rd	185	145	90	5	45	125	475	370	155	105	665	55
43	Bielenberg Dr & Nature Path	--	410	0	5	300	--	--	--	--	5	--	10
44	Bielenberg Dr & Guider Dr	35	315	--	--	190	115	95	--	15	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

2018 Existing PM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
	Alignment A1												
1	Sibley St & Kellogg Blvd	190	220	220	--	--	--	165	845	--	--	455	15
2	Sibley St & 4th St	65	335	--	--	--	--	--	--	--	--	25	20
3	Sibley St & 5th St	--	235	120	--	--	--	105	625	--	--	--	--
4	5th St & Market St	--	100	70	5	25	--	30	520	30	--	--	--
5	5th St & St. Peter St	--	--	--	160	380	--	--	435	160	--	--	--
6	Kellogg Blvd & Wacouta St	--	--	--	--	--	60	--	950	--	--	370	10
	Alignment A2												
7	Kellogg Blvd & Broadway St	20	25	15	40	15	15	40	400	15	10	365	20
	Alignment B												
8	Kellogg Blvd & Mounds Blvd	50	340	170	205	815	50	135	315	550	35	185	180
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	145	--	--	1395	--	--	--	--	100	415	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	145	155	970	520	--	--	--	--	--	--	--
11	Earl St & Hudson Road	25	60	10	15	65	20	25	30	40	20	25	10
12	White Bear Ave & Old Hudson Rd	120	850	70	60	765	10	50	35	140	100	40	50
13	White Bear Ave & I-94 Westbound Ramps	150	840	--	--	600	405	--	--	--	100	5	200
14	White Bear Ave & I-94 Eastbound Ramps	--	475	125	250	450	--	515	5	275	--	--	--
15	White Bear Ave & Suburban Ave	15	150	125	300	225	200	175	100	30	120	40	275
	Alignment C												
16	Ruth St & Old Hudson Rd	25	375	225	50	280	20	25	100	50	275	65	10
17	Ruth St & I-94 Westbound On-Ramp	100	625	--	--	300	275	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	405	--	--	300	--	320	--	180	--	--	--
19	Pedersen St & Old Hudson Rd	--	--	--	35	--	40	55	285	--	--	350	50
20	McKnight Rd & 1st St	--	775	5	5	1300	--	--	--	--	5	--	0
21	McKnight Rd & Hudson Service Rd	--	710	25	--	1145	160	70	--	175	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	210	620	--	--	770	550	--	--	--	215	245	115
23	McKnight Rd & Burns Ave	45	425	50	375	690	115	65	75	70	5	5	15
24	Hudson Rd & 4th St	--	--	--	--	--	95	--	--	--	--	480	5
25	Hudson Rd & 8th St	--	--	--	--	--	90	--	--	--	--	395	20
26	Hudson Rd & 19th St	--	--	--	--	--	450	--	--	--	--	400	20
27	Century Ave & Hudson Rd / Hudson Blvd	--	555	220	90	1830	235	--	--	--	--	--	105
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	145	675	--	--	1815	15	--	--	--	100	25	100
29	Century Ave & I-94 Eastbound Ramps	--	405	130	1125	790	--	415	0	300	--	--	--
30	4th St & Hadley Ave	5	170	115	130	55	20	10	15	5	55	20	225
31	4th & Hale Ave	--	--	--	55	--	15	5	255	--	--	285	10
	Alignment D3												
32	4th St & Hudson Blvd / Hayward Ave	55	10	50	25	5	30	20	285	5	10	210	15
33	Eastbound 4th St & BRT Guideway	--	--	--	--	--	--	--	360	--	--	235	--
34	4th St & Helmo Ave	5	45	35	150	10	20	45	310	5	15	210	90
35	3rd St & Helmo Ave	--	45	5	5	25	--	--	--	--	5	--	40
36	Helmo Ave & Hudson Blvd / 2nd St												
37	Bielenberg Dr & Hudson Rd	--	--	410	--	--	--	--	--	--	305	--	--
38	Bielenberg Dr & Hartford North Driveway	10	375	0	5	300	10	30	0	15	5	0	5
39	Bielenberg Dr & Hartford South Driveway	10	365	5	5	315	0	10	0	250	5	0	5
40	Bielenberg Dr & Tamarack Hills North	10	330	5	10	555	5	20	5	45	30	5	30
41	Bielenberg Dr & Tamarack Hills	130	305	60	10	595	25	20	5	140	140	5	20
42	Bielenberg Dr & Tamarack Rd	165	180	400	85	230	560	275	1075	370	275	685	40
43	Bielenberg Dr & Nature Path	--	740	10	10	865	--	--	--	--	5	--	5
44	Bielenberg Dr & Guider Dr	30	550	--	--	530	340	200	--	25	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

2040 No-Build AM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
	Alignment A1												
1	Sibley St & Kellogg Blvd	550	410	120	--	--	--	100	230	--	--	760	65
2	Sibley St & 4th St	55	510	--	--	--	--	--	--	--	--	55	10
3	Sibley St & 5th St	--	470	55	--	--	--	70	200	--	--	--	--
4	5th St & Market St	--	195	185	5	30	--	30	735	75	--	--	--
5	5th St & St. Peter St	--	--	--	255	185	--	--	760	160	--	--	--
6	Kellogg Blvd & Wacouta St	--	--	--	--	--	50	--	350	--	--	675	20
	Alignment A2												
7	Kellogg Blvd & Broadway St	10	20	25	35	30	10	20	225	30	15	700	70
	Alignment B												
8	Kellogg Blvd & Mounds Blvd	770	870	30	80	205	130	135	110	35	20	410	290
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	170	--	--	265	--	--	--	--	185	1510	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	170	110	210	235	--	--	--	--	--	--	--
11	Earl St & Hudson Road	10	20	15	5	15	10	5	20	5	10	20	5
12	White Bear Ave & Old Hudson Rd	80	655	55	15	605	15	15	25	105	160	60	90
13	White Bear Ave & I-94 Westbound Ramps	105	525	--	--	395	475	--	--	--	105	90	265
14	White Bear Ave & I-94 Eastbound Ramps	--	315	85	185	315	--	315	5	125	--	--	--
15	White Bear Ave & Suburban Ave	10	180	55	150	225	65	65	20	10	190	15	160
	Alignment C												
16	Ruth St & Old Hudson Rd	75	200	25	15	240	15	10	20	35	160	220	80
17	Ruth St & I-94 Westbound On-Ramp	150	300	--	--	185	250	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	340	--	--	185	--	105	--	95	--	--	--
19	Pedersen St & Old Hudson Rd	--	--	--	20	--	25	25	90	--	--	105	20
20	McKnight Rd & 1st St	--	900	30	100	655	--	--	--	--	0	--	10
21	McKnight Rd & Hudson Service Rd	--	895	715	--	600	55	35	--	45	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	220	1480	--	--	375	270	--	--	--	55	50	130
23	McKnight Rd & Burns Ave	40	615	60	120	345	50	55	50	35	10	10	15
24	Hudson Rd & 4th St	--	--	--	--	--	10	--	--	--	--	225	55
25	Hudson Rd & 8th St	--	--	--	--	--	15	--	--	--	--	265	490
26	Hudson Rd & 19th St	--	--	--	--	--	35	--	--	--	--	665	570
27	Century Ave & Hudson Rd / Hudson Blvd	--	1395	165	15	320	210	--	--	--	--	--	125
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	480	820	--	--	315	5	--	--	--	100	540	740
29	Century Ave & I-94 Eastbound Ramps	--	1085	85	115	300	--	215	0	185	--	--	--
30	4th St & Hadley Ave	10	125	130	305	65	20	35	35	10	125	30	155
31	4th & Hale Ave	50	0	50	20	0	10	35	385	50	50	250	95
	Alignment D3												
32	4th St & Hudson Blvd / Hayward Ave	20	10	10	10	20	20	60	270	125	60	355	30
33	Eastbound 4th St & BRT Guideway	--	--	--	--	--	--	--	290	--	--	445	--
34	4th St & Helmo Ave	10	10	20	130	95	55	10	235	45	30	380	125
35	3rd St & Helmo Ave	--	30	0	100	70	--	--	--	--	0	--	10
36	Helmo Ave & Hudson Blvd / 2nd St	X	X	X	X	X	X	X	X	X	X	X	X
37	Bielenberg Dr & Hudson Rd	--	--	150	--	--	--	--	--	--	290	--	--
38	Bielenberg Dr & Hartford North Driveway	25	155	10	10	220	60	0	0	0	0	0	0
39	Bielenberg Dr & Hartford South Driveway	315	190	10	10	200	10	0	0	10	10	0	0
40	Bielenberg Dr & Tamarack Hills North	35	495	35	30	160	30	10	0	10	10	0	10
41	Bielenberg Dr & Tamarack Hills	105	545	140	15	150	15	10	10	55	20	10	10
42	Bielenberg Dr & Tamarack Rd	265	180	145	10	70	145	545	425	195	155	730	65
43	Bielenberg Dr & Nature Path	25	555	0	10	370	40	25	0	15	5	--	10
44	Bielenberg Dr & Guider Dr	40	460	--	--	225	165	120	--	20	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

2040 No-Build PM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
	Alignment A1												
1	Sibley St & Kellogg Blvd	195	225	225	--	--	--	170	870	--	--	470	15
2	Sibley St & 4th St	65	345	--	--	--	--	--	--	--	--	25	20
3	Sibley St & 5th St	--	240	125	--	--	--	110	645	--	--	--	--
4	5th St & Market St	--	105	75	5	30	--	35	550	35	--	--	--
5	5th St & St. Peter St	--	--	--	170	400	--	--	460	170	--	--	--
6	Kellogg Blvd & Wacouta St	--	--	--	--	--	70	--	1065	--	--	415	15
	Alignment A2												
7	Kellogg Blvd & Broadway St	20	25	15	45	15	15	45	450	15	10	410	20
	Alignment B												
8	Kellogg Blvd & Mounds Blvd	55	355	180	215	855	55	140	330	580	35	195	190
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	150	--	--	1465	--	--	--	--	105	435	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	150	165	1020	545	--	--	--	--	--	--	--
11	Earl St & Hudson Road	30	65	10	15	70	20	30	35	45	20	30	10
12	White Bear Ave & Old Hudson Rd	125	895	75	65	805	10	55	40	150	105	45	55
13	White Bear Ave & I-94 Westbound Ramps	160	880	--	--	630	425	--	--	--	105	5	210
14	White Bear Ave & I-94 Eastbound Ramps	--	500	130	265	475	--	540	5	290	--	--	--
15	White Bear Ave & Suburban Ave	15	160	130	315	235	210	185	105	35	125	45	290
	Alignment C												
16	Ruth St & Old Hudson Rd	25	395	235	55	265	20	25	105	55	290	70	10
17	Ruth St & I-94 Westbound On-Ramp	105	655	--	--	315	290	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	425	--	--	315	--	335	--	190	--	--	--
19	Pedersen St & Old Hudson Rd	--	--	--	40	--	45	60	300	--	--	370	55
20	McKnight Rd & 1st St	--	805	10	10	1360	--	--	--	--	10	--	0
21	McKnight Rd & Hudson Service Rd	--	740	30	--	1200	170	75	--	185	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	220	650	--	--	810	575	--	--	--	220	250	120
23	McKnight Rd & Burns Ave	50	445	55	385	710	120	70	85	75	10	10	20
24	Hudson Rd & 4th St	--	--	--	--	--	100	--	--	--	--	490	10
25	Hudson Rd & 8th St	--	--	--	--	--	95	--	--	--	--	405	25
26	Hudson Rd & 19th St	--	--	--	--	--	465	--	--	--	--	410	25
27	Century Ave & Hudson Rd / Hudson Blvd	--	620	220	90	1930	235	--	--	--	--	--	130
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	155	725	--	--	1915	15	--	--	--	115	30	115
29	Century Ave & I-94 Eastbound Ramps	--	445	150	1190	840	--	435	0	315	--	--	--
30	4th St & Hadley Ave	10	295	200	225	95	35	20	30	10	95	35	390
31	4th & Hale Ave	50	0	50	95	0	30	10	395	50	50	440	20
	Alignment D3												
32	4th St & Hudson Blvd / Hayward Ave	95	20	90	45	10	55	35	495	10	20	360	30
33	Eastbound 4th St & BRT Guideway	--	--	--	--	--	--	--	630	--	--	410	--
34	4th St & Helmo Ave	10	80	65	260	20	35	80	540	10	30	365	155
35	3rd St & Helmo Ave	--	85	10	10	50	--	--	--	--	10	--	70
36	Helmo Ave & Hudson Blvd / 2nd St												
37	Bielenberg Dr & Hudson Rd	--	--	485	--	--	--	--	--	--	380	--	--
38	Bielenberg Dr & Hartford North Driveway	15	440	0	10	355	15	35	0	20	10	0	10
39	Bielenberg Dr & Hartford South Driveway	15	430	10	10	375	0	15	0	290	10	0	10
40	Bielenberg Dr & Tamarack Hills North	15	395	10	15	650	10	25	10	55	35	10	35
41	Bielenberg Dr & Tamarack Hills	150	370	70	15	695	30	25	10	160	160	10	25
42	Bielenberg Dr & Tamarack Rd	235	230	595	100	275	640	315	1230	450	345	750	45
43	Bielenberg Dr & Nature Path	20	1020	15	15	1025	30	35	0	25	5	--	5
44	Bielenberg Dr & Guider Dr	35	805	--	--	570	485	250	--	35	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

2040 Build AM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
	Alignment A1												
1	Sibley St & Kellogg Blvd	550	410	125	--	--	--	100	230	--	--	760	65
2	Sibley St & 4th St	55	515	--	--	--	--	--	--	--	--	55	10
3	Sibley St & 5th St	--	475	55	--	--	--	70	200	--	--	--	--
4	5th St & Market St	--	195	185	5	30	--	30	735	75	--	--	--
5	5th St & St. Peter St	--	--	--	255	185	--	--	760	160	--	--	--
6	Kellogg Blvd & Wacouta St	--	--	--	55	--	50	--	350	--	--	675	20
	Alignment A2												
7	Kellogg Blvd & Broadway St	10	20	30	35	30	10	20	225	30	20	700	70
	Alignment B												
8	Kellogg Blvd & Mounds Blvd	770	870	30	80	205	130	135	115	35	20	410	290
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	170	--	--	265	--	--	--	--	185	1510	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	170	110	210	235	--	--	--	--	--	--	--
11	Earl St & Hudson Road	10	20	15	5	15	10	5	20	5	10	20	5
12	White Bear Ave & Old Hudson Rd	80	655	55	15	605	15	15	25	105	160	60	90
13	White Bear Ave & I-94 Westbound Ramps	105	525	--	--	395	475	--	--	--	105	90	265
14	White Bear Ave & I-94 Eastbound Ramps	--	315	85	185	315	--	315	5	125	--	--	--
15	White Bear Ave & Suburban Ave	10	180	55	150	225	65	65	20	10	190	15	160
	Alignment C												
16	Ruth St & Old Hudson Rd	75	200	25	15	240	15	10	20	35	160	220	80
17	Ruth St & I-94 Westbound On-Ramp	150	300	--	--	185	250	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	340	--	--	185	--	105	--	95	--	--	--
19	Pedersen St & Old Hudson Rd	--	--	--	30	--	25	30	90	--	--	105	90
20	McKnight Rd & 1st St	--	900	30	100	665	--	--	--	--	0	--	10
21	McKnight Rd & Hudson Service Rd	--	895	715	--	600	65	35	--	55	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	230	1480	--	--	385	270	--	--	--	55	100	130
23	McKnight Rd & Burns Ave	40	625	60	130	345	50	55	50	35	10	10	15
24	Hudson Rd & 4th St	--	--	--	--	--	X	--	--	--	--	285	55
25	Hudson Rd & 8th St	--	--	--	--	--	25	--	--	--	--	315	490
26	Hudson Rd & 19th St	--	--	--	--	--	35	--	--	--	--	715	570
27	Century Ave & Hudson Rd / Hudson Blvd	--	1395	165	15	530	--	--	--	--	--	--	125
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	480	820	--	--	315	215	--	--	--	100	540	740
29	Century Ave & I-94 Eastbound Ramps	--	1085	85	115	300	--	215	0	185	--	--	--
30	4th St & Hadley Ave	10	125	155	345	65	20	35	35	10	160	30	190
31	4th & Hale Ave	50	0	50	20	0	10	35	450	50	50	320	95
	Alignment D3												
32	4th St & Hudson Blvd / Hayward Ave	20	10	10	10	20	20	60	310	150	60	425	30
33	Eastbound 4th St & BRT Guideway	--	--	--	--	--	--	--	330	--	--	515	--
34	4th St & Helmo Ave	80	125	140	65	275	55	10	165	155	335	380	125
35	3rd St & Helmo Ave	--	315	55	120	645	--	--	--	--	75	--	30
36	Helmo Ave & Hudson Blvd / 2nd St	0	345	55	20	650	50	5	0	25	75	0	20
37	Bielenberg Dr & Hudson Rd	--	225	75	270	410	--	--	--	--	155	--	150
38	Bielenberg Dr & Hartford North Driveway	25	300	10	10	495	60	0	0	0	0	0	0
39	Bielenberg Dr & Hartford South Driveway	315	335	10	10	475	10	0	0	10	10	0	0
40	Bielenberg Dr & Tamarack Hills North	35	640	35	30	435	30	10	0	10	10	0	10
41	Bielenberg Dr & Tamarack Hills	105	690	140	15	425	15	10	10	55	20	10	10
42	Bielenberg Dr & Tamarack Rd	265	260	145	65	220	215	580	390	195	165	660	95
43	Bielenberg Dr & Nature Path	25	635	0	10	530	40	25	0	15	5	--	10
44	Bielenberg Dr & Guider Dr	125	540	--	--	375	175	120	--	35	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

2040 Build PM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
	Alignment A1												
1	Sibley St & Kellogg Blvd	195	225	230	--	--	--	170	870	--	--	470	15
2	Sibley St & 4th St	65	350	--	--	--	--	--	--	--	--	25	20
3	Sibley St & 5th St	--	245	125	--	--	--	110	645	--	--	--	--
4	5th St & Market St	--	105	75	5	30	--	35	550	35	--	--	--
5	5th St & St. Peter St	--	--	--	170	400	--	--	460	170	--	--	--
6	Kellogg Blvd & Wacouta St	--	--	--	75	--	70	--	1065	--	--	415	15
	Alignment A2												
7	Kellogg Blvd & Broadway St	20	25	20	45	15	15	45	450	15	15	410	20
	Alignment B												
8	Kellogg Blvd & Mounds Blvd	55	355	180	215	855	55	140	330	585	35	195	190
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	150	--	--	1465	--	--	--	--	105	435	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	150	165	1020	545	--	--	--	--	--	--	--
11	Earl St & Hudson Road	30	65	10	15	70	20	30	35	45	20	30	10
12	White Bear Ave & Old Hudson Rd	125	895	75	65	805	10	55	40	150	105	45	55
13	White Bear Ave & I-94 Westbound Ramps	160	880	--	--	630	425	--	--	--	105	5	210
14	White Bear Ave & I-94 Eastbound Ramps	--	500	130	265	475	--	540	5	290	--	--	--
15	White Bear Ave & Suburban Ave	15	160	130	315	235	210	185	105	35	125	45	290
	Alignment C												
16	Ruth St & Old Hudson Rd	25	395	235	55	265	20	25	105	55	290	70	10
17	Ruth St & I-94 Westbound On-Ramp	105	655	--	--	315	290	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	425	--	--	315	--	335	--	190	--	--	--
19	Pedersen St & Old Hudson Rd	--	--	--	100	--	50	60	300	--	--	370	65
20	McKnight Rd & 1st St	--	815	10	10	1360	--	--	--	--	10	--	0
21	McKnight Rd & Hudson Service Rd	--	740	30	--	1200	170	85	--	235	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	220	650	--	--	860	575	--	--	--	220	260	120
23	McKnight Rd & Burns Ave	50	445	55	425	720	120	70	85	75	10	10	20
24	Hudson Rd & 4th St	--	--	--	--	--	X	--	--	--	--	600	10
25	Hudson Rd & 8th St	--	--	--	--	--	195	--	--	--	--	415	25
26	Hudson Rd & 19th St	--	--	--	--	--	465	--	--	--	--	420	25
27	Century Ave & Hudson Rd / Hudson Blvd	--	620	220	90	2165	--	--	--	--	--	--	130
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	155	725	--	--	1915	250	--	--	--	115	30	115
29	Century Ave & I-94 Eastbound Ramps	--	445	150	1190	840	--	435	0	315	--	--	--
30	4th St & Hadley Ave	10	295	210	240	95	35	20	30	10	150	35	450
31	4th & Hale Ave	50	0	50	95	0	30	10	420	50	50	555	20
	Alignment D3												
32	4th St & Hudson Blvd / Hayward Ave	95	20	90	45	10	55	35	510	20	20	475	30
33	Eastbound 4th St & BRT Guideway	--	--	--	--	--	--	--	645	--	--	525	--
34	4th St & Helmo Ave	125	255	270	130	190	35	80	380	185	130	365	155
35	3rd St & Helmo Ave	0	560	85	30	475	0	--	--	--	50	0	90
36	Helmo Ave & Hudson Blvd / 2nd St	0	510	55	0	455	90	195	0	10	20	0	50
37	Bielenberg Dr & Hudson Rd	--	390	265	195	290	--	--	--	--	340	--	175
38	Bielenberg Dr & Hartford North Driveway	15	610	0	10	605	15	35	0	20	10	0	10
39	Bielenberg Dr & Hartford South Driveway	15	600	10	10	625	0	15	0	290	10	0	10
40	Bielenberg Dr & Tamarack Hills North	15	565	10	15	900	10	25	10	55	35	10	35
41	Bielenberg Dr & Tamarack Hills	150	540	70	15	945	30	25	10	160	160	10	25
42	Bielenberg Dr & Tamarack Rd	235	325	605	150	415	700	355	1190	450	345	690	80
43	Bielenberg Dr & Nature Path	20	1125	15	15	1165	30	35	0	25	5	--	5
44	Bielenberg Dr & Guider Dr	50	900	--	--	710	485	260	--	110	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

METRO Gold Line

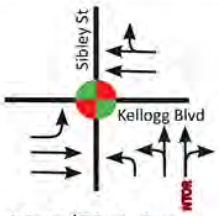
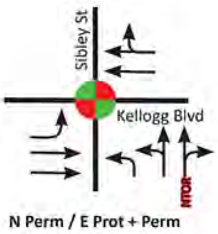
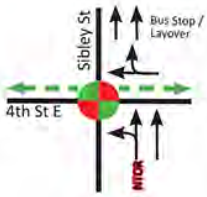
BUS RAPID TRANSIT PROJECT ENVIRONMENTAL ASSESSMENT

Appendix A: Environmental Assessment Technical Reports

Attachment A-3-2:
Intersection Geometrics and Control

May 2019

Gold Line BRT Intersection Layout Table

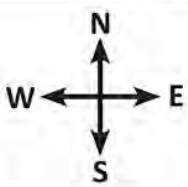
Intersection	Existing	No Build	Build	Notes
Sibley St / Kellogg Blvd	 N Perm / E Prot + Perm	 N Perm / E Prot + Perm	 N Perm / E Prot + Perm	Alignment A1
Sibley St / 4th St	 N Perm	 N Perm	 N Perm	Alignment A1. Buses stop in right lane on Sibley St.
Sibley St / 5th St	 E Perm	 E Perm	 E Perm	Alignment A1. *Bus only lane
5th St / Market St	 N-S Perm / E Perm	 N-S Perm / E Perm	 N-S Perm / E Perm	Alignment A1. Buses stop in right lane on 5th St.
5th St / St. Peter St	 S Perm	 S Perm	 S Perm	Alignment A1

Legend

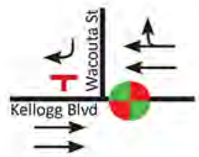
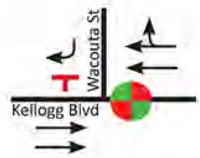
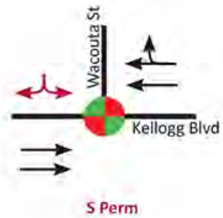
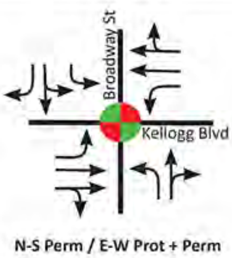
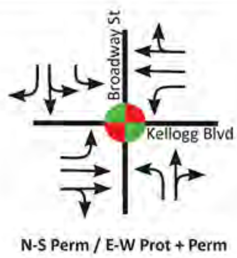
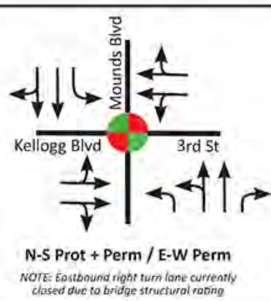
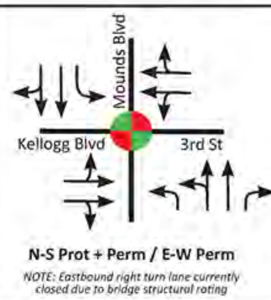
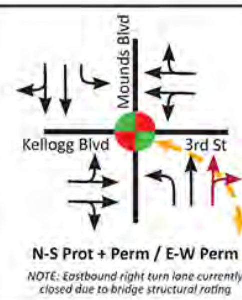
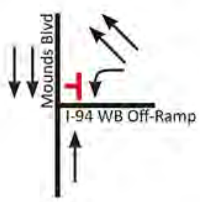
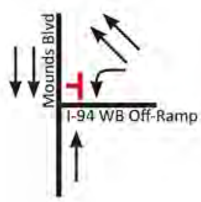
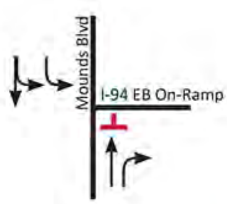
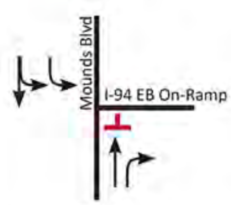
Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase



Gold Line BRT Intersection Layout Table

<table>
<tr><th>Intersection</th><th>Existing</th><th>No Build</th><th>Build</th><th>Notes</th></tr>
<tr><td>Kellogg Blvd / Wacouta St</td><td>  </td><td>  </td><td>  </td><td>Alignment A1</td></tr>
<tr><td>Kellogg Blvd / Broadway St</td><td>  </td><td>  </td><td>  </td><td>Alignment A2</td></tr>
<tr><td>Kellogg Blvd / Mounds Blvd</td><td>  </td><td>  </td><td>  </td><td>WB BRT operates on exclusive phase. EB BRT operates in mixed traffic with the EB TH and RT movements.</td></tr>
<tr><td>Mounds Blvd / I-94 Westbound Off-Ramp</td><td>  </td><td>  </td><td>  </td><td>Pedestrian crossing of Mounds Blvd added in Build Alternatives 1 and 2</td></tr>
<tr><td>Mounds Blvd / I-94 Eastbound On-Ramp</td><td>  </td><td>  </td><td>  </td><td></td></tr>
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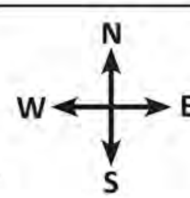
Legend

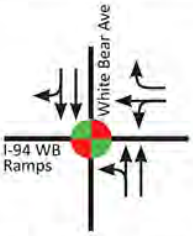
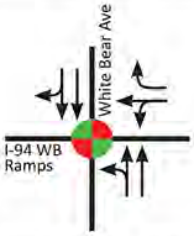
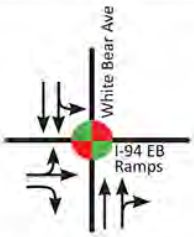
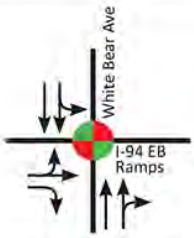
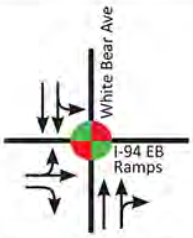
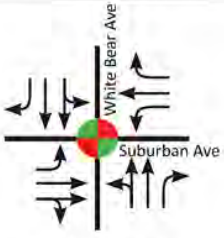
Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

Lane Use
Lane Use Change
No Turn on Red NTOR
BRT Guideway
LRT

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase



Gold Line BRT Intersection Layout Table

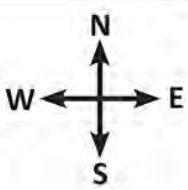
Intersection	Existing	No Build	Build	Notes
Earl St / Hudson Rd				
White Bear Ave / Old Hudson Rd	 N-S Prot + Perm / E-W Perm	 N-S Prot + Perm / E-W Perm	 N-S Prot + Perm / E-W Perm	
White Bear Ave / I-94 Westbound Ramps	 N Prot + Perm / W Perm	 N Prot + Perm / W Perm	 N Prot + Perm / W Perm	BRT grade-separated
White Bear Ave / I-94 Eastbound Ramps	 S Prot + Perm / E Perm	 S Prot + Perm / E Perm	 S Prot + Perm / E Perm	
White Bear Ave / Suburban Ave	 N Perm / S Prot + Perm / E Prot + Perm / W Perm	 N Perm / S Prot + Perm / E Prot + Perm / W Perm	 N Perm / S Prot + Perm / E Prot + Perm / W Perm	

Legend

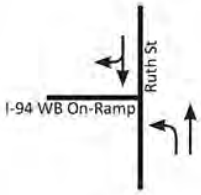
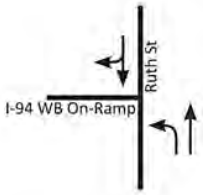
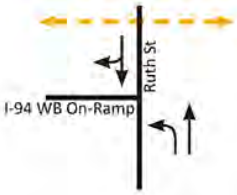
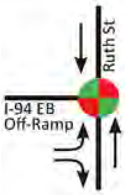
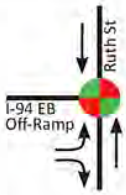
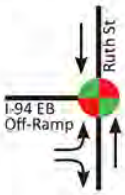
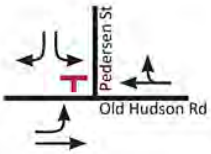
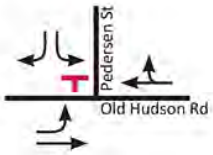
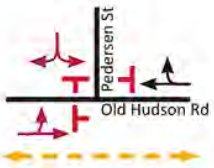
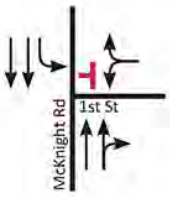
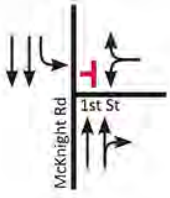
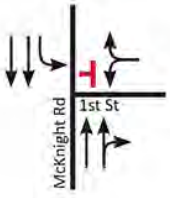
- Traffic Signal
- Stop Control
- N = NB Approach
- S = SB Approach
- E = EB Approach
- W = WB Approach

- Lane Use
- Lane Use Change
- No Turn on Red
- BRT Guideway
- LRT

- Perm = Permissive Left-Turn Phase
- Prot = Protected Left-Turn Phase
- Prot+Perm = Protected/ Permissive Left-Turn Phase



Gold Line BRT Intersection Layout Table

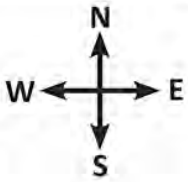
Intersection	Existing	No Build	Build	Notes
Ruth St / Old Hudson Rd	 N-S Perm / E Prot + Perm / W Perm	 N-S Perm / E Prot + Perm / W Perm	 N-S Perm / E Prot + Perm / W Perm	
Ruth St / I-94 Westbound On-Ramp				BRT is grade-separated
Ruth St / I-94 Eastbound Off-Ramp	 E Perm	 E Perm	 E Perm	
Pedersen St / Old Hudson Rd				
McKnight Rd / 1st St				

Legend

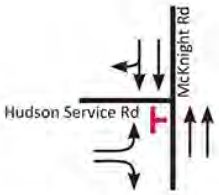
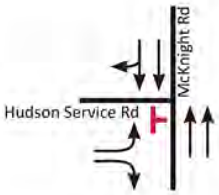
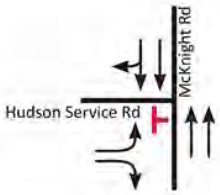
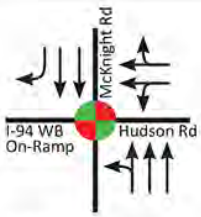
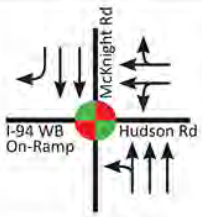
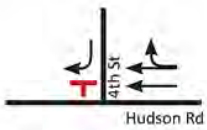
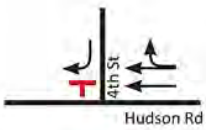
Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase



Gold Line BRT Intersection Layout Table

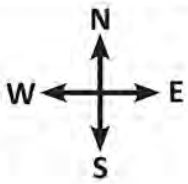
Intersection	Existing	No Build	Build	Notes
McKnight Rd / Hudson Service Rd				
McKnight Rd / Hudson Rd / I-94 Westbound On-Ramp	 N Prot + Perm / W Perm	 N Prot + Perm / W Perm	 N Prot + Perm / W Perm	BRT is grade-separated
McKnight Rd / Burns Ave	 N-S Prot + Perm / E-W Perm	 N-S Prot + Perm / E-W Perm	 N-S Prot + Perm / E-W Perm	
Hudson Rd / 4th St				Partial signal installed and southbound right-turn restricted in Build Alternatives 1 and 2
Hudson Rd / 8th St				Partial signal installed in Build Alternatives 1 and 2

Legend

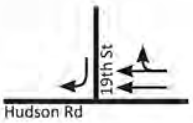
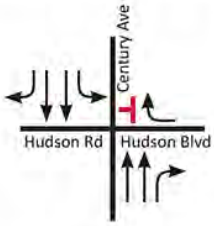
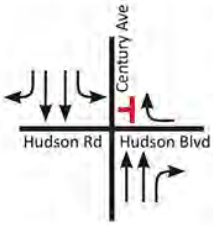
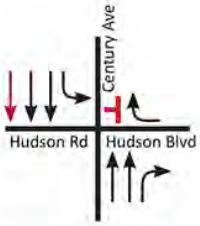
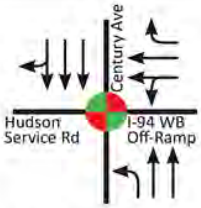
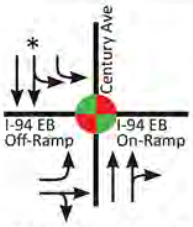
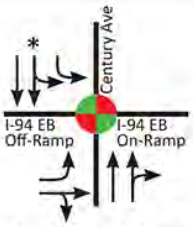
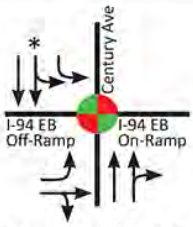
Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase



Gold Line BRT Intersection Layout Table

Intersection	Existing	No Build	Build	Notes
Hudson Rd / 19th St				Partial signal installed in Build Alternatives 1 and 2
Century Ave / Hudson Rd / Hudson Blvd				
Century Ave / Hudson Service Rd / I-94 Westbound Off-Ramp	 N Prot + Perm / W Perm	 N Prot + Perm / W Perm	 N Prot + Perm / W Perm	BRT grade-separated
Century Ave / I-94 Eastbound Ramps	 S Prot + Perm / W Perm	 S Prot + Perm / W Perm	 S Prot + Perm / W Perm	*Dynamic Lane Use AM - Thru PM - Shared Left/Thru
4th St / Hadley Ave		 N Perm / S Prot + Perm / E-W Perm	 N-S Prot + Perm / E Prot + Perm / W Perm	

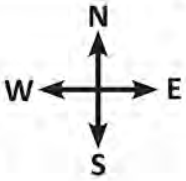
Legend

Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

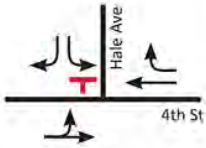
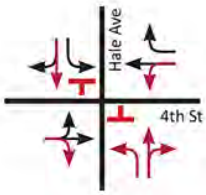
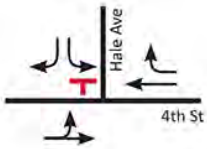
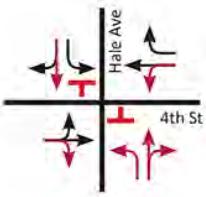
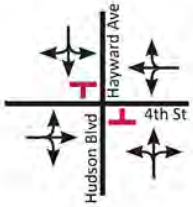
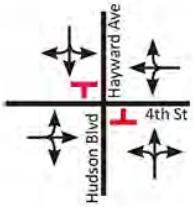
Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

NTOR

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase



Gold Line BRT Intersection Layout Table

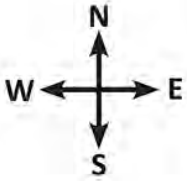
Intersection	Existing	No Build	Build	Notes
4th St / Hadley Ave (Dedicated Guideway Option)		 N Perm / S Prot + Perm / E-W Perm	 N-S Prot + Perm / E-W Perm	In No Build Alternative, traffic signal is triggered by development. In Build Alternatives 1 and 2, traffic signal is constructed with the Project. WB BRT operates on exclusive phase in Build Alternatives 1 and 2.
4th St / Hale Ave				
4th St / Hale Ave (Dedicated Guideway Option)			 N-S Prot + Perm / E-W Prot	
4th St / Hudson Blvd / Hayward Ave			 N-S Prot + Perm / E-W Prot	Center-running BRT guideway

Legend

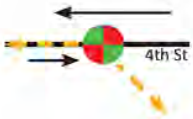
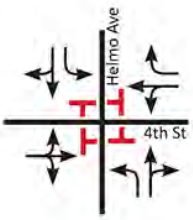
Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase



Gold Line BRT Intersection Layout Table

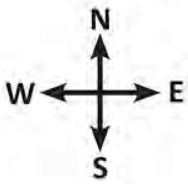
Intersection	Existing	No Build	Build	Notes
Eastbound 4th St / BRT Guideway	N / A	N / A		
4th St / Helmo Ave		 N Perm / S Prot + Perm / E-W Prot + Perm	 N-S Prot + Perm / E-W Prot + Perm	In No Build Alternative, traffic signal is triggered by development. In Build Alternatives 1 and 2, traffic signal is constructed with the Project.
3rd St / Helmo Ave				
Helmo Ave / Hudson Blvd / 2nd St	N / A	N / A	 N-S Prot / E Perm / W Prot	

Legend

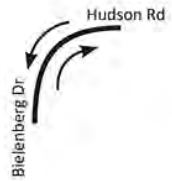
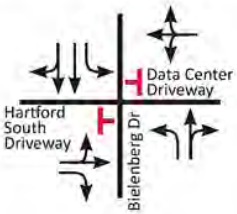
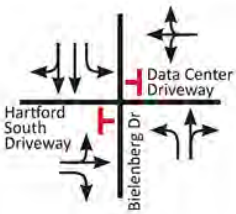
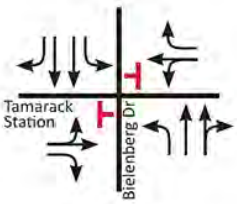
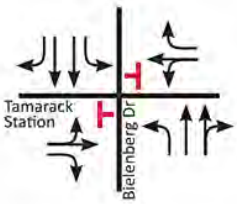
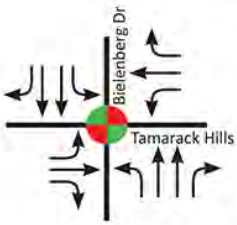
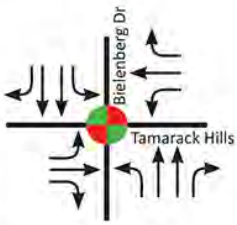
Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase



Gold Line BRT Intersection Layout Table

Intersection	Existing	No Build	Build	Notes
Bielenberg Dr / Hudson Rd			 S Prot / W Perm	Center-running BRT guideway
Bielenberg Dr / Hartford North Driveway			 N-S Prot / E-W Perm	Center-running BRT guideway
Bielenberg Dr / Hartford South Driveway			 N-S Prot / E-W Perm	Center-running BRT guideway
Bielenberg Dr / Tamarack Station			 N-S Prot / E-W Perm	Center-running BRT guideway
Bielenberg Dr / Tamarack Hills	 N-S Prot + Perm / E-W Perm	 N-S Prot + Perm / E-W Perm	 N-S Prot / E-W Perm	Center-running BRT guideway

Legend

Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

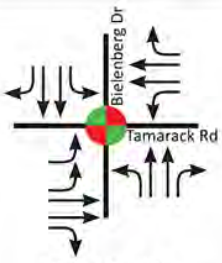
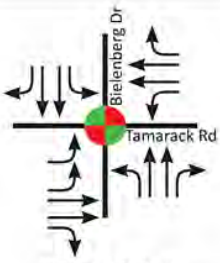
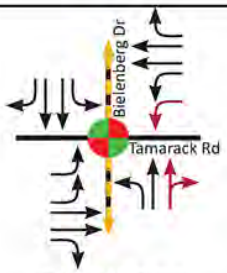
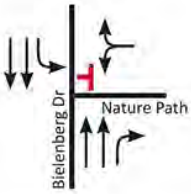
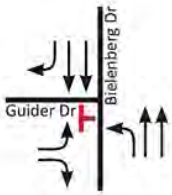
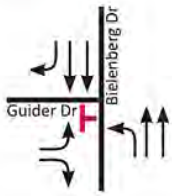
Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

NTOR

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase

N
W E
S

Gold Line BRT Intersection Layout Table

Intersection	Existing	No Build	Build	Notes
Bielenberg Dr / Tamarack Rd	 N-S Prot / E-W Prot	 N-S Prot / E-W Prot	 N-S Prot / E-W Prot	Center-running BRT guideway
Bielenberg Dr / Nature Path		 N-S Prot / E-W Perm	 N-S Prot / E-W Perm	In No Build Alternative, traffic signal is triggered by development. In Build Alternative, traffic signal is constructed with the Project.
Bielenberg Dr / Guider Dr			 N Prot / E Prot	

Legend

Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

NTOR

Perm = Permissive Left-Turn Phase
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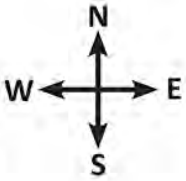


METRO Gold Line

BUS RAPID TRANSIT PROJECT ENVIRONMENTAL ASSESSMENT

Appendix A: Environmental Assessment Technical Reports

Attachment A-3-3:
Intersection Delay and Level of Service

May 2019

AM Level of Service and Intersection Delay

Scenario			2018			2040					
			Existing Conditions			No Build			Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
Alignment A1											
1	Sibley St & Kellogg Blvd	EB	B	C	23.8	B	C	23.9	B	C	24.0
		WB	C			C			C		
		NB	C			C			C		
		SB	--			--			--		
2	Sibley St & 4th St	EB	--	B	10.6	--	B	10.8	--	B	12.3
		WB	B			B			B		
		NB	B			B			B		
		SB	--			--			--		
3	Sibley St & 5th St	EB	B	A	7.7	B	A	7.9	B	B	12.1
		WB	--			--			--		
		NB	A			A			B		
		SB	--			--			--		
4	5th St & Market St	EB	C	B	17.9	C	B	18.1	C	B	18.9
		WB	--			--			--		
		NB	A			A			A		
		SB	B			B			B		
5	5th St & St. Peter St	EB	A	A	8.7	A	A	8.7	A	A	8.7
		WB	--			--			--		
		NB	--			--			--		
		SB	C			C			C		
6	Kellogg Blvd & Wacouta St [a]	EB	A	A	1.3	A	A	1.4	A	A	5.1
		WB	A			A			A		
		NB	--			--			--		
		SB	A			A			A		
Alignment A2											
7	Kellogg Blvd & Broadway St [a]	EB	A	B	11.6	A	B	12.3	B	B	12.0
		WB	B			B			B		
		NB	A			B			B		
		SB	B			B			B		
Alignment B											
8	Kellogg Blvd & Mounds Blvd	EB	C	C	24.5	C	C	24.9	D	C	30.1
		WB	B			B			B		
		NB	C			C			C		
		SB	C			C			C		
9	Mounds Blvd & I-94 Westbound Off-Ramp	EB	--	A	1.9	--	A	2.1	--	C	24.3
		WB	A			A			C		
		NB	A			A			D		
		SB	A			A			C		
10	Mounds Blvd & I-94 Eastbound On-Ramp	EB	--	A	4.7	--	A	4.9	--	A	5.1
		WB	--			--			--		
		NB	B			B			B		
		SB	A			A			A		
11	Earl St & Hudson Road	EB	A	A	6.5	A	A	6.8	--	B	13.3
		WB	A			A			B		
		NB	A			A			A		
		SB	A			A			B		

AM Level of Service and Intersection Delay

Scenario			2018			2040					
			Existing Conditions			No Build			Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
12	White Bear Ave & Old Hudson Rd [a]	EB	B	B	13.2	B	B	13.7	B	B	13.5
		WB	C			C			C		
		NB	A			A			A		
		SB	A			B			B		
13	White Bear Ave & I-94 Westbound Ramps [a]	EB	--	A	9.7	--	B	10.4	--	B	10.5
		WB	B			B			B		
		NB	A			A			A		
		SB	A			A			A		
14	White Bear Ave & I-94 Eastbound Ramps [a]	EB	C	B	16.2	C	B	16.3	C	B	16.7
		WB	--			--			--		
		NB	A			A			A		
		SB	B			B			B		
15	White Bear Ave & Suburban Ave [a]	EB	B	B	14.4	B	B	14.7	B	B	14.6
		WB	C			B			C		
		NB	A			A			A		
		SB	B			B			B		
Alignment C											
16	Ruth St & Old Hudson Rd [a]	EB	B	B	12.8	B	B	13.4	B	B	13.0
		WB	B			B			B		
		NB	B			B			B		
		SB	B			B			B		
17	Ruth St & I-94 Westbound On-Ramp [a]	EB	--	A	2.8	--	A	3.0	--	A	2.5
		WB	--			--			--		
		NB	A			A			A		
		SB	A			A			A		
18	Ruth St & I-94 Eastbound Off-Ramp [a]	EB	B	A	7.3	B	A	7.4	B	A	7.5
		WB	--			--			--		
		NB	A			A			A		
		SB	A			A			A		
19	Pedersen St & Old Hudson Rd [a]	EB	A	A	1.0	A	A	1.1	A	A	5.8
		WB	A			A			A		
		NB	-			-			-		
		SB	A			A			A		
20	McKnight Rd & 1st St [a]	EB	-	A	2.4	-	A	2.4	-	A	2.9
		WB	A			A			A		
		NB	A			A			A		
		SB	A			A			A		
21	McKnight Rd & Hudson Service Rd [a]	EB	A	A	1.6	B	A	1.8	B	A	2.3
		WB	-			-			-		
		NB	A			A			A		
		SB	A			A			A		
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp [a]	EB	-	A	7.7	-	B	10.3	-	B	12.7
		WB	C			C			C		
		NB	A			A			A		
		SB	A			B			B		
23	McKnight Rd & Burns Ave [a]	EB	C	A	9.0	C	A	9.3	C	B	10.4
		WB	B			C			B		
		NB	A			A			A		
		SB	A			A			A		

AM Level of Service and Intersection Delay

Scenario			2018			2040					
			Existing Conditions			No Build			Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
24	Hudson Rd & 4th St	EB	-	A	0.3	-	A	0.4	-	A	0.7
		WB	A			A			A		
		NB	-			-			-		
		SB	A			A			-		
25	Hudson Rd & 8th St	EB	-	A	0.9	-	A	1.0	-	A	4.6
		WB	A			A			A		
		NB	-			-			-		
		SB	A			A			A		
26	Hudson Rd & 19th St	EB	-	A	0.8	-	A	1.0	-	A	3.4
		WB	A			A			A		
		NB	A			A			A		
		SB	A			A			A		
27	Century Ave & Hudson Rd / Hudson Blvd [a]	EB	-	A	2.8	-	A	3.2	-	A	3.7
		WB	A			B			B		
		NB	A			A			A		
		SB	A			A			A		
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp [a]	EB	-	C	27.7	-	C	26.0	-	C	26.4
		WB	B			C			C		
		NB	D			C			C		
		SB	C			C			C		
29	Century Ave & I-94 Eastbound Ramps [a]	EB	E	C	21.6	C	B	18.3	C	C	22.6
		WB	-			-			-		
		NB	B			B			C		
		SB	B			B			B		
30A	4th St & Hadley Ave	EB	A	A	4.8	B	B	10.4	C	B	17.5
		WB	A			B			B		
		NB	A			B			C		
		SB	A			A			B		
30B	4th St & Hadley Ave (Dedicated Guideway Option)	EB	A	A	4.8	B	B	10.4	C	B	17.5
		WB	A			B			B		
		NB	A			B			C		
		SB	A			A			B		
31A	4th St & Hale Ave	EB	A	A	0.6	A	A	2.5	A	A	3.6
		WB	A			A			A		
		NB	-			A			A		
		SB	A			A			B		
31B	4th St & Hale Ave (Dedicated Guideway Option)	EB	A	A	0.6	A	A	2.5	B	B	12.2
		WB	A			A			B		
		NB	-			A			A		
		SB	A			A			B		
Alignment D3											
32A	4th St & Hudson Blvd / Hayward Ave	EB	A	A	2.1	A	A	5.7	B	B	12.1
		WB	A			A			B		
		NB	A			B			C		
		SB	A			C			B		
32B	4th St & Hudson Blvd / Hayward Ave (Dedicated Guideway Option)	EB	A	A	2.1	A	A	5.7	B	B	13.1
		WB	A			A			B		
		NB	A			B			C		
		SB	A			C			B		

AM Level of Service and Intersection Delay

Scenario			2018			2040					
			Existing Conditions			No Build			Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
33A	Eastbound 4th St & BRT Guideway	EB							A		
		WB							-		
		NB							-	A	2.6
		SB							-		
33B	Eastbound 4th St & BRT Guideway (Dedicated Guideway Option)	EB							A		
		WB							-		
		NB							-	A	2.5
		SB							-		
34A	4th St & Helmo Ave	EB	B			A			C		
		WB	C			A			B		
		NB	A	B	13.4	B	A	8.6	B	C	24.8
		SB	A			B			D		
34B	4th St & Helmo Ave (Dedicated Guideway Option)	EB	B			A			D		
		WB	C			A			B		
		NB	A	B	13.4	B	A	8.6	B	C	25.5
		SB	A			B			D		
35A	3rd St & Helmo Ave	EB	-			-			A		
		WB	A			A			C		
		NB	A	A	0.6	A	A	0.7	A	A	3.8
		SB	A			A			A		
35B	3rd St & Helmo Ave (Dedicated Guideway Option)	EB	-			-			A		
		WB	A			A			B		
		NB	A	A	0.6	A	A	0.7	A	A	3.2
		SB	A			A			A		
36A	Helmo Ave & Hudson Blvd / 2nd St	EB							D		
		WB							D		
		NB							B	B	16.2
		SB							B		
36B	Helmo Ave & Hudson Blvd / 2nd St (Dedicated Guideway Option)	EB							D		
		WB							D		
		NB							B	B	15.7
		SB							B		
37	Bielenberg Dr & Hudson Rd [a]	EB							-		
		WB							C		
		NB							B	B	16.7
		SB							B		
38	Bielenberg Dr & Hartford North Driveway [a]	EB	A			A			A		
		WB	A			A			A		
		NB	A	A	0.6	A	A	0.7	A	A	3.1
		SB	A			A			A		
39	Bielenberg Dr & Hartford South Driveway [a]	EB	A			A			A		
		WB	B			C			D		
		NB	A	A	2.5	A	A	3.1	B	B	12.7
		SB	A			A			A		
40	Bielenberg Dr & Tamarack Hills North [a]	EB	A			A			B		
		WB	A			A			B		
		NB	A	A	2.1	A	A	2.7	B	B	14.5
		SB	A			A			A		

AM Level of Service and Intersection Delay

Scenario			2018			2040					
			Existing Conditions			No Build			Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
41	Bielenberg Dr & Tamarack Hills [a]	EB	A	A	4.8	A	A	5.8	B	B	16.7
		WB	B			B			D		
		NB	A			A			B		
		SB	A			A			B		
42	Bielenberg Dr & Tamarack Rd [a]	EB	C	C	26.1	D	D	38.1	D	D	37.5
		WB	C			D			D		
		NB	C			C			C		
		SB	B			C			C		
43	Bielenberg Dr & Nature Path [a]	EB	-	A	1.1	B	A	3.5	C	A	7.4
		WB	A			A			B		
		NB	A			A			A		
		SB	A			A			A		
44	Bielenberg Dr & Guider Dr [a]	EB	A	A	2.5	B	A	3.6	C	B	11.5
		WB	-			-			-		
		NB	A			A			B		
		SB	A			A			A		

[a] *Indicates intersection was modeled in Synchro/SimTraffic. All other intersections were modeled in VISSIM.*

X'd out box indicates an intersection was eliminated or did not yet exist

PM Level of Service and Intersection Delay

Scenario			2018			2040					
			Existing Conditions			No Build			Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
Alignment A1											
1	Sibley St & Kellogg Blvd	EB	A	B	17.4	A	B	17.6	A	B	17.7
		WB	B			B			B		
		NB	D			D			D		
		SB	--			--			--		
2	Sibley St & 4th St	EB	--	B	10.7	--	B	10.9	--	B	12.7
		WB	B			B			B		
		NB	B			B			B		
		SB	--			--			--		
3	Sibley St & 5th St	EB	A	A	8.7	A	A	8.9	B	B	12.9
		WB	--			--			--		
		NB	A			A			C		
		SB	--			--			--		
4	5th St & Market St	EB	C	C	25.5	C	C	25.7	C	C	27.5
		WB	--			--			--		
		NB	A			A			A		
		SB	B			B			B		
5	5th St & St. Peter St	EB	A	A	9.4	A	A	9.4	A	A	9.4
		WB	--			--			--		
		NB	--			--			--		
		SB	B			B			B		
6	Kellogg Blvd & Wacouta St [a]	EB	A	A	2.9	A	A	3.0	A	A	6.8
		WB	A			A			A		
		NB	--			--			A		
		SB	A			A			B		
Alignment A2											
7	Kellogg Blvd & Broadway St [a]	EB	B	B	11.0	B	B	11.1	B	B	11.5
		WB	B			B			B		
		NB	B			B			B		
		SB	B			B			B		
Alignment B											
8	Kellogg Blvd & Mounds Blvd	EB	B	C	20.8	B	C	21.1	C	C	29.9
		WB	B			B			B		
		NB	C			C			C		
		SB	C			C			C		
9	Mounds Blvd & I-94 Westbound Off-Ramp	EB	--	A	1.5	--	A	1.6	--	B	16.5
		WB	A			A			B		
		NB	A			A			B		
		SB	A			A			B		
10	Mounds Blvd & I-94 Eastbound On-Ramp	EB	--	A	8.3	--	A	8.6	--	A	7.5
		WB	--			--			--		
		NB	E			E			D		
		SB	A			A			A		
11	Earl St & Hudson Road	EB	A	A	7.5	A	A	7.8	--	B	11.9
		WB	A			A			B		
		NB	A			A			B		
		SB	A			A			A		

PM Level of Service and Intersection Delay

Scenario			2018			2040					
			Existing Conditions			No Build			Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
12	White Bear Ave & Old Hudson Rd [a]	EB	C	B	19.7	D	C	21.1	C	C	20.1
		WB	E			E			E		
		NB	A			A			A		
		SB	B			C			C		
13	White Bear Ave & I-94 Westbound Ramps [a]	EB	--	B	13.8	--	B	14.2	--	B	15.2
		WB	B			B			B		
		NB	B			B			B		
		SB	B			B			B		
14	White Bear Ave & I-94 Eastbound Ramps [a]	EB	C	C	21.5	C	C	23.9	C	C	24.0
		WB	--			--			--		
		NB	C			C			C		
		SB	B			B			C		
15	White Bear Ave & Suburban Ave [a]	EB	C	B	15.5	C	B	15.6	C	B	15.9
		WB	B			B			B		
		NB	C			C			C		
		SB	A			A			A		
Alignment C											
16	Ruth St & Old Hudson Rd [a]	EB	D	C	22.8	D	C	25.1	D	C	25.2
		WB	D			D			D		
		NB	A			A			A		
		SB	C			C			C		
17	Ruth St & I-94 Westbound On-Ramp [a]	EB	--	B	10.2	--	B	12.7	--	B	11.2
		WB	--			--			--		
		NB	C			C			C		
		SB	A			A			A		
18	Ruth St & I-94 Eastbound Off-Ramp [a]	EB	B	B	10.7	B	B	13.3	B	B	11.0
		WB	--			--			--		
		NB	B			B			B		
		SB	B			B			B		
19	Pedersen St & Old Hudson Rd [a]	EB	A	A	1.8	A	A	2.0	A	A	9.2
		WB	A			A			B		
		NB	-			-			-		
		SB	A			A			A		
20	McKnight Rd & 1st St [a]	EB	-	A	3.8	-	A	3.6	-	A	3.6
		WB	E			D			D		
		NB	A			A			A		
		SB	A			A			A		
21	McKnight Rd & Hudson Service Rd [a]	EB	E	B	10.9	F	B	14.1	F	C	20.6
		WB	-			-			-		
		NB	A			A			A		
		SB	A			A			A		
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp [a]	EB	-	C	20.7	-	C	20.7	-	C	21.2
		WB	C			D			D		
		NB	B			B			C		
		SB	B			B			B		
23	McKnight Rd & Burns Ave [a]	EB	D	B	15.1	D	B	16.5	D	B	17.1
		WB	B			B			B		
		NB	B			B			B		
		SB	B			B			B		

PM Level of Service and Intersection Delay

Scenario			2018			2040					
			Existing Conditions			No Build			Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
24	Hudson Rd & 4th St	EB	-	A	1.4	-	A	1.3	-	A	0.1
		WB	A			A			A		
		NB	-			-			-		
		SB	A			A			-		
25	Hudson Rd & 8th St	EB	-	A	0.4	-	A	0.4	-	A	1.7
		WB	A			A			A		
		NB	-			-			-		
		SB	A			A			A		
26	Hudson Rd & 19th St	EB	-	A	0.1	-	A	0.1	-	A	3.5
		WB	A			A			A		
		NB	A			A			A		
		SB	A			A			A		
27	Century Ave & Hudson Rd / Hudson Blvd [a]	EB	-	A	8.4	-	B	10.1	-	A	7.3
		WB	A			A			A		
		NB	A			A			A		
		SB	B			B			A		
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp [a]	EB	-	B	13.6	-	B	14.8	-	B	15.0
		WB	C			C			C		
		NB	B			B			B		
		SB	B			B			B		
29	Century Ave & I-94 Eastbound Ramps [a]	EB	D	D	36.8	D	D	41.6	D	D	52.2
		WB	-			-			-		
		NB	D			E			F		
		SB	C			C			D		
30A	4th St & Hadley Ave	EB	A	A	6.6	B	B	12.7	C	D	38.0
		WB	B			B			D		
		NB	A			B			D		
		SB	A			A			B		
30B	4th St & Hadley Ave (Dedicated Guideway Option)	EB	A	A	6.6	B	B	12.7	C	C	25.2
		WB	B			B			C		
		NB	A			B			C		
		SB	A			A			B		
31A	4th St & Hale Ave	EB	A	A	1.2	A	A	2.7	A	A	7.7
		WB	A			A			A		
		NB	-			A			C		
		SB	A			A			C		
31B	4th St & Hale Ave (Dedicated Guideway Option)	EB	A	A	1.2	A	A	2.7	B	B	12.7
		WB	A			A			B		
		NB	-			A			A		
		SB	A			A			B		
Alignment D3											
32A	4th St & Hudson Blvd / Hayward Ave	EB	A	A	3.0	A	A	9.3	B	B	16.2
		WB	A			A			B		
		NB	B			D			C		
		SB	A			C			C		
32B	4th St & Hudson Blvd / Hayward Ave (Dedicated Guideway Option)	EB	A	A	3.0	A	A	9.3	B	B	13.3
		WB	A			A			B		
		NB	B			D			B		
		SB	A			C			B		

PM Level of Service and Intersection Delay

Scenario			2018			2040					
			Existing Conditions			No Build			Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
33A	Eastbound 4th St & BRT Guideway	EB							D	B	19.4
		WB							-		
		NB							-		
		SB							-		
33B	Eastbound 4th St & BRT Guideway (Dedicated Guideway Option)	EB							C	B	16.5
		WB							-		
		NB							-		
		SB							-		
34A	4th St & Helmo Ave	EB	E	C	22.1	B	B	14.5	D	C	28.7
		WB	C			B	C		B		
		NB	B			C	B		C		
		SB	A			B			C		
34B	4th St & Helmo Ave (Dedicated Guideway Option)	EB	E	C	22.1	B	B	14.5	D	C	30.2
		WB	C			B	C		B		
		NB	B			C	B		C		
		SB	A			B			D		
35A	3rd St & Helmo Ave	EB	-	A	2.0	-	A	2.2	A	A	3.9
		WB	A			A	A		C		
		NB	A			A	A		A		
		SB	A			A			A		
35B	3rd St & Helmo Ave (Dedicated Guideway Option)	EB	-	A	2.0	-	A	2.2	A	A	4.2
		WB	A			A	A		B		
		NB	A			A	A		A		
		SB	A			A			A		
36A	Helmo Ave & Hudson Blvd / 2nd St	EB							D	B	16.2
		WB							C		
		NB							B		
		SB							B		
36B	Helmo Ave & Hudson Blvd / 2nd St (Dedicated Guideway Option)	EB							D	B	16.6
		WB							A		
		NB							B		
		SB							C		
37	Bielenberg Dr & Hudson Rd [a]	EB							-	B	14.4
		WB							C		
		NB							A		
		SB							B		
38	Bielenberg Dr & Hartford North Driveway [a]	EB	A	A	1.1	A	A	2.1	C	A	4.6
		WB	A			A	A		B		
		NB	A			A	A		A		
		SB	A			A			A		
39	Bielenberg Dr & Hartford South Driveway [a]	EB	A	A	2.5	A	A	3.1	B	A	7.1
		WB	A			B	A		C		
		NB	A			A	A		A		
		SB	A			A			A		
40	Bielenberg Dr & Tamarack Hills North [a]	EB	E	A	7.9	F	D	34.2	E	C	21.1
		WB	D			F			E		
		NB	A			A			B		
		SB	A			C			B		

PM Level of Service and Intersection Delay

Scenario			2018			2040					
			Existing Conditions			No Build			Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
41	Bielenberg Dr & Tamarack Hills [a]	EB	B	C	27.4	C	E	56.1	C	C	33.8
		WB	C			F			D		
		NB	B			B			B		
		SB	D			F			D		
42	Bielenberg Dr & Tamarack Rd [a]	EB	D	D	51.4	F	F	100+	F	F	100+
		WB	D			F			F		
		NB	D			F			F		
		SB	F			F			F		
43	Bielenberg Dr & Nature Path [a]	EB	-	A	2.0	C	A	7.0	C	B	17.4
		WB	B			A			D		
		NB	A			A			C		
		SB	A			A			B		
44	Bielenberg Dr & Guider Dr [a]	EB	F	A	8.9	F	F	61.9	C	B	11.5
		WB	-			-			-		
		NB	A			A			A		
		SB	A			A			B		

[a] *Indicates intersection was modeled in Synchro/SimTraffic. All other intersections were modeled in VISSIM.*

X'd out box indicates an intersection was eliminated or did not yet exist

METRO Gold Line

BUS RAPID TRANSIT PROJECT ENVIRONMENTAL ASSESSMENT

Appendix A: Environmental Assessment Technical Reports

Attachment A-3-4:
Ridership Forecasts

May 2019

Memorandum

To:	Gold Line BRT Project File
From:	Ridership Forecasting Team
Date:	August 22, 2019
Subject:	Gold Line BRT – STOPS Setup and Ridership Forecasts

This memorandum documents the implementation and application of the Simplified Trips-on-Project Software (STOPS) for the Gold Line BRT (Bus Rapid Transit) Project (Project) being studied by Metro Transit. Metro Transit is the primary public transportation operator in the Minneapolis–Saint Paul region. The Project entered the New Starts Project Development phase of Federal Transit Administration's (FTA) Capital Investment Grant (CIG) program in January 2018.

STOPS is a transit demand forecasting software developed by FTA and is utilized as the primary ridership forecasting tool for the Project. This memorandum also documents the assumptions, the alternatives modeled, and the ridership forecasts prepared for the Project.

The ridership results as well as the modeled operating plans for the Project and the background bus plan presented in this memorandum may change. The Project continues to progress through its design, engineering and funding steps. Feedback from the public and agencies may require changes to the Project's characteristics.

After a brief overview of the Project, this memorandum outlines the input data sources and user-defined parameters required by STOPS. The memorandum then describes the model calibration results by comparing STOPS ridership estimates against the observed data. The calibrated model was applied to forecast trips on Gold Line BRT for the alternatives described in Section 4 of this memorandum. The forecasts presented herein are for the current (2016) and horizon (2040) years. Unless mentioned otherwise, the ridership data in the memorandum reflects an average weekday in September/October.

1 Introduction

The Project's Environmental Assessment (EA) evaluates BRT service in the Twin Cities Metropolitan region between Woodbury and downtown Saint Paul. The planned ten-mile dedicated BRT line will connect the cities of Saint Paul, Maplewood, Landfall, Oakdale and Woodbury generally along Interstate 94 (I-94). Transit service in the Project area today is concentrated in Saint Paul and a few park-and-ride locations along the I-94 corridor. Currently, the study area lacks all-day transit service traveling in both directions, particularly east of Maplewood. I-94 and local roads in the Project area are congested today during peak periods, and traffic volumes and periods of congestion are expected to increase in the future because of the expected population growth in the eastern parts of the corridor in Washington County. The proposed Project will address limited existing transit service, demand for more frequent service throughout the day, and the growing population and employment in the area.

Metro Transit currently operates a variety of transit modes in the Twin Cities region. Apart from local and express buses, a rapid bus[1] (A Line), two Light Rail lines (Green and Blue Lines), and a Commuter Rail line (Northstar) serve the region. Gold Line BRT will be Minnesota's first BRT line in a dedicated lane, fully accessible to bikes, strollers, and wheelchairs.

The study corridor[2] has 303,000 people and 148,000 jobs. The largest employment center within the corridor is downtown Saint Paul (47,000 jobs). Excluding downtown Saint Paul, the corridor has 296,000 people and 101,000 jobs. The eastern parts of the corridor – Woodbury, Oakdale, and eastern Washington County – are suburban and have about 243,000 people. The corridor also has the corporate headquarters of 3M (18,000 jobs) in the city of Maplewood. 3M is a private, multinational company and is one of the largest employers in the region. Further, downtown Minneapolis and University of Minnesota are two major employment and activity centers which lie to the west of downtown Saint Paul.

Based on the 2006-2010 American Community Survey (ACS) worker flows, scaled to the 2016 population and employment levels, the Saint Paul Central Business District (CBD) attracts a total of 125,000 work trips on an average weekday, 35,000 of which are from the corridor. Similarly, the extensive employment and activity centers to the west of downtown Saint Paul attract a total of 651,000 work trips, 53,000 of which are from the corridor. Given the presence of 3M in the eastern part of corridor, the corridor to the east of Saint Paul CBD attracts about 70,000 work trips, 21,000 of which are intra-corridor trips.

The corridor is served by I-94, the east-west freeway immediately adjacent to the Project's alignment. This section of I-94 in the corridor is one of the most heavily used in the state, with demand exceeding 120,000 vehicles per day. The commute from Woodbury to Saint Paul downtown is congested and unreliable with the 9-mile distance taking about 16-30 minutes in the AM peak period.

Forecasts suggest further growth in number of people, jobs, and travel activities in the study corridor by 2040. These expected changes will increase the burden on the existing infrastructure leading to poorer level of service and performance. The population and employment in the study corridor are expected to grow 28% and 27% respectively by 2040. The

[1] Another rapid bus (C Line) opened in June 2019; since it will not impact Gold Line corridor, it was not modeled as part of this effort

[2] The study corridor includes downtown Saint Paul, Maplewood, Oakdale, Woodbury, and eastern Washington County.

population growth rate is higher than the corresponding growth level in the entire region (22%). Specifically, eastern Washington County is expected to see rapid growth, with the population and employment expected to grow 32% and 48% respectively by 2040. No major highway capacity improvements are anticipated to occur in the corridor by 2040, and as a result congestion along I-94 would worsen.

Metro transit offers the following public transportation options in the corridor:

- Two local buses – Route 63 and Route 70, that generally parallel the Project. These east-west routes serve Sun Ray Transit Center and downtown Saint Paul. Route 63 and Route 70 operate at 20- and 30-minute headways respectively throughout the day.
- Two peak-period, peak direction express bus services along I-94 that are destined to downtown Saint Paul. The two express routes provide five to six peak directional trips in each of the AM and PM peak hours.
    - Route 294 Express: Connects Oakdale, Stillwater, and Saint Paul
    - Route 351 Express: Connects Woodbury and Saint Paul
- A limited stop bus, Route 350 which connects locations south of I-94 in the corridor with Sun Ray Transit Center and downtown Saint Paul. Route 350 provides four peak directional trips in each of the AM and PM peak hours.

Figure 1 highlights the existing routes and shows all the new stations that the Project would serve. This memorandum presents ridership forecasts for the following two Build Alternatives:

- **Build Alternative A1-BC-D3:** Would operate between the existing Smith Avenue Transit Center in downtown Saint Paul and a new station near Woodbury Theatre and I-494 in Woodbury. Build Alternative 1 includes 10 platforms (5 stations) in downtown Saint Paul, including two new stations at Union Depot, and 11 stations along the remainder of the alignment.
- **Build Alternative A2-BC-D3:** Would operate between a new station at Union Depot in downtown Saint Paul and a new station near Woodbury Theatre and I-494 in Woodbury. Build Alternative 2 includes 1 station in downtown Saint Paul at the Union Depot bus deck and 11 stations along the remainder of the alignment The alignments for the two Build Alternatives are shown in Figure 2.

Transit service improvements in the corridor are discussed in Section 4.

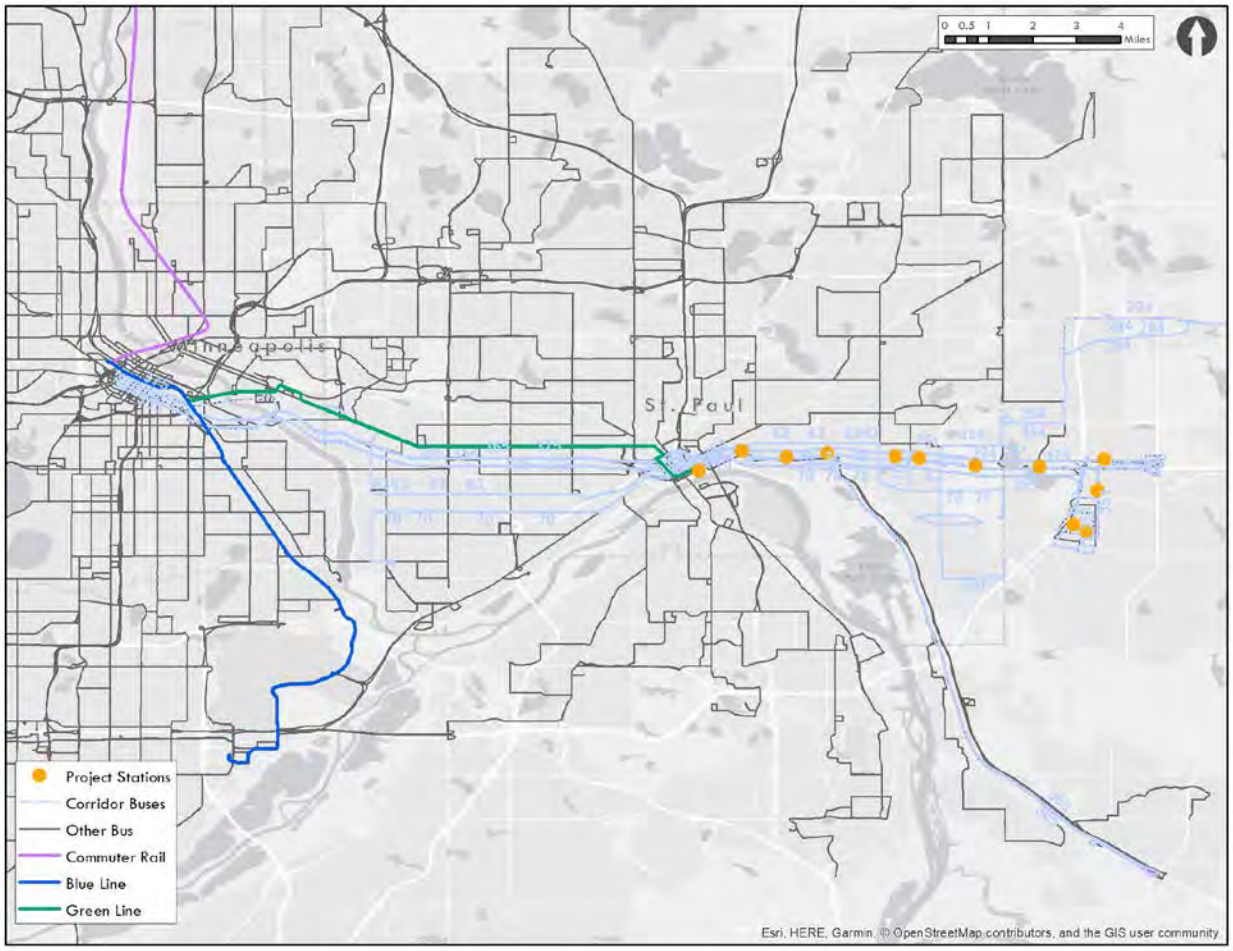


Figure 1. Existing Commuter and Light Rail Lines, Express Service in the Project Area, and Proposed Gold Line BRT Stations in Alternative A2-BC-D3

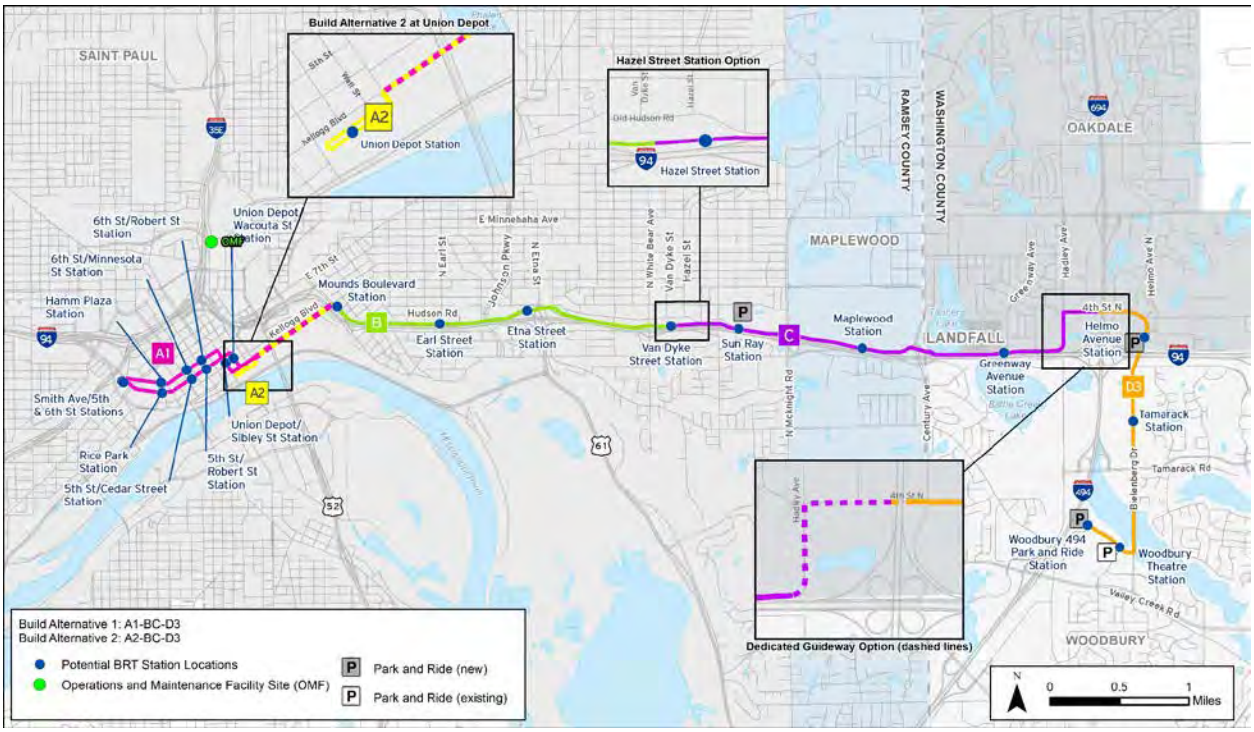


Figure 2. Gold Line BRT Project Alternatives

2 STOPS Inputs and Parameters

STOPS is a simplified implementation of the conventional four-step travel demand model. It is a tool developed by FTA to quantify travel demand measures used to evaluate and rate CIG projects. The Project team is targeting to secure CIG funding and STOPS provides all the necessary ridership information needed to calculate the CIG rating for the Project. STOPS version 2.50 (dated 5/25/2018) is used for this study. Additional information about STOPS can be found at this link (https://www.transit.dot.gov/funding/grant-programs/capital-investments/stops).

2.1 STOPS Set up

The Metropolitan Council (Council) is the regional governmental agency and metropolitan planning organization in Minnesota serving the Twin Cities seven-county metropolitan area. The model's geographical coverage includes all the seven counties (Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington) within the Council's region, four other counties in Minnesota (Chisago, Isanti, Sherburne, and Wright) and two counties (Pierce and St. Croix) in Wisconsin.

STOPS requires a 'current year' against which the model is calibrated. The 'current year' definition in STOPS is the most recent year for which all or most of the input data is available. For this model, the current year represents year 2016. The model also includes a 2040 horizon year for planning applications.

STOPS has three approaches that can be used to develop an application:

- "Synthetic": In this approach, STOPS relies almost entirely on travel patterns from the Census Transportation Planning Package (CTPP) and aggregate ridership information to estimate transit demand.

- "Synthetic with Special Markets": In this approach, STOPS uses the "synthetic" approach with additional distinct travel patterns that are not captured by the CTPP data. Examples of special markets include large airports, universities, or tourist areas.
- "Incremental": The "Incremental" STOPS approach uses data from a transit rider survey as the basis for developing person trips and calibrating STOPS, instead of relying on travel patterns from the CTPP data and aggregate transit trip information.

The Project uses the "Incremental" STOPS approach. The 2016 regional transit on-board survey was used to develop the zone-to-zone transit trip flow data and for calibrating the model. The survey data obtained by the ridership team was already expanded to the average weekday ridership in September/October 2016. The survey records were filtered to include only those records which had information related to auto availability, trip purpose, origin-destination location, and access/egress modes. As a result, 1,500 records out of 30,600 records were purged from the database. After purging, the original survey expansion weights were re-scaled so that the boardings totals by route and access mode are same as the original expansion targets.

Further, bike access/egress trips were assigned to walk and Kiss and Ride (KNR) for use in STOPS based on the access distance. Records with an origin or destination outside the STOPS modeling region were also excluded prior to generating the input trip table to STOPS.

2.2 Existing Ridership Data

The ridership team obtained the most recent available ridership information such as on-board surveys, regional transit boardings, station level boardings and other data from various sources. The following key datasets were used:

- 2016 Systemwide origin-destination (OD) on-board survey,
- 2016 Metropolitan Council Automatic Passenger Count (APC) data,
- 2016 National Transit Database (NTD) Profiles, and
- 2016 Annual Regional Park and Ride Report

STOPS requires the current year regional weekday unlinked transit boardings as an input. For the Minneapolis-Saint Paul region, this target is set to 346,000. Metro Transit is the primary agency in the region constituting approximately 85% of the transit riders. The remainder of the transit ridership is generally suburban agencies. Table 1 show the transit agencies that were utilized in the STOPS model and their total daily boardings.

Table 1. Unlinked Transit Trip Boardings for an Average Weekday in September/October 2016

Agency	Total Daily Boardings	Source / Notes
Metro Transit	293,300	2016 On-Board Survey Expansion
Council Buses	12,000	2016 On-Board Survey Expansion
Minnesota Valley	9,400	2016 On-Board Survey Expansion
Maple Grove	3,500	2016 On-Board Survey Expansion
University of Minnesota	21,700	2016 On-Board Survey Expansion
SouthWest Transit	4,300	2016 On-Board Survey Expansion
Plymouth	1,800	2016 On-Board Survey Expansion
Total	**346,000**	

STOPS users can also provide targets for regional linked transit trips by trip purpose (Home Based Work - HBW, Home Based Other - HBO, and Non-Home Based - NHB) and market segment (i.e., 0-car, 1-car, and 2+car owning households). The ridership team obtained these linked trip targets by utilizing the transit on-board survey. The regional linked transit trip targets are shown in Table 2.

Table 2. Linked Transit Trips by Purpose and Market Segment

Auto Availability	Trip Purpose			*Total*	*Total %*
	HBW	HBO	NHB		
0-car	31,150	49,900	14,800	***95,850***	***35%***
1-car	44,050	29,850	9,100	***83,000***	***30%***
2-car	58,000	24,750	10,550	***93,350***	***34%***
Total	***133,200***	***104,500***	***34,450***	***272,150***	***100%***
Total %	***49%***	***38%***	***13%***	***100%***	

2.3 STOPS Parameters

STOPS v2.50 uses two Fixed Guideway Settings (FGS), denoted as “Partial FGS” and “Full FGS”, that approximate the perceived differentiation between fixed-guideway alternatives and regular bus services. Both FGS settings can vary between 0.0 and 1.0. FGS values near zero imply that the fixed-guideway mode is not perceived by riders to be meaningfully different from traditional bus services beyond headway and travel time characteristics. Larger FGS values imply that riders perceive benefits of fixed-guideway systems beyond headway and travel time.

The Full FGS is generally applied to heavy rail and commuter rail services and is set to 1.0 in the model. In this model, the Full FGS gets applied to the existing light rail (Green and Blue Lines) and commuter rail (Northstar) lines.

The Partial FGS is generally applied to streetcars and BRT systems. In this model, the Partial FGS applies to the Gold Line BRT Project and the existing Red Line. This value is set to 0.70, and is based on the following:

- The FGS is assumed to be based on the capital investments and proposed design of the project, and not its technology per se. In other words, bus- and rail-project with approximately equal service plans, right-of-way, station designs, and traffic signal treatments would receive equivalent FGS values. For example, a hypothetical high-end BRT that operates entirely in exclusive right-of-way and includes signal pre-emption (i.e., essentially a “rubber-tire” train) is equivalent to a fully grade-separated rail line with an FGS of 1.0, assuming other characteristics are identical.
- The Gold Line operates in exclusive right-of-way for 60% of its alignment and the remaining 40% is in mixed traffic and semi-exclusive right-of-way. The Project also includes signal pre-emption. Using an FGS of 1.0 for 60% of the Project’s alignment and an FGS range of 0.15 to 0.35 for the remaining 40% of the alignment, results in a Partial FGS range of 0.66 to 0.74.The average of this range ([0.66+0.74] / 2) – 0.70 is used as the FGS for the Project.

STOPS also allows the user to calibrate transfer penalty which accounts for the general difficulty when transferring between transit routes. This penalty is determined by running the STOPS model and adjusting its value so that the observed linked transit trips generally match the estimated values. The transfer penalty is set to 7 minutes (default value is 5 minutes) for this

model. Additionally, calibration parameters 'KNR Transit' and 'PNR Transit' are also modified. Both parameters scale up/down the Park-and-Ride (PNR) and Kiss-and-Ride (KNR) usage to match on-board surveys or other observed data. For this model, 'KNR Transit' is set to 0.75 (default value is 1.0) and 'PNR Transit' is set to 1.25 (default value is 1.0) to match observed data from existing reports and surveys. The 'Auto Time Factor' was increased from a default of 1.0 to 1.5 based on the spreadsheet calculations to normalize the Metropolitan Planning Organization's (MPO) model travel times to Google online automobile travel time estimates Further, the 'GTFS Connectors' setting was changed from its default value to '04 Walk, PNR, and KNR'. All other STOPS parameters are set to their default values.

2.4 Transit Networks

STOPS requires transit networks for "Existing", "No-Build" and "Build" scenarios. STOPS is calibrated to the "Existing" scenario, whereas the "No-Build" and "Build" scenarios represent transit service that will exist in the future without the Project and when the Project is in operation respectively.

The transit system for the "Existing" scenario is represented by the General Transit Feed Specification (GTFS) data provided by Metro Transit and Minnesota Valley Transit Authority (MVTA). The GTFS files represent the transit service in January 2017 to align with the 'current year' in the STOPS model and the time-period when the transit on-board survey was conducted. Routes that are not surveyed (Route 472-Eagan Blackhawk-Minneapolis, Route 495-Shakopee-Burnsville-Mall, Route 497-Downtown Shakopee-Express, 499-Shakopee-Southbridge-Express, 638-SW Transit - Express – M, 887-Express - St Cloud Link) are not included in the model as no on-board survey data was available for those routes. The Gold Line BRT project corridor ridership will not be meaningfully impacted by these services.

The ridership team updated the stations database in STOPS to incorporate the station identifiers, parking characteristics, and platform characteristics associated with existing and planned stations. Table 3 shows the station attributes specifically for Gold Line BRT.

Table 3. Gold Line BRT Stations/Platforms

Station/Platform Name	Direction (Eastbound [EB]/ Westbound [WB])	County	Within Saint Paul CBD?	Dedicated Park-and-Ride Lot?
Smith Avenue/5th Street (Alignment A1)	EB Only	Ramsey	Yes	No
Smith Avenue/6th Street (Alignment A1)	WB Only	Ramsey	Yes	No
Rice Park (Alignment A1)	EB Only	Ramsey	Yes	No
Hamm Plaza (Alignment A1)	WB Only	Ramsey	Yes	No
5th Street/Cedar Street (Alignment A1)	EB Only	Ramsey	Yes	No
6th Street/Minnesota Street (Alignment A1)	WB Only	Ramsey	Yes	No
5th Street/Robert Street (Alignment A1)	EB Only	Ramsey	Yes	No
6th Street/Robert Street (Alignment A1)	WB Only	Ramsey	Yes	No
Union Depot/Wacouta Street (Alignment A1)	EB Only	Ramsey	Yes	No
Union Depot/Sibley Street (Alignment A1)	WB Only	Ramsey	Yes	No
Union Depot (Alignment A2)	EB and WB	Ramsey	Yes	No
Mounds Boulevard (Alignment B)	EB and WB	Ramsey	No	No
Earl Street (Alignment B)	EB and WB	Ramsey	No	No

Station/Platform Name	Direction (Eastbound [EB]/ Westbound [WB])	County	Within Saint Paul CBD?	Dedicated Park-and-Ride Lot?
Etna Street (Alignment B)	EB and WB	Ramsey	No	No
Van Dyke Street/Hazel Street (Alignment C)	EB and WB	Ramsey	No	No
Sun Ray (Alignment C)	EB and WB	Ramsey	No	Yes
Maplewood Station (Alignment C)	EB and WB	Ramsey	No	No
Greenway Avenue (Alignment C)	EB and WB	Washington	No	No
Helmo Avenue (Alignment C)	EB and WB	Washington	No	Yes
Tamarack Station (Alignment D3)	EB and WB	Washington	No	No
Woodbury Theatre Station (Alignment D3)	EB and WB	Washington	No	Yes
Woodbury 494 Park and Ride (Alignment D3)	EB and WB	Washington	No	Yes

Transit service changes in the "No-Build" and "Build" alternatives are described in Section 4.

2.5 Auto Skims

STOPS requires zone-to-zone current year AM peak period automobile travel times and distances as an input. These skims are obtained from the Council's regional travel demand model, which has a base/calibration year of 2010. This regional activity-based model (ABM) has two additional scenarios for years 2015 and 2040. Skims from the ABM for the 2015 and 2040 scenarios are respectively used to reflect the current year 2016 and horizon year 2040 automobile travel times and distances in STOPS.

2.6 Park-and-Ride Locations/Trips

STOPS requires the user to code all park-and-ride locations in the entire region. The ridership team analyzed the annual park-and-ride report to identify the formal park-and-ride locations. Further, the survey showed that riders were parking at many informal park-and-ride locations. The ridership team added several non-official park-and-ride locations to the model inputs to reflect this behavior.

Discussions with FTA indicated the inability of STOPS to reasonably handle fringe park-and-ride trips in the region. Fringe park-and-ride trips in the region are defined as park-and-ride trips traveling at least 70% of their production-attraction distance on auto. In order to model these fringe park-and-ride trips in STOPS, the ridership team recoded them so that their production zone is the same zone as their boarding location.

2.7 Population and Employment Data

STOPS uses the MPO's current and forecasted population and employment data to grow the CTPP Journey-to-Work (JTW) data to the current (2016) and horizon (2040) years. The population and employment estimates were obtained from the regional travel demand model at the TAZ level. For the 2016 current year, 2014 population and employment data from the regional model were used in STOPS. The ridership team adjusted the 2040 TAZ level population and employment data, based on comments and data received from Cities of Oakdale and Woodbury. In addition, the ridership team also corrected employment data at the TAZ where 3M is located. 3M is a private, multinational company headquartered in the corridor and one of the largest employers in the region.

2.8 District System

STOPS uses districts to define a logical grouping of TAZs both within transportation corridors and throughout the region. Districts are used by STOPS to scale the CTPP JTW trips to the MPO population and employment forecasts and also for reporting STOPS outputs within a logical and concise framework. Twenty-eight (28) districts were created in the region. Figure 3.a and Figure 3.b show the districts defined in the STOPS model.

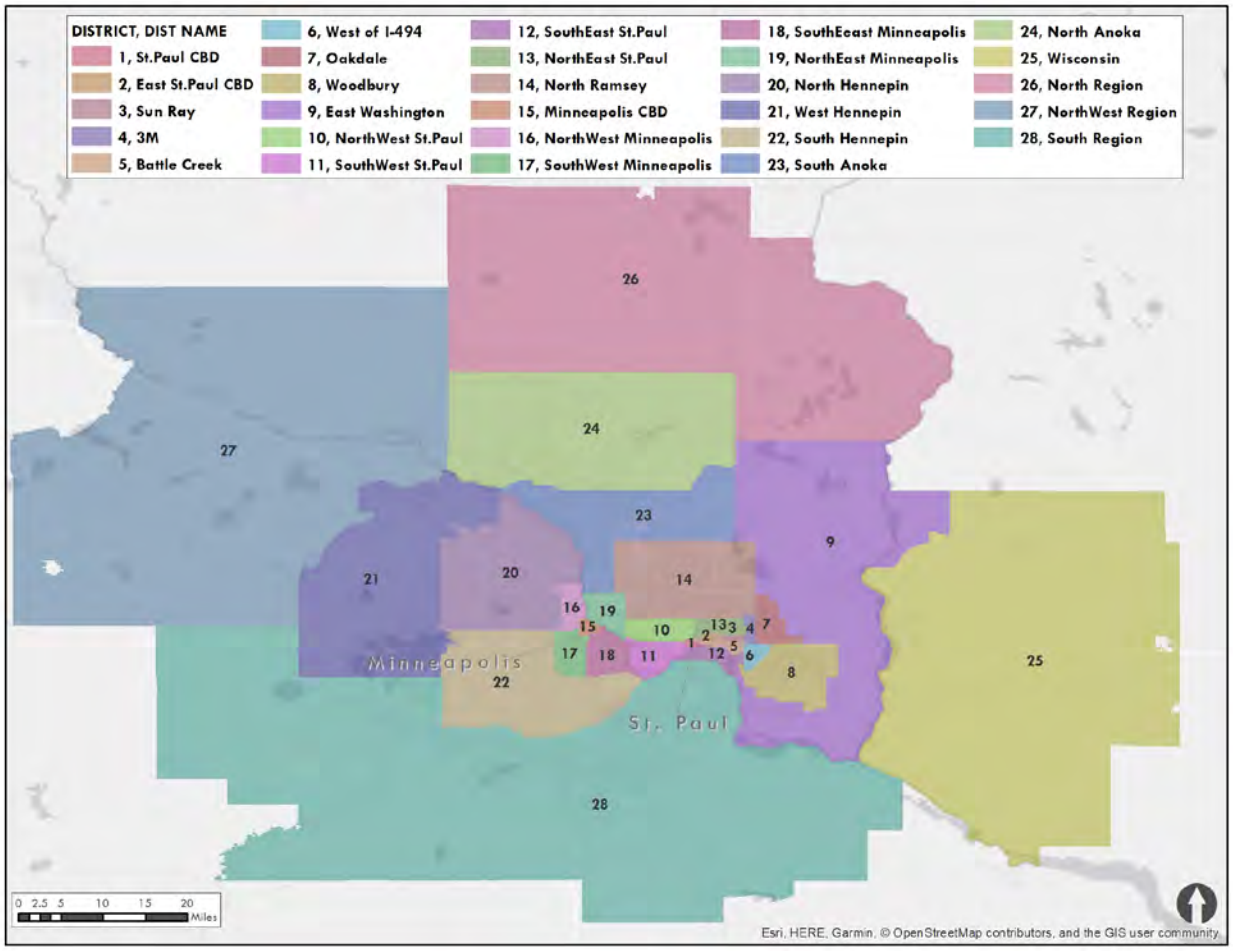
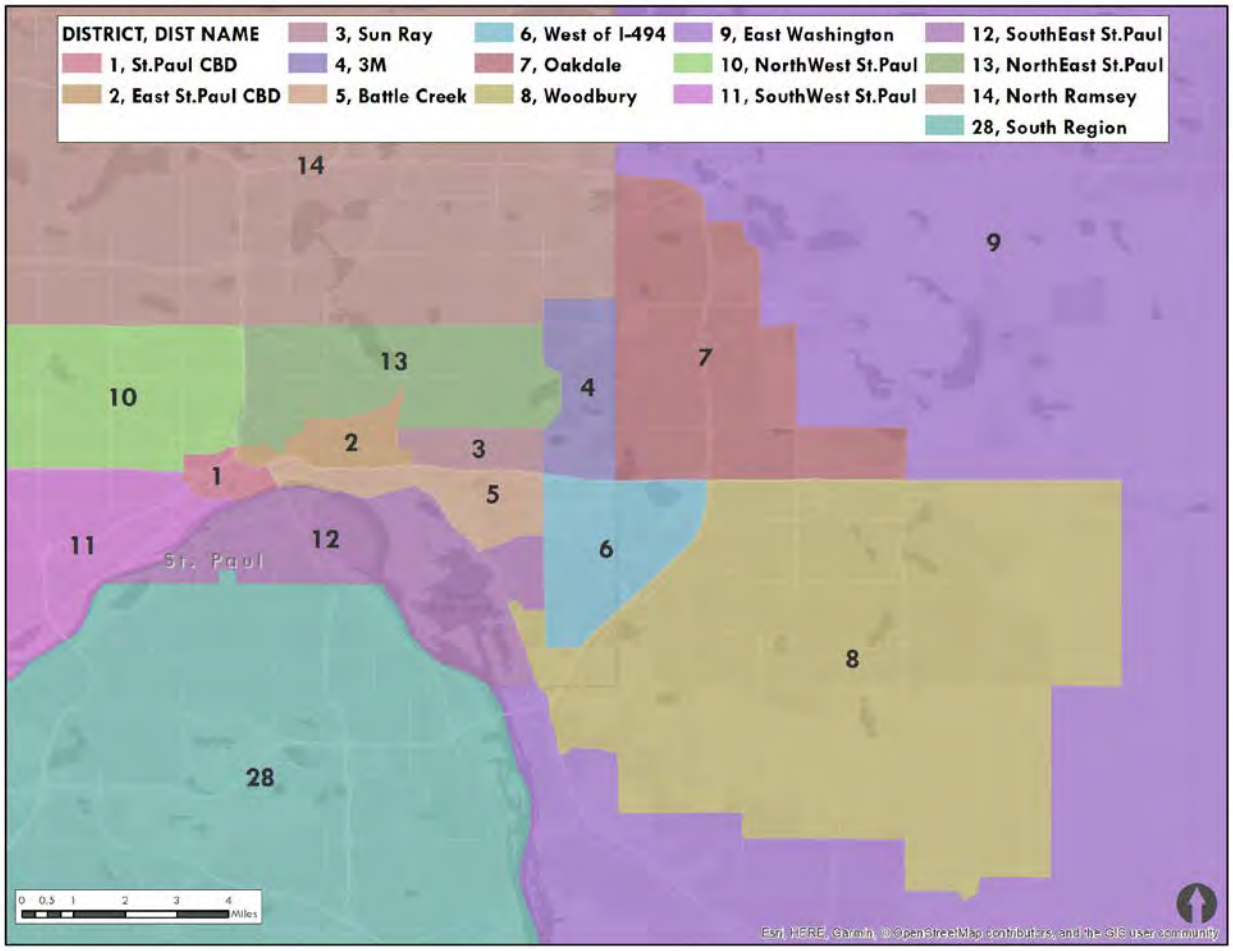


Figure 3.a. Districts for the STOPS Model



3.b Districts in the Study Area

3 STOPS Calibration Results

The calibration results presented in this section are for the 2016 current year with the “Existing” transit service and reflect ridership on an average weekday in September/October.

3.1 Calibration Results

For the current year, the observed boardings target is 346,033, and STOPS nearly matches it by estimating 346,050 boardings. The observed region-wide linked transit trips target is 272,164, and the model estimates of 270,041 trips are almost identical. The regional calibration factor is 1.00. The observed transfer rate of 27% is also matched by the model.

Table 4 shows a detailed comparison of linked transit trips by purpose and auto ownership. The observed splits by trip purpose and auto ownership are nearly matched by the model estimates.

Table 4. Linked Transit Trip Comparison

Linked Transit Trips Comparison			
HBW			
	Observed	Estimated	Delta
0-Car	31,167	30,903	-264
1-Car	44,029	43,606	-423
2+-Car	57,999	57,157	-842
HBO			
	Observed	Estimated	Delta
0-Car	49,889	49,650	-239
1-Car	29,846	29,761	-85
2+-Car	24,767	24,612	-155
NHB			
	Observed	Estimated	Delta
0-Car	14,798	14,768	-30
1-Car	9,101	9,074	-27
2+-Car	10,569	10,510	-59
TOTAL			
	Observed	Estimated	Delta
0-Car	95,854	95,321	-533
1-Car	82,976	82,441	-535
2+-Car	93,335	92,279	-1,056
Total	**272,164**	**270,041**	**-2,123**

Table 5 shows a comparison of linked transit trips by access mode. The total observed and estimated trips are similar to each other.

Table 6 provides a comparison of total boardings by transit mode. In the region, local bus services constitute 64% of the total boardings. Observed share of express buses is just over 12%. STOPS estimates a 62% share for the local buses, whereas the total share of express buses is around 13%. Overall, the observed values by transit mode and by access mode are nearly matched by the model estimates. A detailed route-level comparison of boardings is shown in Appendix A.

Table 7 provides a comparison of total boardings by agency. The observed share of Metro Bus (62%) is nearly matched by the model estimates (63%). Additionally, while the observed share of University of Minnesota (UofM) buses is 6%, the model estimates a 4% share. Part of the underestimation is likely related to the 2016 on-board survey used for this application, which has a relatively low sample rate on UofM buses. Also, the model set up currently does not account for discounted fare on UofM routes. The total observed and estimate boardings on MVTA are almost identical.

Overall, the results show that the STOPS model is well-informed about observed transit travel patterns in the Minneapolis-Saint Paul region, and should produce reasonable ridership estimates for this study.

Table 5. Linked Transit Trips by Access Mode

Access Mode	Observed	Estimated	Difference
Walk	219,916	223,197	3,281
KNR	10,383	10,456	73
PNR	42,139*	36,387	-5,752
Total	**272,438**	**270,040**	**-2,398**

**Approximately 9 percent of the PNR trips were classified as "Fringe PNRs". Within STOPS, the production locations of the Fringe PNR trips are coded at the boarding location and hence are effectively modeled as walk trips.*

Table 6. Summary by Mode - Total Boardings

Transit Mode	Observed	Estimated	Difference
Local Bus	221,786	216,267	-5,519
Express	40,827	46,639	5,812
Rapid Bus	5,133	4,016	-1,117
BRT	954	1,421	467
LRT	74,760	75,213	453
CRT	2,548	2,492	-56
Total	**346,008**	**346,048**	**40**

Table 7. Summary by Agency - Total Boardings

Agency	Observed	Estimated	Difference
Metro Bus	215,959	217,838	1,879
Metro Rail	77,308	77,705	397
Metropolitan Council Bus	12,005	17,193	5,188
UofM	21,745	14,721	-7,024
MVTA	9,365	10,609	1,244
Plymouth	1,830	1,550	-280
Maple Grove	3,510	2,527	-983
Southwest	4,286	3,905	-381
Total	**346,008**	**346,048**	**40**

3.2 Forecast Post-Processing

The ridership team developed a routine that post-processes the STOPS output to address two issues:

1. The over-assignment of park-and-ride trips to the lot closest to Saint Paul CBD and the corresponding under-assignment of park-and-ride trips in the park-and-ride lots further on the edge of the corridor; and
2. The Project's park-and-ride demand exceeding park-and-ride supply.

Issue #1: Loading of Park-and-Ride Trips at Individual Lots

While the preliminary Gold Line ridership forecasts were producing a reasonable number of Project park-and-ride trips in aggregate, the ridership team noticed that the Project's STOPS application was vastly over-assigning park-and-ride trips to the Sun Ray lot, the lot closest to Saint Paul CBD, and significantly under-assigning trips to the other park-and-ride lots in the corridor. This pattern is common in travel models where the transit path-builder attempts to minimize the overall travel time. Consequently, in models sometimes the fastest park-and-ride path is to drive far into the corridor and utilize the park-and-ride lot closest to downtown.

The team reviewed the 2016 Metro Transit Origin/Destination Survey to assess how local park-and-ride trips access transit. The review indicated that most park-and-ride trips east of Saint Paul CBD access transit generally using the lot closest to their home. This information was shared with the FTA STOPS staff. It was mutually decided to develop a post-processing routine that distributes the park-and-ride output from the STOPS model to the other lots based on the trips' origin location. The park-and-ride trips on the Project are reallocated to the closest park-and-ride lots.

Issue #2: Balancing Park-and-Ride Demand and Supply

After reallocating the park-and-ride trips to the lot closest to their origin, each park-and-ride lot's demand is verified against the supply. The STOPS model does not constrain parking, an issue that became more acute as local municipalities desired a firm limit on the number of parking stalls at each Project park-and-ride.

To address the park-and-ride lot demand/supply imbalance, the Project's park-and-ride demand by lot, if greater than the computed supply, is reduced to match the supply. The auto occupancy is assumed to be 1.10 (obtained from the Metro Transit Origin/Destination Survey), and the parking turnover rate is assumed to be 10% (obtained from the Transit Cooperative Research Program (TCRP) Report 95, Chapter 3). For each lot, park-and-ride trips that exceed capacity are removed from the Project ridership and corresponding CIG metrics. The exception to this rule occurs in the current year, where up to 20% of the excess park-and-ride trips at the Helmo Avenue park-and-ride lot are assumed to shift to the Woodbury station park-and-ride lot. FTA and the ridership team had verbally discussed to merge this post-processing routine with the method to reallocate park-and-ride trips described earlier.

When park-and-ride trips are removed from the Project ridership, the corresponding CIG metrics – the Project's trips from zero-car households, new linked transit trips, and delta vehicle-miles traveled are also scaled down. The scaling factor is equal to the number of Project trips after removing the excess park-and-ride trips divided by the number of Project trips in the STOPS output files.

Table 8 shows a summary of the above process at the park-and-ride lot level for the current year.

Table 8. Park-and-Ride Boardings by Lot (Origin/Destination Format) for Build Alternative A1-BC-D3 for Current Year

Project park-and-ride lot	STOPS Output (Boardings)	After Reallocating to Closest park-and-ride lot (Boardings)	After Constraining for park-and-ride lot Supply (Boardings)	Parking Spaces (Proposed/ Demand after Constraining for Supply)
Sun Ray	938	315	183	150/150
Helmo Avenue	105	354	122	100/100
Woodbury*	5	380	427	350/349
Total	**1,048**	**1,049**	**732**	**600/599**

**Park-and-ride at Woodbury Theater and Woodbury 494 Park and Ride stations are combined for these calculations.*

Note that all the ridership forecasts shown in Section 5 of this memo are "post-processed, constrained" forecasts.

4 Definition of No-Build and Build Alternatives

This section describes the changes in the transit network of the No-Build and the two Build Alternatives for both the current (2016) and horizon (2040) years.

4.1 No-Build Alternative

For the current year forecasts, the transit network for the No-Build alternative includes all the existing transit service plus the following changes:

- A new express bus Route 381 is added that connects the planned Manning park-and-ride lot to Saint Paul downtown with five trips in the peak period
- A new express bus Route 385 is added that connects the planned Manning park-and-ride lot to Minneapolis downtown with eight trips in the peak period

These new express buses are included in the current year No-Build alternative because these improvements are expected to occur even without the Project.

The No-Build alternative for the horizon year is similar to the existing transit service in the region, except for the following changes:

- The frequency on Route 63 is increased – from every 20 minutes to every 15 minutes
- An express service complementary to Route 351 (Woodbury – Sun Ray – Saint Paul downtown) is added with an additional stop at the Sun Ray Transit Center
- A new express bus Route 381 is added that connects the planned Manning park-and-ride lot to Saint Paul downtown with five trips in the peak period
- A new express bus Route 385 is added that connects the planned Manning park-and-ride lot to Minneapolis downtown with eight trips in the peak period
- The proposed Rush Line BRT is added. This is a 14-mile route that would connect downtown Saint Paul with downtown White Bear Lake at a frequency of 10 minutes during the peak period and 15 minutes during the mid-day period.

- The proposed Riverview Modern Streetcar is added. This is a 12-mile route that would connect downtown Saint Paul with Minneapolis-St. Paul International Airport and Mall of America at a frequency of 10 minutes during both the peak and mid-day time periods. Further, three key routes that impact the Riverview service are also modified based on the locally preferred alternative service plan:
  - The frequency of Route 46 is increased – from every 30 minutes to every 20 minutes
  - The frequency of Route 83 is increased – from every 30 minutes to every 20 minutes
  - The frequency of Route 54 is decreased – from every 15 minutes to every 30 minutes

4.2 Build Alternative 1 (A1-BC-D3)

In this alternative, the Project operates between the Woodbury-494 park-and-ride near Woodbury theater and the Smith Avenue Transit Center in downtown Saint Paul. The weekday service frequency is every 10 minutes in the peak period and 15 minutes in the off-peak period. The westbound travel time is 36 minutes and the eastbound travel time is 34 minutes. This alternative includes three new park-and-ride lots at I-494, Helmo Avenue and Sun Ray. Table 9 shows the station-to-station travel times by direction for this alternative.

Table 9. Build Alternative A1-BC-D3 Project Run Times

Build Alternative 1: WB Peak - Guider Dr P&R to Smith Ave

Stop ID	Station Name	Incremental Distance	Incremental Time	Dwell Time	Total Time
1	Guider Dr. Park-n-Ride			0:00:00	0:00:00
		0.31	0:01:08		
2	Woodbury Theatre			0:00:14	0:01:08
		1.04	0:03:37		
3	Tamarack Road			0:00:07	0:04:45
		0.63	0:02:13		
4	Helmo Avenue			0:00:14	0:06:58
		1.44	0:04:01		
5	Greenway Avenue			0:00:14	0:10:59
		1.07	0:02:41		
6	Maplewood			0:00:07	0:13:40
		0.87	0:02:03		
7	Sun Ray			0:00:21	0:15:43
		0.40	0:01:14		
8	White Bear Avenue			0:00:14	0:16:57
		1.15	0:02:34		
9	Etna Street			0:00:14	0:19:31
		0.67	0:01:43		
10	Earl Street			0:00:14	0:21:14
		0.79	0:02:02		
11	Mounds Boulevard			0:00:14	0:23:16
		1.01	0:05:10		
12	Union Depot/Sibley St.			0:00:21	0:28:26
		0.22	0:02:00		
13	6th St./Robert St.			0:00:14	0:30:26
		0.13	0:01:27		
14	6th St./Minnesota St.			0:00:21	0:31:53
		0.25	0:02:05		
15	Hamm Plaza			0:00:14	0:33:58
		0.28	0:02:21		
16	Smith Ave./6th St.			0:00:14	0:36:19
	Segment Distance (mi.)	10.26		Total Time	0:36:19
				Average Speed (mph)	16.9

Build Alternative 1: EB Peak - Smith Ave to Guider Dr P&R

Stop ID	Station Name	Incremental Distance	Incremental Time	Dwell Time	Total Time
17	Smith Ave./5th St.			0:00:00	0:00:00
		0.30	0:02:01		
18	Rice Park			0:00:07	0:02:01
		0.25	0:02:13		
19	5th St./Cedar St.			0:00:07	0:04:14
		0.10	0:01:08		
20	5th St./Robert St.			0:00:07	0:05:22
		0.26	0:01:57		
21	Union Depot/Wacouta St.			0:00:07	0:07:19
		0.93	0:04:52		
11	Mounds Boulevard			0:00:14	0:12:11
		0.83	0:02:04		
10	Earl Street			0:00:14	0:14:15
		0.64	0:01:34		
9	Etna Street			0:00:14	0:15:49
		1.15	0:02:33		
8	White Bear Avenue			0:00:14	0:18:22
		0.40	0:01:21		
7	Sun Ray			0:00:21	0:19:43
		0.87	0:01:50		
6	Maplewood			0:00:07	0:21:33
		1.07	0:02:31		
5	Greenway Avenue			0:00:14	0:24:04
		1.44	0:03:30		
4	Helmo Avenue			0:00:14	0:27:34
		0.65	0:02:09		
3	Tamarack Road			0:00:07	0:29:43
		1.03	0:03:26		
2	Woodbury Theatre			0:00:14	0:33:09
		0.31	0:01:01		
1	Gulder Dr. Park-n-Ride			0:00:07	0:34:10
	Segment Distance (mi.)	10.21		Total Time	0:34:10
				Average Speed (mph)	17.9

Table 10 and Table 11 show the changes to the bus routes in the current year and horizon year respectively for both the No-Build and Build Alternatives in the Gold Line BRT corridor. The proposed opening year bus network plan shown in Table 11 results an approximately 5% increase in in-service hours and 7% increase in in-service miles compared to the service that was in place in March 2018 in the corridor. Similarly, the 2040 concept plan presented in Table 12 results a 16% increase in in-service vehicle hours and 17% increase in in-service vehicle

miles compared to the service that was in place in March 2018 in the corridor. Figure 4 shows a map of the 2040 connecting bus network in the Build alternative.

It should be noted that the horizon year build network also includes the proposed Rush Line BRT and Riverview Modern Streetcar, including the changes to the bus routes that specifically impact Riverview Line, as described in Section 4.1.

Table 10. Gold Line BRT – Connecting Bus Route Changes for "Current Year" Forecasts

Route	Stations Served	Current Year No Build Network	Current Year Build Network – "Opening Year Bus Plan"
3M (Private)	Maplewood	Same as existing network, if the route is present	All-day circulator between the Maplewood Station (3M Headquarters) and 3M campus; 10-minute Weekday only; Resources modeled based on existing "express van" service funded and operated by 3M. Recommend that service continues to be funded and operated by 3M (42 platform hours, 3 peak buses)
64			Replace 64D branch with proposed Route 72. Maintain high frequency service to Maryland Avenue and Clarence Street; Maintained high frequency service by cutting back "H" trips to Maryland Avenue and Clarence Street due existing Route 54 and cutting back "D" trips to Maryland Avenue and Clarence Street due to proposed Route 72.
72	Etna Street		New all-day crosstown between the Etna Street Station and the Maplewood Mall Transit Center via Johnson Parkway, Phalen Boulevard, Hazelwood Street, Prosperity Road, Larpenteur Avenue, English Street, Beam Avenue; 30-minute Weekday, Saturday service; Replaces Route 64D branch
74	Sun Ray		Simplify route east of the E 7th Street and White Bear Avenue with two branches: "S" to Sun Ray and "G" to Ivy-Hwy 120; See Route 215; Improves frequency to Sun Ray to every 20-minutes Weekday midday, Saturday; 30-minutes Sunday. 74G services only operates during Weekday peaks; no Saturday/Sunday service.
80	Van Dyke Street/Hazel Street, Sun Ray		Increase Weekday midday frequency from every 60-minutes to every 30-minutes
215	Sun Ray		New all-day crosstown between Sun Ray Transit Center and Maplewood Mall Transit Center via McKnight Road, Lydia Avenue, White Bear Avenue, Beam Avenue; 30-minutes Weekday peak, 60-minutes off-peak; 6am-8pm; Replaces Route 74S along McKnight Road
294	Sun Ray		Eliminate routing through Lake Elmo, Oakdale, Maplewood (3M) and along I-94 and re-route via Hwy 36 and I-35E to downtown Saint Paul
300	Tamarack		Future extension to the I-94 & Manning Avenue park-and-ride (as development continues east)
350			Eliminate
351			Eliminate reverse commute service
381		Same as build network	Future Express routes from Manning park-and-ride Lot to Saint Paul CBD (5 trips in the peaks)
385		Same as build network	Future Express routes from Manning park-and-ride Lot to Minneapolis CBD (8 trips in the peaks)

Table 11. Gold Line BRT – Connecting Bus Route Changes for "Horizon Year" Forecasts

Route	Stations Served	Horizon Year No-Build Network	Horizon Year Build Network – "2040 Concept Bus Plan"
3M (Private)	Maplewood		All-day circulator between the Maplewood Station (3M Headquarters) and 3M campus; 10-minute Weekday only; Resources modeled based on existing "express van" service funded and operated by 3M. Recommend that service continues to be funded and operated by 3M (42 platform hours, 3 peak buses)
63		Convert to a high frequency route (15 minute all day service)	Maintain existing service in the build scenario; i.e. do not include changes considered in the no build scenario
64		Same as existing network, if the route is present	Replace 64D branch with proposed Route 72. Maintain high frequency service to Maryland Avenue and Clarence Street; Maintained high frequency service by cutting back "H" trips to Maryland Avenue and Clarence Street due existing Route 54 and cutting back "D" trips to Maryland Avenue and Clarence Street due to proposed Route 72.
70	Earl Street, Sun Ray		Eliminate D branch via Upper Afton Road and Century Avenue; All service ends at Sun Ray Transit Center. Elimination implemented same time Route 219 is extended to cover Century Avenue (2040 Concept Plan)
72	Etna Street		New all-day crosstown between the Etna Street Station and the Maplewood Mall Transit Center via Johnson Parkway, Phalen Boulevard, Hazelwood Street, Prosperity Road, Larpenteur Avenue, English Street, Beam Avenue; 30-minute Weekday, Saturday service; Replaces Route 64D branch
74	Sun Ray		Simplify route east of the E 7th Street and White Bear Avenue with two branches: "S" to Sun Ray and "G" to Ivy-Hwy 120; See Route 215; Improves frequency to Sun Ray to every 20-minutes Weekday midday, Saturday; 30-minutes Sunday. 74G services only operates during Weekday peaks; no Saturday/Sunday service.
80	Van Dyke Street/Hazel Street, Sun Ray		Increase Weekday midday frequency from every 60-minutes to every 30-minutes
215	Sun Ray		New all-day crosstown between Sun Ray Transit Center and Maplewood Mall Transit Center via McKnight Road, Lydia Avenue, White Bear Avenue, Beam Avenue; 30-minutes Weekday peak, 60-minutes off-peak; 6am-8pm; Replaces Route 74S along McKnight Road
219	Sun Ray, Woodbury-494 Park and Ride		Re-route south of 15th Street in Oakdale to Maplewood Station (3M) via Century Avenue; expand Saturday span and increase frequency from every 60-minutes to every 30-minutes; new Sunday service every 60-minutes from 6 am - 8 pm
221	Greenway		New all-day service between the Greenway Avenue Station and the 3M Foundation Project (mixed housing) in Oakdale via Hadley Avenue; 30- minutes Weekday peak; 60- minutes Weekday off-peak & Saturday; 60-minutes Sunday; Replaces Route 219 along Hadley Avenue/7th Street/Greenway Avenue. Replaces Route 294 along Hadley Avenue north of 10th Street. Provides new service along Hadley Avenue north of 34th Street/Hwy 5/Co Rd 14 in Oakdale

Route	Stations Served	Horizon Year No-Build Network	Horizon Year Build Network – "2040 Concept Bus Plan"
294	Sun Ray	Same as existing network, if the route is present	Eliminate routing through Lake Elmo, Oakdale, Maplewood (3M) and along I-94 and re-route via Hwy 36 and I-35E to downtown Saint Paul
300	Tamarack		Future extension to the I-94 & Manning Avenue park-and-ride (as development continues east)
301	Woodbury Theater		New all-day service between the Woodbury Theatre Station and the City Centre area of Woodbury via Valley Creek Road; 60-minutes Weekday and Weekends
302	Helmo Avenue		New all-day service between Helmo Avenue Station and Manning Avenue park-and-ride along Hudson Boulevard; 30 minutes during the peak and 60 minutes off-peak and weekends.
350			Eliminate
351			Eliminate reverse commute service
351_v2		Include Woodbury - Sun Ray - Saint Paul Express Service (4 trips during peaks)	Not included in the Build scenario
381		Same as build network	Future Express routes from Manning park-and-ride lot to Saint Paul CBD (5 trips in the peaks)
385		Same as build network	Future Express routes from Manning park-and-ride lot to Minneapolis CBD (8 trips in the peaks)

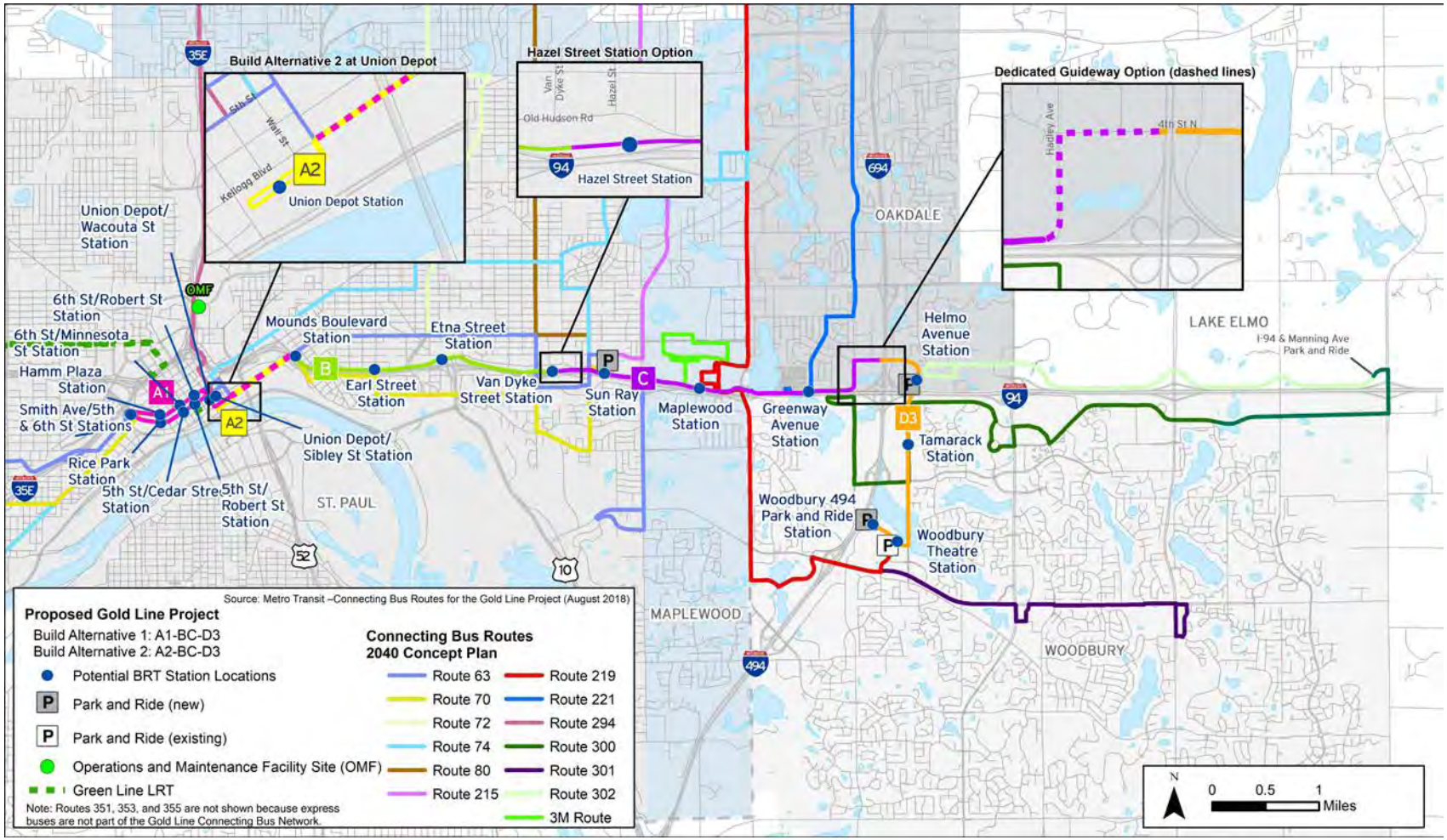


Figure 4. Gold Line BRT - Connecting Bus Network (2040 Concept Plan)

4.3 Build Alternative 2 (A2-BC-D3)

This alternative differs from the previous alternative in that the Gold Line BRT begins at the Woodbury-494 park-and-ride station near Woodbury theater and terminates at Union Depot instead of at the Smith Avenue Transit Center. The weekday service frequency is every 10 minutes in the peak periods and 15 minutes in the off-peak period. The travel time is 28 minutes in both the directions. This alternative includes three new park-and-ride lots at I-494, Helmo Avenue and Sun Ray. Table 12 shows the station-to-station travel times by direction for this alternative.

Table 12 Alternative A2-BC-D3 Gold Line BRT Run Times

Build Alternative 2: WB Peak Period - Guider Dr P&R to Union Depot

Stop ID	Station Name	Incremental Distance	Incremental Time	Dwell Time	Total Time
1	Guider Dr. Park-n-Ride			0:00:00	0:00:00
		0.31	0:01:08		
2	Woodbury Theatre			0:00:14	0:01:08
		1.04	0:03:37		
3	Tamarack Road			0:00:07	0:04:45
		0.63	0:02:13		
4	Helmo Avenue			0:00:14	0:06:58
		1.44	0:04:01		
5	Greenway Avenue			0:00:14	0:10:59
		1.07	0:02:41		
6	Maplewood			0:00:07	0:13:40
		0.87	0:02:03		
7	Sun Ray			0:00:21	0:15:43
		0.40	0:01:14		
8	White Bear Avenue			0:00:14	0:16:57
		1.15	0:02:34		
9	Etna Street			0:00:14	0:19:31
		0.67	0:01:43		
10	Earl Street			0:00:14	0:21:14
		0.79	0:02:02		
11	Mounds Boulevard			0:00:14	0:23:16
		0.90	0:05:20		
22	Union Depot			0:00:21	0:28:36
	Segment Distance (mi.)	9.27		Total Time	0:28:36
				Average Speed (mph)	19.4

Build Alternative 2: EB Peak Period - Union Depot to Guider Dr P&R

Stop ID	Station Name	Incremental Distance	Incremental Time	Dwell Time	Total Time
22	Union Depot			0:00:00	0:00:00
		0.97	0:06:00		
11	Mounds Boulevard			0:00:14	0:06:00
		0.83	0:02:04		
10	Earl Street			0:00:14	0:08:04
		0.64	0:01:34		
9	Etna Street			0:00:14	0:09:38
		1.15	0:02:33		
8	White Bear Avenue			0:00:14	0:12:11
		0.40	0:01:21		
7	Sun Ray			0:00:21	0:13:32
		0.87	0:01:50		
6	Maplewood			0:00:07	0:15:22
		1.07	0:02:31		
5	Greenway Avenue			0:00:14	0:17:53
		1.44	0:03:30		
4	Helmo Avenue			0:00:14	0:21:23
		0.65	0:02:09		
3	Tamarack Road			0:00:07	0:23:32
		1.03	0:03:26		
2	Woodbury Theatre			0:00:14	0:26:58
		0.31	0:01:01		
1	Guider Dr. Park-n-Ride			0:00:07	0:27:59
	Segment Distance (mi.)	9.34		Total Time	0:27:59
				Average Speed (mph)	20.0

The connecting bus route changes in this alternative are identical to the changes for the A1-BC-D3 alternative described in Section 4.2. Table 13 provides a summary of the Gold Line BRT service plan statistics in the two Build alternatives.

Table 13 Gold Line BRT Operating Plan Service Statistics

Build Alternative 1 - All Service to Smith Avenue Ramp

Segments	Time	Dist.	Day	Service Frequency Ear	AM	Mid	PM	Eve	Late	Vehicles Max	Total	Daily Rev. Bus-Mi's	Bus-Hrs	Annual Rev. Bus-Miles	Bus-Hrs	Bus Requirements Early	AM	Mid	PM	Eve	Late
Guider Dr. to Smith @ 6th	36.32	10.26	M-F	15	10	15	10	15	30	9.0	12.0	1,651	120	421,100	30,600	6.0	9.0	6.0	9.0	6.0	3.0
Smith @ 5th to Guider Dr.	34.17	10.21	Sat		15	15	15	30				1,362	99	70,800	5,100	0.0	6.0	6.0	6.0	3.0	0.0
Smith Ave. Ramp Turnaround	2.15	0.17	Sun		30	30	30	30				660	48	38,300	2,800	0.0	3.0	3.0	3.0	3.0	0.0
Round Trip	72.63	20.64								9.0	12.0			530,200	38,500	6.0	9.0	6.0	9.0	6.0	3.0

Build Alternative 2 - All Service to Union Depot

Segments	Time	Dist.	Day	Service Frequency Ear	AM	Mid	PM	Eve	Late	Vehicles Max	Total	Daily Rev. Bus-Mi's	Bus-Hrs	Annual Rev. Bus-Miles	Bus-Hrs	Bus Requirements Early	AM	Mid	PM	Eve	Late
Guider Dr. to Union Depot	28.60	9.27	M-F	15	10	15	10	15	30	8.0	11.0	1,489	105	379,600	26,800	5.0	8.0	5.0	8.0	5.0	3.0
Union Depot to Guider Dr.	27.98	9.34	Sat		15	15	15	30				1,228	85	63,900	4,400	0.0	5.0	5.0	5.0	3.0	0.0
			Sun		30	30	30	30				596	48	34,500	2,800	0.0	3.0	3.0	3.0	3.0	0.0
Round Trip	56.58	18.61								8.0	11.0			478,000	34,000	5.0	8.0	5.0	8.0	5.0	3.0

Table 14 provides a summary of the No-Build and Build alternatives for both the current and horizon years.

Table 14. Summary of No-Build and Build Alternatives

Scenario	Transit Networks for Current Year	Transit Networks for Horizon Year
No-Build Alternative	No-Build network from Table 10	No-Build network from Table 11 + Rush Line BRT + Riverview Modern Streetcar *(including changes to routes that impact Riverview Line)*
Build Alternatives A1-BC-D3 and A2-BC-D3	"Opening Year Bus Plan" (Table 10) + Gold Line BRT	"2040 Concept Bus Plan" (Table 11) + Rush Line BRT + Riverview Modern Streetcar *(including changes to routes that impact Riverview Line)* + Gold Line BRT

5 Ridership Forecasts

This section summarizes the ridership forecasts for the proposed Build Alternatives. Forecasts are generated for the 2016 current year and 2040 horizon year:

- **Build Alternative A1-BC-D3:** Would operate between the existing Smith Avenue Transit Center in downtown Saint Paul and a new station near the Woodbury Theatre and I-494 in Woodbury. Build Alternative 1 includes 10 platforms (5 stations) in downtown Saint Paul, including two new stations near Union Depot, and 11 stations along the remainder of the alignment.
- **Build Alternative A2-BC-D3:** Would operate between a new station at the Union Depot in downtown Saint Paul and a new station near the Woodbury Theatre and I-494 in Woodbury. Build Alternative 2 includes 1 station in downtown Saint Paul at the Union Depot bus deck and 11 stations along the remainder of the alignment

Table 15 summarizes the ridership forecasts on the two Build Alternatives for an average weekday in September/October. A "project trip" is defined as any trip that boards and/or alights at one of the project stations. STOPS forecasts 6,500 trips on the Project in the current year for Build Alternative 1, serving downtown stops (A1-BC-D3), whereas Build Alternative 2, terminating at Union Depot (A2-BC-D3), is forecast to carry 5,700 riders per day. The ridership is expected to increase to 7,100 trips in Build Alternative 1 and 6,350 trips in Build Alternative 2 by the 2040 horizon year, representing a growth of 9% and 11% respectively from the current year. The parking constraint at the Project stations has a significant impact in limiting the ridership growth by the 2040 horizon year.

Riders from zero-car households would comprise about 26% of the Project ridership; which is lower than the 34% share of zero-car-households riders using the existing transit system. Given that the Project would connect downtown Saint Paul to eastern parts of the region with growing populations, this discrepancy could result from riders with cars switching to transit, which would result in a lower percentage of trips by riders from zero-car households utilizing the Project than the rest of the transit system. The share of Project trips from zero-car households in the horizon year is expected to be similar to the share in the current year.

The Project is expected to move about 3,500 trips from auto to transit in the current year for the A1-BC-D3 alternative. The corresponding movement of trips in the horizon year is expected be 3,300 trips. This reduction in new linked transit trips in comparison to the current year is mainly because the horizon year includes both the Rush Line and Riverview Line in the No-Build Alternative. As a result, there would be some riders switching transit routes in the horizon year build alternatives, specifically from Rush Line to Gold Line. Hence, the net impact of trips moving from auto to transit in the horizon year would be lower than in the current year which does not include Rush Line or Riverview Line. The movement of trips from auto to transit for current year is forecast to be approximately 13% lower for the A2-BC-D3 alternative which terminates at Union Depot.

With an increase in regional transit trips, the Build Alternatives are anticipated to reduce the number of auto trips made in the region each weekday. The reduction in automobile trips would result in a decrease in regional automobile vehicle miles traveled (VMT). STOPS reports the change in daily VMT in the Build alternative in comparison to the No-Build Alternative. The two alternatives would offer some benefit by decreasing the daily VMT in the region by 14,450 to 16,500 miles per day in the current year, and 15,750, to 17,600 miles per day in the horizon year.

Table 15 Summary of STOPS Forecasts

CIG Metrics	Build A1-BC-D3	Build A2-BC-D3
Current Year (2016) with "Opening Year Bus Plan"		
Trips on Project (Total)	6,500	5,700
Trips on Project (Zero-Car Households)	1,700	1,500
New Linked Transit Trips	3,500	3,050
Vehicle Miles Travel Reduction	16,500	14,450
Horizon Year (2040) with "2040 Concept Bus Plan"		
Trips on Project (Total)	7,100	6,350
Trips on Project (Zero-Car Households)	1,650	1,450
New Linked Transit Trips	3,300	2,950
Vehicle Miles Travel Reduction	17,600	15,750

Table 16 and Table 17 provide station level boarding forecasts for current and horizon years. It should be noted that the Project include three new park-and-ride lots. These are Sun Ray park-and-ride, Helmo Avenue park-and-ride, and I-494 park-and-ride (Woodbury) lots. Almost 60% of the Project riders would access the system by walking to the stations, and the remaining 40% would either drive to access the system or transfer from another transit route.

Table 16 Station Level Boardings by Access Mode (Current Year Forecasts)

Station	Current Year (2016) with "Opening Year Bus Plan"									
	Alternative A1-BC-D3					Alternative A2-BC-D3				
	Walk	KNR	PNR	Transfer	Total	Walk	KNR	PNR	Transfer	Total
Smith Avenue/5th Street (EB)	118	11	-	3	132	-	-	-	-	-
Rice Park (EB)	171	1	-	150	322	-	-	-	-	-
5th Street/Cedar Street (EB)	227	1	-	45	273	-	-	-	-	-
5th Street/Robert Street (EB)	89	-	-	64	153	-	-	-	-	-
Union Depot/Wacouta Street (EB)	252	1	-	260	513	-	-	-	-	-
Union Depot	-	-	-	-	-	1,671	6	-	909	2,586
Union Depot/Sibley Street (WB)	252	1	-	260	513	-	-	-	-	-
6th Street/Robert Street (WB)	89	-	-	64	153	-	-	-	-	-
6th Street/Minnesota Street (WB)	227	1	-	45	273	-	-	-	-	-
Hamm Plaza (WB)	171	1	-	150	322	-	-	-	-	-
Smith Avenue/6th Street (WB)	118	11	-	3	132	-	-	-	-	-
Downtown Stations Total Boardings	*1,714*	*25*	*-*	*1,040*	*2,779*	*1,671*	*6*	*-*	*909*	*2,586*
Mounds Boulevard	430	6	-	18	454	338	3	-	70	411
Earl Street	212	2	-	11	225	172	-	-	6	178
Etna Street	270	11	-	8	289	232	6	-	3	241
Van Dyke Street/Hazel Street	181	11	-	10	202	149	6	-	1	156
Sun Ray	716	112	184	66	1,078	651	72	184	23	930
Maplewood	159	11	-	7	177	154	9	-	-	163
Greenway Avenue	90	7	-	155	252	86	6	-	93	185
Helmo Avenue	7	126	123	-	256	9	81	123	-	213
Tamarack	33	4	-	89	126	29	3	-	64	96
Woodbury Theatre	40	74	214	44	372	36	45	184	51	316
Woodbury 494 Park and Ride	-	62	214	-	276	-	42	184	-	226
Total Boardings	**3,852**	**448**	**735**	**1,448**	**6,483**	**3,522**	**274**	**675**	**1,220**	**5,691**

Notes: Downtown EB and WB stops ridership is balanced
Subtotals may not add up due to rounding
EB: Eastbound Only; WB: Westbound only

Table 17 Station Level Boardings by Access Mode (Horizon Year Forecasts)

Station	Horizon Year 2040 with "2040 Concept Bus Plan"									
	Alternative A1-BC-D3					Alternative A2-BC-D3				
	Walk	KNR	PNR	Transfer	Total	Walk	KNR	PNR	Transfer	Total
Smith Avenue/5th Street (EB)	81	7	-	4	92	-	-	-	-	-
Rice Park (EB)	165	1	-	270	436	-	-	-	-	-
5th Street/Cedar Street (EB)	251	1	-	40	292	-	-	-	-	-
5th Street/Robert Street (EB)	100	-	-	51	151	-	-	-	-	-
Union Depot/Wacouta Street (EB)	254	-	-	290	544	-	-	-	-	-
Union Depot	-	-	-	-	-	1,083	5	-	2,001	3,089
Union Depot/Sibley Street (WB)	254	-	-	290	544	-	-	-	-	-
6th Street/Robert Street (WB)	100	-	-	51	151	-	-	-	-	-
6th Street/Minnesota Street (WB)	251	1	-	40	292	-	-	-	-	-
Hamm Plaza (WB)	165	1	-	270	436	-	-	-	-	-
Smith Avenue/6th Street (WB)	81	7	-	4	92	-	-	-	-	-
Downtown Stations Total Boardings	*1,702*	*16*	*-*	*1,308*	*3,026*	*1,083*	*5*	*-*	*2,001*	*3,089*
Mounds Boulevard	492	4	-	15	511	332	2	-	120	454
Earl Street	223	1	-	16	240	166	-	-	3	169
Etna Street	305	13	-	4	322	219	7	-	5	231
Van Dyke Street/Hazel Street	228	9	-	7	244	171	4	-	-	175
Sun Ray	774	63	184	63	1,084	601	41	184	24	850
Maplewood	173	12	-	142	327	130	9	-	139	278
Greenway Avenue	127	9	-	104	240	99	7	-	87	193
Helmo Avenue	9	107	123	33	272	10	69	123	16	218
Tamarack	48	5	-	85	138	33	4	-	56	93
Woodbury Theatre	57	80	214	53	404	46	49	214	52	361
Woodbury 494 Park and Ride	-	80	214	-	294	-	54	214	-	268
Total Boardings	**4,138**	**398**	**735**	**1,830**	**7,101**	**2,884**	**246**	**735**	**2,503**	**6,368**

Notes: Downtown EB and WB stops ridership is balanced
Subtotals may not add up due to rounding
EB: Eastbound Only; WB: Westbound only

6 Summary

The Gold Line BRT Project team is evaluating BRT service in the Twin Cities Metropolitan area between Woodbury and downtown Saint Paul. The planned ten-mile dedicated BRT line will connect the cities of Saint Paul, Maplewood, Landfall, Oakdale and Woodbury generally along Interstate 94. The proposed Project will address limited existing transit service, demand for more frequent service over the day, and the growing population and employment in the area.

FTA's STOPS is used as the tool to forecast ridership on the Project. The ridership team developed and calibrated a STOPS model to the existing local transit travel patterns observed in the Twin Cities region based on the 2016 on-board transit survey. This calibrated model was used to produce ridership estimates for the Gold Line BRT.

Two different Build Alternatives were evaluated in this study. The difference between the two alternatives is that one serves several downtown stops in downtown Saint Paul, terminating at Smith Avenue Transit Center whereas the other alternative terminates at Union Depot. Both the alternatives propose three new park-and-ride lots in the corridor and operate every 10 minutes in the peak periods and 15 minutes in the off-peak period.

STOPS forecasts 6,500 trips on the Gold Line BRT Project in the current year for the alternative serving downtown stops and is expected to increase to 7,100 trips by the 2040 horizon year, representing a 9% growth. The ridership forecasts show that the alternative serving downtown stops results in an additional 12% to 14% riders on the project over the alternative that terminates at Union Depot.

Riders from zero-car households would comprise about 26% of the Project ridership. The Project is expected to move about 3,500 trips from auto to transit in the current year for the alternative serving downtown stops. This movement of trips from auto to transit is forecast to be approximately 13% lower for the alternative which terminates at Union Depot. Almost 60% of the Project riders would access the system by walking to the stations, and the remaining 40% either would drive to access the system or transfer from another transit route.

Appendix A: Route Level Boardings Comparison (Observed vs. STOPS Estimation)

Route	Observed	Estimated	Difference
10---Central Av - University Av - Northtown	7,942	6,621	-1,321
11---Columbia Heights - 2nd St NE - 4th Av S	4,597	4,580	-17
111---Ltd Stop - 66th St - Chicago - Cedar - U of M	86	41	-45
113---Ltd Stop - Grand Av S - Lyndale Av S - U of M	563	1,597	1,034
114---Ltd Stop - Excelsior Blvd - Uptown - U of M	703	607	-96
115---Ltd Stop - Grand Av S - Uptown - U of M	130	0	-130
118---Ltd Stop - Central Av - Lowry Av - U of M	111	67	-44
12---Uptown - Excelsior Blvd - Hopkins - Opus	2,484	2,405	-79
120---U of M Stadium Super Shuttle	119	288	169
121---U of M - Campus Connector	14,718	10,079	-4,639
122---U of M - University Ave Circulator	4,248	2,527	-1,721
123---U of M - 4th Street Circulator	2,495	1,644	-851
124---U of M - Saint Paul Circulator	165	183	18
129---U of M - Huron Shuttle	91	9	-82
133---Ltd Stop - Bloomington Av - Chicago Av - Mpls	225	533	308
134---Ltd Stop - Cleveland Av - Cretin Av - Mpls	531	817	286
135---Ltd Stop - Grand Av S - 35th St - 36th St - Mpls	275	688	413
14---Robbinsdale-West Broadway-Bloomington Av	5,980	6,491	511
141---Ltd Stop - New Brighton - Johnson St - Mpls	440	285	-155
146---Ltd Stop - Vernon Av - 50th St - Mpls	408	732	324
156---Express - 58th St - 56th St - Diamond Lake - Mpls	511	700	189
16---U of M - University Av - Midway	1,340	2,718	1,378
17---Minnetonka Blvd - Uptown - Washington St NE	5,619	4,249	-1,370
18---Nicollet Av - South Bloomington	10,427	6,395	-4,032
19---Olson Memorial Hwy - Penn Av N - Brooklyn Center	7,945	6,346	-1,599
2---Franklin Av - Riverside Av - U of M - 8th St SE	7,043	7,349	306
20---Northstar Rail-Downtown Shuttle	66	101	35
21---Uptown - Lake St - Selby Av	13,253	6,977	-6,276
219---Maplewood - Century Av - Hadley Av - Sunray	853	965	112
22---Brklyn Ctr - Lyndale Av N - Cedar - 28th Av S - VA	6,744	6,183	-561
223---Rosedale - Little Canada - Maplewood	111	282	171
225---Deluxe - Roseville - Coventry - Rosedale	129	250	121
227---Target Shoreview - Victoria - Rosedale	114	210	96
23---Uptown - 38th St - Highland Village	1,801	2,264	463
25---Northtown - Silver Lake - Stinson - Lake of Isles	986	1,275	289
250---Express - St Josephs P&R - 95Av P&R - Mpls	1,874	1,367	-507
252---95AV P&R- U of M	163	51	-112
261---Express - Shoreview - Roseville - Mpls	394	735	341
262---Ltd Stop - 95Av P&R - Rice St - St Paul	137	243	106
263---Express - Rice St Park and Ride - Roseville	352	422	70
264---Express - Co Rd C Park and Ride - Roseville	647	596	-51
265---Express - White Bear Lake - Maplewood - St Paul	259	617	358
27---Lake St Station-26/28St	48	849	801
270---Express - Mahtomedi - Maplewood - Minneapolis	1,537	1,035	-502
272---Express - Maplewood - Roseville - U of M	59	31	-28
275---Express - Forest Lake-Running Aces - St Paul	439	273	-166

Route	Observed	Estimated	Difference
288---Express - Forest Lake - Mpls	596	411	-185
294---Express - Oakdale - Stillwater - St Paul	312	532	220
3---U of M - Como Av - Energy Park Dr - Maryland Av	8,239	9,725	1,486
30---Broadway Crosstown - Westgate Station	782	1,133	351
32---Robbinsdale - Lowry Av - Rosedale	1,886	2,072	186
350---Ltd Stop - Sunray - McKnight - St Paul	156	158	2
351---Express - Woodbury - St Paul	334	249	-85
353---Express - Woodbury - St Paul - Mpls	35	0	-35
355---Express - Woodbury - Mpls	1,143	1,063	-80
361---Express - Cottage Grove - St Paul	235	311	76
364---Express - Newport - Cottage Grove - St Paul	41	65	24
365---Express - Cottage Grove - Mpls	751	555	-196
375---Express - Oakdale - Mpls	802	655	-147
39---Wells Fargo - Abbott NW and Children's Hospitals	163	0	-163
4---New Brighton - Johnson St - Bryant Av - Southtown	6,614	7,394	780
415---MOA - Mendota Heights - Eagan	8	2	-6
417---Mendota Heights - St Paul	16	24	8
420---Rosemount-Apple Valley Flex	67	45	-22
421---Burnsville-Savage Flex	20	14	-6
426---Burnsville Shuttle	40	180	140
436---Eagan Hwy 55 Rev Comm	99	93	-6
437---Eagan Cedar Grove Rev Comm	23	50	27
438---Cliff Lake Flex	47	105	58
440---Apple Valley-Cedar Grove-VA Hospital	172	362	190
442---Burnsville Center-Apple Valley	109	139	30
444---Savage-Burnsville-Mall of America	945	1,084	139
445---Eagan-Cedar Grove	271	273	2
446---Eagan-46th Street LRT	323	419	96
452---Express - West St Paul - Mpls	143	179	36
46---50St - 46St - 46St LRT- Highland Village	1,448	1,782	334
460---Burnsville-Minneapolis	1,663	2,748	1,085
464---Savage-Burnsville-Minneapolis	218	325	107
465---Burnsville-Minneapolis-U of M	989	2,021	1,032
467---Express - Lakeville-Minneapolis	1,253	1,568	315
470---Eagan-Minneapolis	522	171	-351
475---Apple Valley-Cedar Grove-Mpls/U of M	246	341	95
476---Palomino Hills-Minneapolis	407	297	-110
477---Lakeville/Apple Valley-Mpls	1,381	398	-983
478---Rosemount-Minneapolis	160	163	3
479---157th Street-Minneapolis	49	13	-36
480---Apple Valley/Burnsville-St Paul	556	480	-76
484---Eagan/Rosemount-St Paul	222	91	-131
489---St Paul-Eagan Rev Comm	68	60	-8
490---Prior Lake-Shakopee-Minneapolis	496	400	-96
491---Scott County-Minneapolis Rev Commute	31	167	136
492---Prior Lake-Minneapolis Rev Commute	10	0	-10
493---Shakopee-Minneapolis	232	170	-62
5---Brklyn Center - Fremont - 26th Av - Chicago - MOA	18,305	12,645	-5,660

Route	Observed	Estimated	Difference
515---Southdale - 66th St - Bloomington Av - VA - MOA	1,907	1,431	-476
53---Ltd Stop - Uptown - Lake St - Marshall Av	784	744	-40
535---Ltd Stop - South Bloomington - Richfield - Mpls	1,761	3,027	1,266
537---Norm Coll - France Av - York Av - Southdale	145	91	-54
538---Southdale - York Av - Southtown - 86th St - MOA	526	580	54
539---Norm Coll - France Av - 98St - MOA	1,251	1,427	176
54---Ltd Stop - W 7St - Airport - MOA	4,726	4,288	-438
540---Edina - Richfield - 77th St - MOA	973	1,348	375
542---84th St - 76th St - American Blvd - MOA	305	441	136
552---Express - 12th Av - Bloomington Av - Mpls	163	298	135
553---Express - Bloomington - Portland Av - Mpls	217	472	255
554---Express - Bloomington - Nicollet Av - Mpls	307	511	204
558---Express - Southtown - Lyndale Av - Penn Av - Mpls	158	93	-65
578---Express - Edina - Southdale - Mpls	405	513	108
579---Express - U of M - Southdale	131	170	39
587---Express - Edina - Valley View Rd - Mpls	236	259	23
588---Mpls - Normandale Lake Office Park	45	100	55
589---Express - West Bloomington - Mpls	150	136	-14
59---Ltd Stop - Blaine - Hwy 65 - Central - Mpls	631	867	236
597---Express - West Bloomington - Mpls	572	765	193
6---U of M - Hennepin - Xerxes - France - Southdale	9,448	11,754	2,306
604---Wayzata Blvd - Louisiana Av - Excelsior Blvd	72	209	137
61---E Hennepin Av - Larpenteur Av - Arcade St	3,138	4,004	866
614---Ridgedale - Minnetonka Heights	48	54	6
615---Ridgedale - Co Rd 73 - St Louis Park	139	188	49
62---Rice St - Little Canada - Shoreview - Signal Hills	3,037	2,283	-754
63---Grand Av - Raymond Sta - Sunray - McKnight Rd	4,452	4,758	306
64---Payne - Maryland - White Bear Av - Maplewood	5,902	4,805	-1,097
643---Ltd Stop - Cedar Lake Rd - Mpls	134	149	15
649---Express - Louisiana Av - Cedar Lake Rd- Mpls	296	629	333
65---Dale St - Co Rd B - Rosedale	1,276	1,309	33
652---Express - Plymouth Rd - Co Rd 73 P&R - U of M	243	226	-17
663---Express - Cedar Lake Rd - Mpls	470	1,528	1,058
664---Express - Co Rd 3 - Excelsior Blvd - Mpls	201	257	56
667---Express - Minnetonka - St Louis Park - Mpls	450	368	-82
668---Express - Hopkins - St Louis Park - Mpls	195	381	186
67---W Minnehaha - Raymond Sta - Hiawatha	1,399	2,284	885
670---Express - Excelsior - Mpls	143	150	7
671---Express - Excelsior - Deephaven - Mpls	107	136	29
672---Express - Wayzata - Minnetonka - Mpls	312	501	189
673---Express - Co Rd 73 P&R - Mpls	826	780	-46
674---Express - Maple Plain -Orono - Wayzata - Mpls	127	87	-40
675---Express - Mound - Wayzata - Ridgedale - Mpls	1,619	1,729	110
677---Express- Mound - Orono - Plymouth Rd - Mpls	202	333	131
679---Express Co Rd 73 Target Field	20	0	-20
68---Jackson St - Robert St - 5th Av - Inver Hills	3,686	3,732	46
684---SW Transit - Express - Eden Prairie - Southdale	358	343	-15
687---SW Transit - Express - Eden Prairie - Target N Cam	29	0	-29

Route	Observed	Estimated	Difference
690---SW Transit - Express - Eden Prairie - Mpls	1,423	1,536	113
691---SW Transit - Express - Eden Prairie - Mpls	34	0	-34
692---SW Transit - Express - Chanhassen	170	14	-156
694---SW Transit - Express - Best Buy - Normandale	91	94	3
695---SW Transit - Express - Chaska - Chanhassen - Mpls	531	505	-26
697---SW Transit - Express - Carver-Chaska - Mpls	260	262	2
698---SW Transit - Express - Chaska - Chanhassen - Mpls	859	353	-506
699---SW Transit - Express - Chaska - Mpls	531	798	267
7---Plymouth - 27Av - Midtown - 46St LRT - 34Av S	1,736	2,677	941
70---St Clair Av - W 7St - Burns Av - Sunray	1,053	1,675	622
705---Starlite - Winnetka Av	464	458	-6
71---Little Canada - Edgerton - Concord - Inver Hills	1,981	2,409	428
716---Zane Av - 63rd Av - Crystal - Robbinsdale	199	573	374
717---Brooklyn Center - Robbinsdale-Plymouth	320	411	91
721---Ltd Stop - Brooklyn Center - New Hope - Mpls	1,143	657	-486
722---Brooklyn Ctr - Humboldt Av N - Shingle Creek Pkwy	873	709	-164
723---Starlite - North Henn Comm College - Brooklyn Ctr	854	838	-16
724---Ltd Stop - Target Campus - Starlite - Brooklyn Ctr	2,603	3,721	1,118
74---46St - Randolph - W 7St - E 7St - Sunray	5,014	5,638	624
740---Plymouth - Fernbrook Ln - Xenium Ln	37	34	-3
741---Plymouth - Annapolis - Campus Dr - Station 73	46	42	-4
742---Plymouth - Express - Bass Lake Rd	116	178	62
747---Plymouth - Express - Station 73 - Mpls	243	239	-4
75---Stryker - Robert - Parkview Plaza - Lake Cove Apts	874	1,150	276
755---Ltd Stop - Hwy 55 - Golden Valley Rd - Winnetka Av	491	621	130
756---Express- Hwy 55 - Mendelssohn Rd - Boone Av	235	181	-54
758---Express - Douglas - MnDot P&R - Noble - Mpls	421	424	3
760---Express - Zane Av - 63rd Av - 65th Av P&R - Mpls	616	679	63
761---Express - Brooklyn Park - Xerxes - 49th Av - Mpls	282	630	348
762---Ltd Stop - Brooklyn Ctr - North Mpls - Mpls	88	99	11
763---Express - 85th Av - Brookdale Dr - Humboldt - Mpls	227	332	105
764---Express - Winnetka Av - 42nd Av - Mpls	247	386	139
765---Express - Target - Hwy 252 and 73rd Av P&R - Mpls	146	19	-127
766---Express - Champlin - Noble P&R - West River Rd	715	1,100	385
767---Express - 63rd Av P&R - 65th Av P&R - Mpls	177	179	2
768---Express - Noble P&R - Downtown	1,659	2,911	1,252
771---Plymouth - SW Plymouth - Station 73	29	51	22
772---Plymouth - Express - Station 73	195	167	-28
774---Plymouth - Express - Station 73	204	192	-12
776---Plymouth - Express - Southwest Plymouth	328	163	-165
777---Plymouth - Express - NW Plymouth - Station 73	196	262	66
780---Maple Grove - Express - Shepherd of the Grove P&R	107	240	133
781---Maple Grove - Express - Maple Grove Station	1,713	1,205	-508
782---Maple Grove - Express - Zachary and 96th Av P&R	175	148	-27
783---Maple Grove - Express - Crosswinds Church P&R	291	284	-7
785---Maple Grove - Express - Parkway Station	977	564	-413
787---Maple Grove - Midday Shuttle - Flex Route	28	25	-3
788---Maple Grove - Bass Lake Rd - Crosswinds Church P&R	40	42	2

Route	Observed	Estimated	Difference
789---Maple Grove - U of M	179	19	-160
790---Plymouth - Express - Cub Foods - Four Seasons	329	178	-151
791---Plymouth - Shuttle - Larch Ln - Four Seasons	22	14	-8
793---Plymouth - Express - Cub Foods - Four Seasons	67	7	-60
795---Plymouth - Express - Midday - Northeast Plymouth	17	23	6
80---Maplewood - White Bear Av - Sunray	396	431	35
801---Brooklyn Ctr - Columbia Heights - Rosedale	407	496	89
805---Anoka Traveler - Anoka - Coon Rapids - Northtown	402	386	-16
824---Ltd Stop - Northtown - Monroe - University - Mpls	165	77	-88
825---Ltd Stop - Northtown - St. Anthony - Mpls	663	875	212
83---HarMar Target - Lexington Av	566	914	348
831---Anoka Traveler - 117th Av - Polk - Northtown	154	200	46
84---Rosedale - Snelling - 46th St LRT - Sibley Plaza	1,053	2,146	1,093
850---Express - Riverdale P&R - Foley P&R - Mpls	2,205	2,716	511
852---Express - Anoka - Coon Rapids - Northtown - Mpls	1,109	1,677	568
854---Express - Paul Pkwy - Northdale - Northtown - Mpls	584	660	76
860---Express - Riverdale - Northtown - St Paul	566	495	-71
865---Express - Blaine - Ham Lake - East Bethel	635	344	-291
87---Rosedale - U of M St Paul - Cleveland Av	1,250	2,692	1,442
888---Northstar-Big Lk-Elk Rv-Anoka-Coon Rp-Mpls	2,548	2,492	-56
9---Glenwood Av - Wayzata Blvd - Cedar Lk Rd -46St LRT	2,975	3,888	913
Blue---METRO Blue Line	30,809	31,332	523
Green---METRO Green Line	43,951	43,881	-70
RED---METRO Red Line	954	1,421	467
A Line---A Line	5,133	4,016	-1,117
94---Express - Mpls - St Paul	2,315	4,446	2,131
Total	**346,008**	**346,048**	**40**

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Gold Line

BUS RAPID TRANSIT PROJECT ENVIRONMENTAL ASSESSMENT

Appendix A: Environmental Assessment Technical Reports

Attachment A-3-5:
Freeway Interchange Analysis Area

May 2019

Traffic Memorandum

To:	**Marc Briese, P.E.** **Manager of Design and Construction, Gold Line Bus Rapid Transit Project**
From:	JoNette Kuhnau, P.E., PTOE Traffic Engineering Task Lead, Kimley-Horn and Associates, Inc.
Date:	May 8, 2019
Subject:	Traffic Technical Memorandum – Freeway Interchange Analysis Areas

The purpose of this memorandum is to present the traffic analysis that was completed for freeway interchange areas along the Gold Line Bus Rapid Transit Project (Project). The information presented in this memorandum is specific to areas that are under the jurisdiction of the Minnesota Department of Transportation (MnDOT) and Federal Highway Administration (FHWA), which is a subset of the larger traffic analysis that was completed for the Project.

For a description of the Project and the full transportation analysis, refer to the Background and Alternatives Technical Report and the Transportation Resources Technical Report in Appendix A of the Environmental Assessment (EA). The traffic analysis presented in this memorandum is based on the Project scope as shown in the 15% Concept Plans located in **Attachment 4** of this memorandum.

The traffic modeling results show that the Project is not expected to negatively impact traffic operations or safety conditions on any freeway facilities or at freeway interchange areas. Queue lengths are not expected to extend into the mainline freeway on any ramps within the study area, and all freeway ramp intersections within the study area are anticipated to operate at LOS D or better.

1. REGULATORY CONTEXT AND METHODOLOGY

1.1 Methodology

The traffic operations analysis utilized methodologies from the Highway Capacity Manual (HCM)[1] and created the Project traffic models using Synchro/SimTraffic and Vissim – software packages that implement HCM methodologies. The Project analysis modeled lane geometrics, traffic, transit and pedestrian volumes, intersection-control and signal-timing characteristics.

[1] *Transportation Research Board.* Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis. *2016. Washington, D.C.*

An intersection's "level of service" (LOS) describes a driver's quality of experience relative to the intersection's operations. The HCM uses six letter "grades," from A to F, to describe an intersection's LOS, with LOS A being the best operating conditions and LOS F being the worst.

The HCM uses equations to calculate the delay motorists experience due to traffic signals or stop signs, as well as conflicting traffic, as the basis to determine an intersection's LOS.

Table 1-1 shows the HCM control delay thresholds in seconds per vehicle for each LOS rating.

TABLE 1-1: INTERSECTION LEVEL OF SERVICE DEFINITIONS

LOS	Signalized Intersection Average Delay (Seconds per Vehicle)	Unsignalized Intersection Average Delay (Seconds per Vehicle)
A	<10	<10
B	10-20	10-15
C	20-35	15-25
D	35-55	25-35
E	55-80	35-50
F	>80	>50

Source: HCM

LOS D/E is the acceptable threshold for intersections during the peak traffic hour for urban and suburban areas, according to standard practice in the traffic engineering industry, guidance from the American Association of State Highway and Transportation Officials (AASHTO), MnDOT and Twin Cities Metropolitan Area practice.

The analysis used the following criteria to identify intersections that have traffic-backups or queuing issues:

- A 95th percentile queue length that exceeds lane storage length and has one of the following criteria:
  - Average back-of-queue exceeds storage length
  - Traffic movement operates at LOS E or F
  - 95th percentile queue blocks upstream full-access intersection(s)
- A 95th percentile queue length that exceeds 500 feet on a stop-controlled approach
- An average or 95th percentile queue length that extends onto the mainline freeway

For Project locations where the analysis identified a queuing problem, the Council determined the need for mitigation measures by comparing the intersection's Build Alternative conditions with those of the No-Build Alternative including the severity of the queuing, the potential safety and operations implications to the mainline freeway or at intersections, and whether the queue issue impacts the larger roadway network.

Peak hour analysis reflects the times of day when a facility is typically busiest; therefore, the peak hours indicate the "worst-case scenario" in terms of impacts. The Council analyzed time periods including the hour of highest traffic volume during the weekday morning (AM) peak period (6-9 a.m.) and afternoon (PM) peak period (3-7 p.m.). The peak hour varied by intersection, but the analysis generally identified AM peak hours as occurring between 7-8:30 a.m. and PM peak hours as occurring between 4:30-5:45 p.m.

The operations analysis also incorporated the requirements and standards in the *Minnesota Manual on Uniform Traffic Control Devices*[2] related to signal operations, including transit signals, and transit signal priority and preemption.

1.2 Study Area

The Project includes alignments with the BRT operating in dedicated guideways, mixed traffic and grade-separated operations, which the following statements define:

- **Dedicated guideway:** BRT would operate in its own, dedicated lane that does not allow general traffic; pedestrian, bicycle, and vehicle traffic cross the guideway at controlled intersections
- **Mixed traffic:** BRT would operate within general traffic and not in its own separate lane
- **Grade-separated:** BRT would operate on a structure over or under the existing roadway

Figure 1-1 shows the Build Alternatives within the overall Project area.

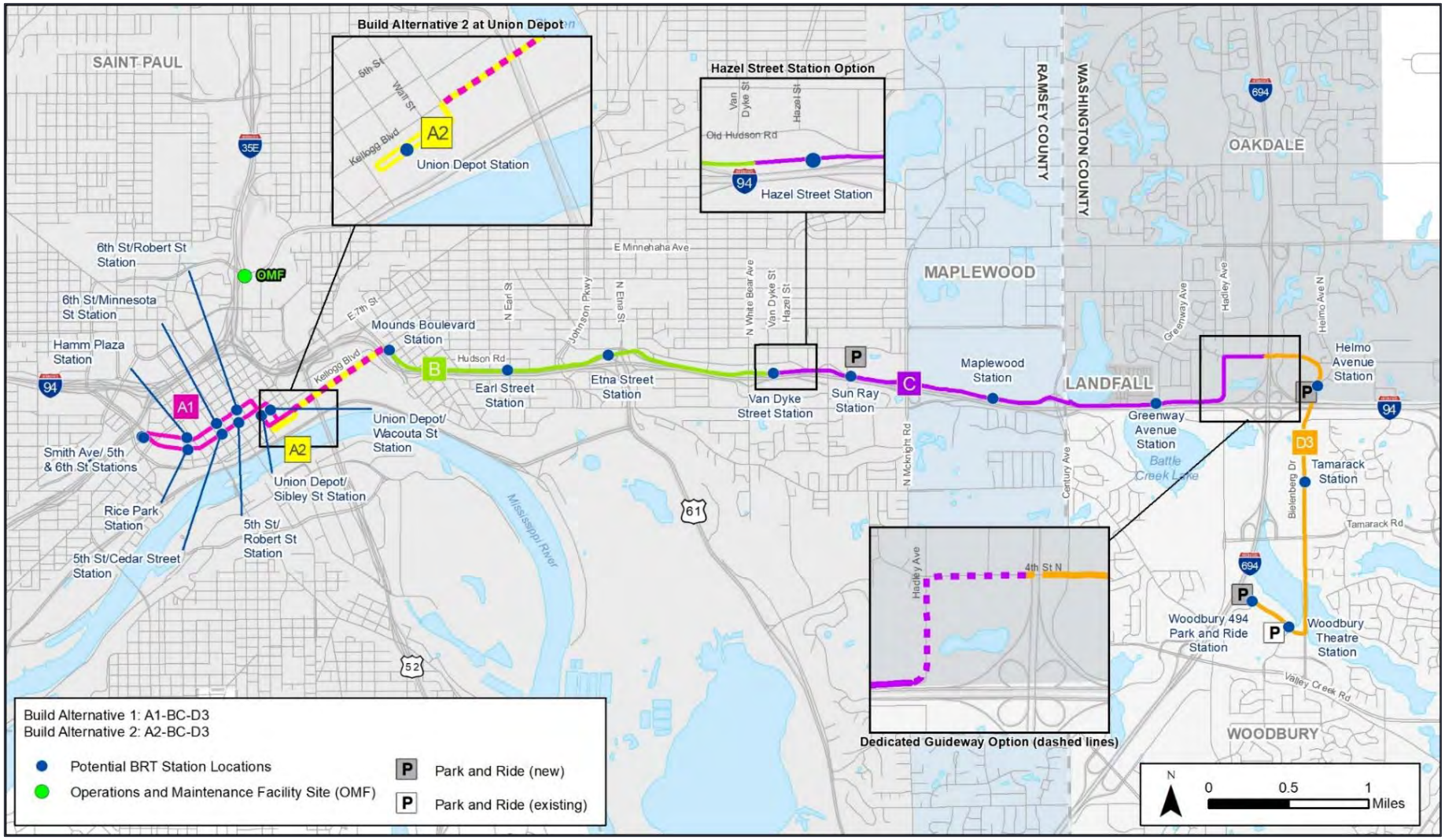
The study area included all intersections on the Project alignments, adjacent intersections on high-traffic roadways, and intersections within the potential area of disturbance. The analysis considered changes and potential impacts to each intersection to determine which intersections the traffic modeling should include. The Council also considered impacts from changes in traffic patterns to potential driveway and access closures or modifications. The traffic modeling included all full-access intersections with the dedicated guideway, adjacent intersections on high-traffic roadways, and intersections with geometric or operations changes that could produce a traffic impact.

The traffic analysis evaluated the following five alignments:

- Alignment A1 (Smith Avenue to Mounds Boulevard), which would operate in bus-only lanes and mixed traffic
- Alignment A2 (Union Depot to Mounds Boulevard), which would operate in mixed traffic
- Alignment B (Mounds Boulevard to White Bear Avenue), which would operate primarily in a dedicated guideway with limited areas of mixed traffic and grade separations at TH 61 and White Bear Avenue
- Alignment C (White Bear Avenue to I-694), which would operate in a dedicated guideway and in mixed traffic and grade separations at Ruth Street, McKnight Road, and Century Avenue
- Alignment D3 (I-694 to Woodbury 494 Park-and-Ride), which would operate primarily in center running and side running dedicated guideways with limited areas in mixed traffic and grade separations at I-694 and I-94

[2] *Minnesota Department of Transportation.* Minnesota Manual on Uniform Traffic Control Devices. *Revision 6. Last Modified: February 21, 2018. Available at: http://www.dot.state.mn.us/trafficeng/publ/mutcd/. Accessed May 2018.*

FIGURE 1-1 PROJECT BUILD ALTERNATIVES IN THE ENVIRONMENTAL ASSESSMENT



This memorandum includes the following interchange areas in or near the Project alignments:

- Alignment A1
  - No analysis included in this memorandum. The Project will operate in mixed traffic at the 5th Street/6th Street intersection with the TH 94 ramps and no geometric changes are proposed at the intersection, therefore no traffic analysis was conducted.
- Alignment A2
  - No analysis included in this memorandum. The alignment does not affect the traffic operations on any interstate or interchange facilities.
- Alignment B
  - TH 94 at Mounds Boulevard analysis included in this memorandum.
  - TH 94 at TH 61 interchange was not included in the traffic analysis because the Project is only proposing to add pedestrian facilities in this area, and is not proposing to modify intersection geometrics or control at the ramp terminals or existing ramp lengths. Therefore, there are no changes that would be discernible in a traffic analysis.
  - TH 94 at White Bear Avenue analysis included in this memorandum.
- Alignment C
  - TH 94 at Ruth Street analysis included in this memorandum.
  - TH 94 at McKnight Road analysis included in this memorandum.
  - Hudson Road at 4th Street, 8th Street, and 19th Street analysis included in this memorandum.
  - TH 94 at Century Avenue (TH 120) analysis included in this memorandum.
- Alignment D3
  - No analysis included in this memorandum. This alignment does not affect the traffic operations on any interstate or interchange facilities.

Figure 1-2, **Figure 1-3** and **Figure 1-4** show the locations of the intersections that were analyzed as part of the Transportation Resources Technical Report in the EA. The intersections included in this technical memorandum are highlighted in yellow.

FIGURE 1-2 ALIGNMENTS A1, A2, AND B ANALYSIS INTERSECTIONS

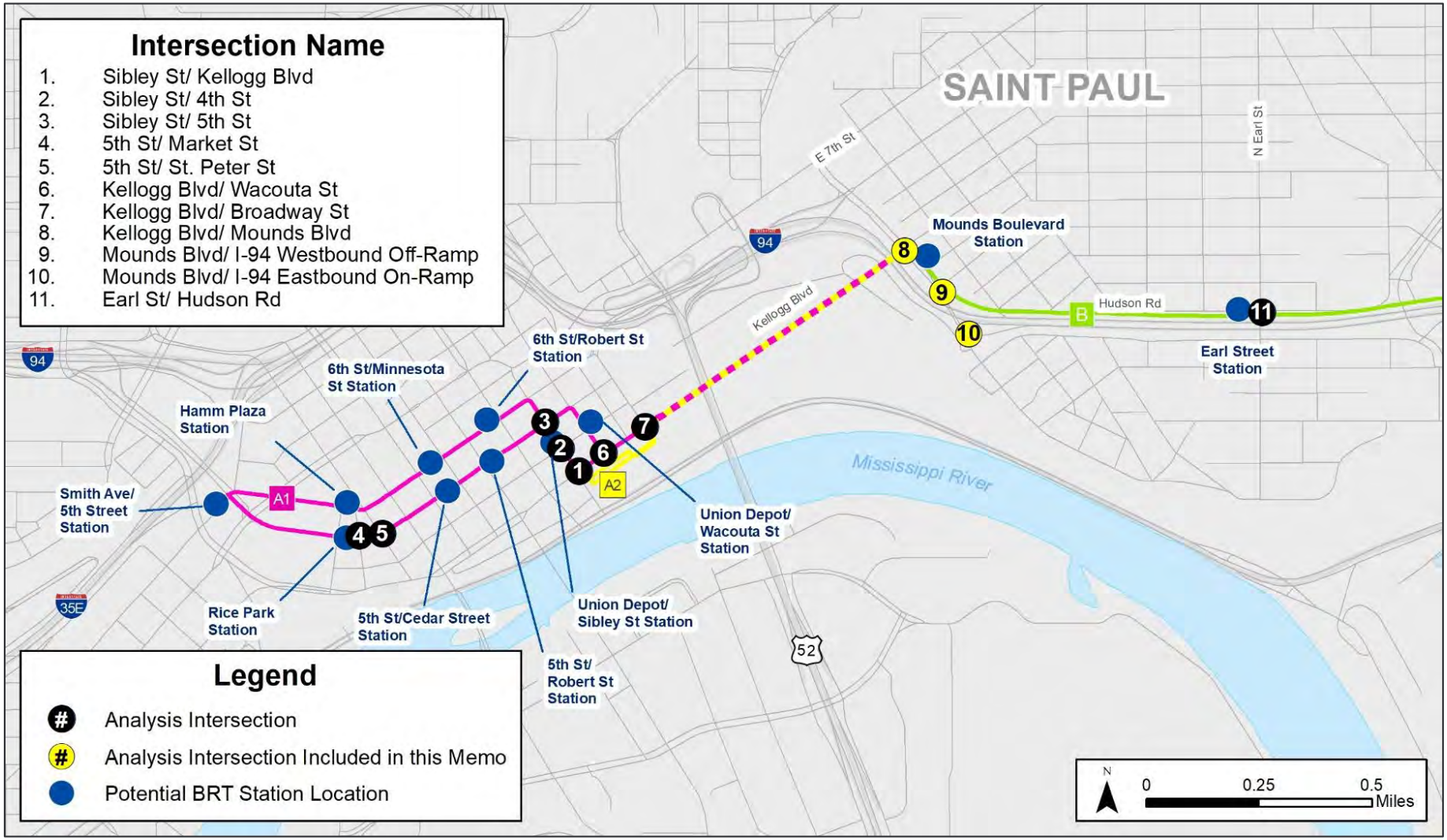


FIGURE 1-3 ALIGNMENTS B AND C ANALYSIS INTERSECTIONS

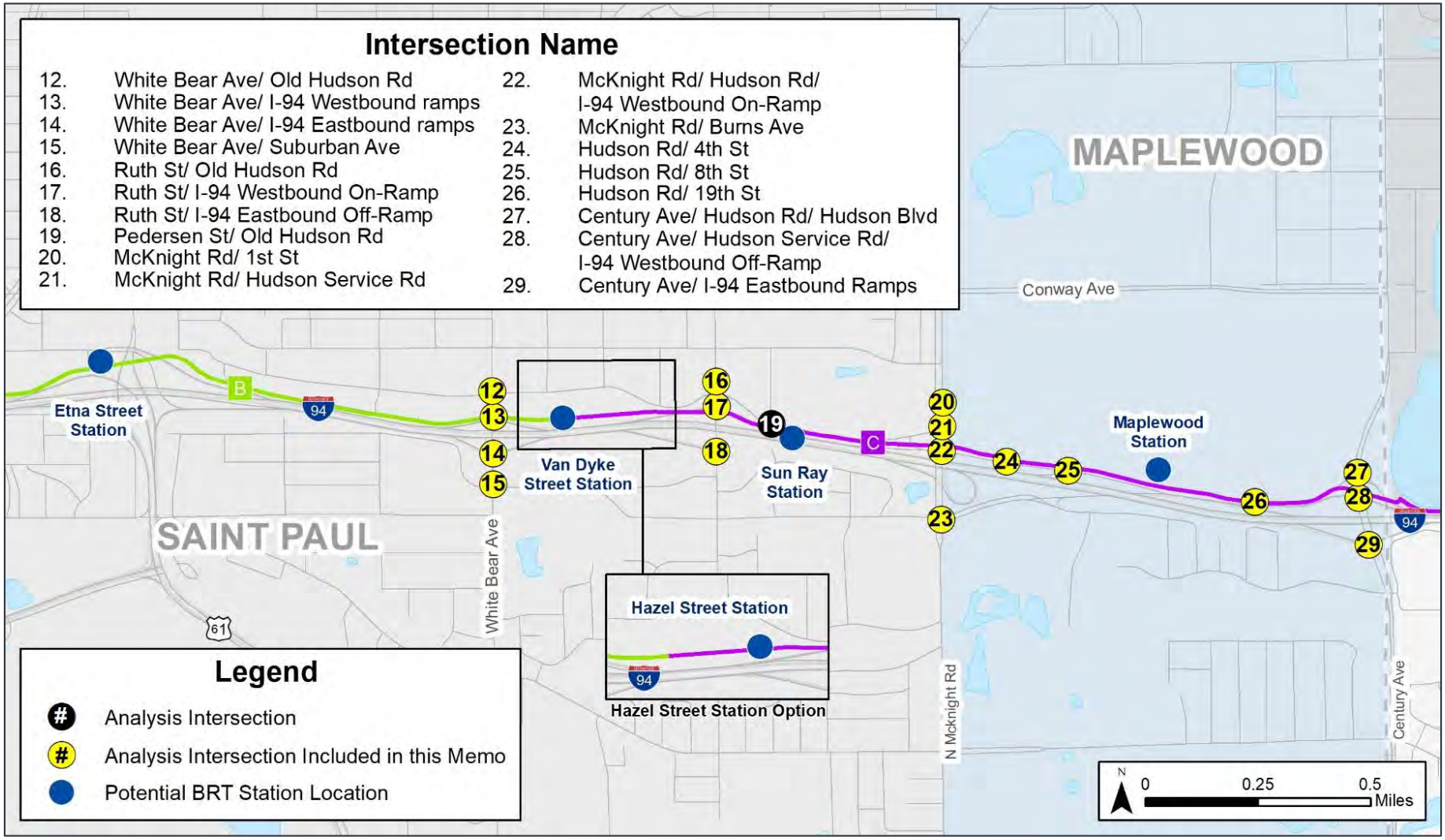
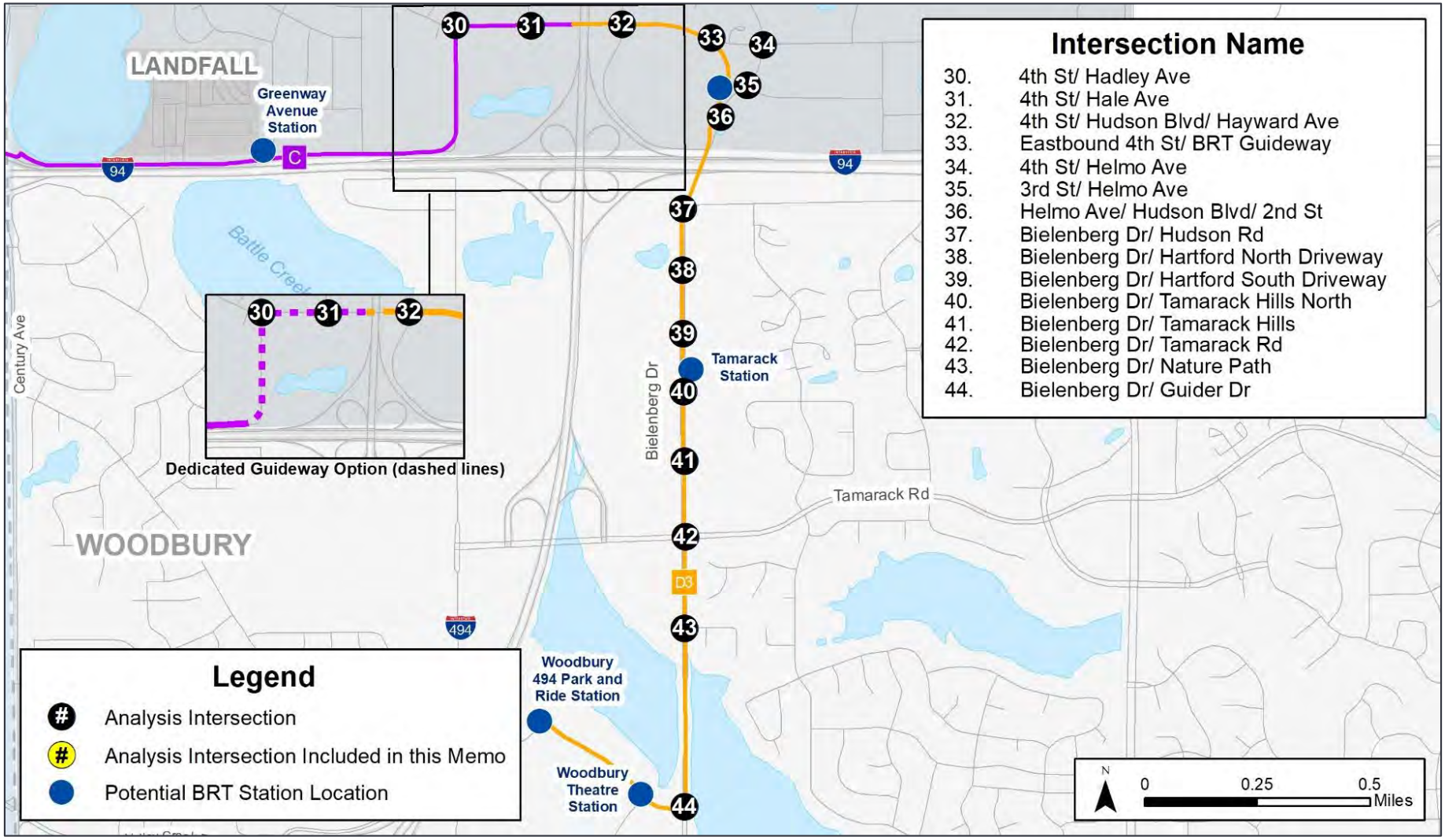


FIGURE 1-4 ALIGNMENTS C AND D3 ANALYSIS INTERSECTIONS



1.3 Forecast Traffic Volumes

The analysis based its future-year traffic forecasts on preliminary 2040 socioeconomic data from local communities consistent with the Council's *2040 Transportation Policy Plan* (2040 TPP). The Council used this data for its regional travel demand model to generate outputs it could then compare with existing and historic traffic counts. The Council developed its future-year forecasts for each roadway segment within the Project area using this data combined with changes in land use and population anticipated in the *Thrive MSP 2040* regional development program.

2. EXISTING OPERATIONS ANALYSIS

2.1 Existing-Conditions Analysis

The Council based its existing-conditions analysis on traffic volumes, roadway geometrics and signal operations as they existed in 2017-2018, when the Project team completed its data collection. The analysis found that all evaluated intersections operate at LOS D or better during the existing-conditions AM and PM peak hours.

Attachment 1 includes tables showing the existing peak hour traffic volumes. **Attachment 2** includes intersection layout tables showing existing-condition geometrics and intersection control. **Attachment 3** includes the complete results of the existing-conditions analysis of delay and LOS.

ALIGNMENT B (MOUNDS BOULEVARD TO WHITE BEAR AVENUE) EXISTING CONDITIONS

For Alignment B, the Council used Vissim to model Intersections 8-10 due to the dedicated guideway, complex traffic signal phasing, or the need to model vehicle interactions in detail at these locations. The Council used Synchro/SimTraffic to model Intersections 12-15 because they are typical configurations and would not have operational interactions with the dedicated guideway under the Build Alternative conditions. The existing-conditions analysis showed that all intersections operate at LOS D or better, and it found the following queuing issue:

- **White Bear Avenue/Old Hudson Road:** For the northbound left-turn movement in the PM peak, the left-turn lane is only 50 feet long due to its proximity to the White Bear Avenue/I-94 westbound ramps intersection. The modeled 95th percentile queue exceeds the storage length in the PM peak hour.

Table 2-1 lists the existing-conditions analysis results for the intersections in Alignment B.

TABLE 2-1: ALIGNMENT B EXISTING AM AND PM PEAK-HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
8. Kellogg Blvd/Mounds Blvd	24.5	C	20.8	C
9. Mounds Blvd/I-94 WB off-ramp	1.9	A	1.5	A
10. Mounds Blvd/I-94 EB on-ramp	4.7	A	8.3	A
12. White Bear Ave/Old Hudson Rd[b]	13.2	B	19.7	B

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
13. White Bear Ave/I-94 WB ramps[b]	9.7	A	13.8	B
14. White Bear Ave/I-94 EB ramps[b]	16.2	B	21.5	C
15. White Bear Ave/Suburban Ave[b]	14.4	B	15.5	B

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

ALIGNMENT C (WHITE BEAR AVENUE TO I-694) EXISTING CONDITIONS

For Alignment C, the Council used Vissim to model Intersections 24-26 due to the dedicated guideway, complex geometrics and traffic signal phasing. The Council used Synchro/SimTraffic to model Intersections 16-18, 20-23, and 27-29 because they are typical configurations and would not interact operationally with the dedicated guideway under the Build Alternative conditions. The existing-conditions analysis showed that all the intersections operate at LOS D or better, and it found the following queuing issues:

- **Century Avenue/Hudson Service Road (SR)/I-94 westbound off-ramp:** Northbound left-turn movement queues through the I-94 eastbound ramps intersection in the AM peak due to heavy traffic accessing I-94 westbound
- **Century Avenue/I-94 eastbound ramps:** Eastbound left-turn movement exceeds the storage length in the AM peak due to signal timing that favors Century Avenue's heavier northbound movements; however, the queue does not reach the mainline freeway

Table 2-2 lists the existing-conditions analysis results for the intersections in Alignment C.

TABLE 2-2: ALIGNMENT C EXISTING AM AND PM PEAK HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
16. Ruth St/Old Hudson Rd[b]	12.8	B	22.8	C
17. Ruth St/I-94 WB on-ramp[b]	2.8	A	10.2	B
18. Ruth St/I-94 EB off-ramp[b]	7.3	A	10.7	B
20. McKnight Rd/1st St[b]	2.4	A	3.8	A
21. McKnight Rd/Hudson SR[b]	1.6	A	10.9	B
22. McKnight Rd/Hudson Rd/I-94 WB on-ramp[b]	7.7	A	20.7	C
23. McKnight Rd/Burns Ave[b]	9.0	A	15.1	B
24. Hudson Rd/4th St	0.3	A	1.4	A

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
25. Hudson Rd/8th St	0.9	A	0.4	A
26. Hudson Rd/19th St	0.8	A	0.1	A
27. Century Ave/Hudson Rd/Hudson Blvd[b]	2.8	A	8.4	A
28. Century Ave/Hudson SR/I-94 WB off-ramp[b]	27.7	C	13.6	B
29. Century Ave/I-94 EB Ramps[b]	21.6	C	36.8	D

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

3. FUTURE YEAR OPERATIONS ANALYSIS

3.1 2040 No-Build Alternative

The No-Build Alternative accounts for the following planned, capacity-related roadway improvement projects:

- Add a managed lane (e.g., MnPASS) on I-94 between downtown Minneapolis (5th and 6th Street South) and Saint Paul (Mounds Boulevard) (MnDOT)
- Traffic signal and turn lane construction at the 4th Street/Helmo Avenue and 4th Street/Hadley Avenue intersections, based on planned development and traffic (Oakdale)

The 2040 No-Build Alternative conditions traffic analysis provides a basis from which the Council could identify Project-related impacts to traffic. The Council based the No-Build Alternative conditions analysis on the forecasted traffic volumes, existing roadway geometrics and intersection control for this scenario (except as noted above). The analysis assumed timing for existing traffic signals would be optimized between the existing and 2040 No-Build Alternative conditions.

Alignment B (Mounds Boulevard to White Bear Avenue) for 2040 No-Build Alternative

For Alignment B, the Council used Vissim to model Intersections 8-10 and Synchro/SimTraffic to model Intersections 12-15, consistent with the existing-conditions analysis. The analysis anticipates that all the intersections would operate at LOS D or better, and it found the following queuing issue:

- **White Bear Avenue/Old Hudson Road** – Northbound left-turn movement in the PM peak: The existing left-turn lane is only 50 feet long due to its proximity to the White Bear Avenue/I-94 westbound ramps intersection. The anticipated 95th percentile queue is expected to exceed the storage length in the PM peak hour. This issue also occurs in the existing conditions.

Table 3-1 lists the 2040 No-Build Alternative analysis results for the intersections in Alignment B.

TABLE 3-1: ALIGNMENT B 2040 NO-BUILD ALTERNATIVE AM AND PM PEAK HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
8. Kellogg Blvd/Mounds Blvd	24.9	C	21.1	C
9. Mounds Blvd/I-94 WB off-ramp	2.1	A	1.6	A
10. Mounds Blvd/I-94 EB on-ramp	4.9	A	8.6	A
12. White Bear Ave/Old Hudson Rd[b]	13.7	B	21.1	C
13. White Bear Ave/I-94 WB Ramps[b]	10.4	B	14.2	B
14. White Bear Ave/I-94 EB Ramps[b]	16.3	B	23.9	C
15. White Bear Ave/Suburban Ave[b]	14.7	B	15.6	B

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

Alignment C (White Bear Avenue to I-694) for 2040 No-Build Alternative

For Alignment C, the Council used Vissim to model Intersections 24-26, and Synchro/SimTraffic to model Intersections 16-18, 20-23 and 27-29, consistent with the existing-conditions analysis. The analysis anticipates that all the intersections would operate at LOS D or better, and it found the following queuing issues:

- **Century Avenue/Hudson SR/I-94 westbound off-ramp** – Northbound left-turn movement queues through the I-94 eastbound ramps intersection in the AM peak due to heavy traffic accessing I-94 westbound. This issue also occurs in the existing conditions.
- **Century Avenue/I-94 eastbound ramps** – Eastbound left-turn movement exceeds the lane storage length in the PM peak due to signal timing that favors the heavier southbound movements on Century Avenue; however, the queue does not reach the mainline freeway

Table 3-2 lists the 2040 No-Build Alternative analysis results for the intersections in Alignment C.

TABLE 3-2: ALIGNMENT C 2040 NO-BUILD ALTERNATIVE AM AND PM PEAK HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
16. Ruth St/Old Hudson Rd[b]	13.4	B	25.1	C
17. Ruth St/I-94 WB on-ramp[b]	3.0	A	12.7	B
18. Ruth St/I-94 EB off-ramp[b]	7.4	A	13.3	B

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
20. McKnight Rd/1st St[b]	2.4	A	3.6	A
21. McKnight Rd/Hudson SR[b]	1.8	A	14.1	B
22. McKnight Rd/Hudson Rd/I-94 WB on-ramp[b]	10.3	B	20.7	C
23. McKnight Rd/Burns Ave[b]	9.3	A	16.5	B
24. Hudson Rd/4th St	0.4	A	1.3	A
25. Hudson Rd/8th St	1.0	A	0.4	A
26. Hudson Rd/19th St	1.0	A	0.1	A
27. Century Ave/Hudson Rd/Hudson Blvd[b]	3.2	A	10.1	B
28. Century Ave/Hudson SR/I-94 WB off-ramp[b]	26.0	C	14.8	B
29. Century Ave/I-94 EB Ramps[b]	18.3	B	41.6	D

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

3.2 2040 Build Alternative 1 (A1-BC-D3)

The Project proposes four park-and-ride facilities. The Project would newly construct three, and one would use the existing Woodbury Theatre facility where a portion of the existing spaces would be available for the Project users. **Table 3-3** lists the Project's proposed park-and-ride sites.

TABLE 3-3:PROJECT PARK-AND-RIDE SITES

Park-and-Ride Site	Number of Spaces	Type of Structure
Sun Ray Station	150[a]	New Surface Lot
Helmo Avenue Station	100	New Surface Lot
Woodbury Theatre Station	150	Existing Surface Lot
Woodbury 494 Park-and-Ride Station	200	New Surface Lot

[a] *The Project would construct a total of 186 spaces, of which 150 would be for park-and-ride use and 36 would be replacement spaces for existing land uses. Existing traffic counts already captured the traffic generated by the 36 replacement spaces; therefore, the Council did not complete additional traffic analysis for the replacement spaces.*

For Build Alternative 1 Alignments B and C, the Council would incorporate several improvements that would provide adequate infrastructure to accommodate buses, pedestrians and park-and-ride traffic near stations; provide LOS D or better traffic operations at all intersections; and safely and efficiently control BRT bus movements at intersections.

At full-access intersections with a dedicated center or side running guideway, the Project would construct new traffic signals to safely control the movements of vehicles, pedestrians, bicycles and the BRT buses through the intersections. Full-access intersections where BRT buses operate in mixed traffic, or where the guideway would run curbside to the right of the vehicle lane, generally would not need traffic signals to safely accommodate the BRT traffic. **Attachment 2** includes tables that show the geometrics and intersection control for the 2040 Build Alternative conditions. **Attachment 3** includes the complete results of the Build Alternative conditions analysis of delay and LOS.

The 2040 Build Alternative 1 modeling factored the roadway infrastructure improvements shown in the 15% Concept Plans in **Attachment 4** that include traffic signal modifications/reconstructions, grade crossings, one-way streets, and other infrastructure changes that are part of the Project.

The infrastructure improvements that were part of the Build Alternative for the intersections included in this memorandum included:

- Alignment B
  - Add a new traffic signal at the Mounds Boulevard/I-94 westbound off-ramp intersection to provide a controlled pedestrian crossing and to control the merging of the northbound movements.
- Alignment C
  - Close the southbound right-turn movement at the Hudson Road/4th Street intersection due to low traffic volumes and geometric constraints with the BRT guideway
  - Add a new traffic signal at the Hudson Road/4th Street intersection to control movements at the intersection with the BRT guideway; the traffic signal would not stop Hudson Road through traffic
  - Add a new traffic signal at the Hudson Road/8th Street intersection to control movements at the intersection with the BRT guideway; the traffic signal would not stop Hudson Road through traffic
  - Add a new traffic signal at the Hudson Road/19th Street intersection to control movements at the intersection with the BRT guideway; the traffic signal would not stop Hudson Road through traffic

Alignment B (Mounds Boulevard to White Bear Avenue) for 2040 Build Alternative 1

For Alignment B, the Council used Vissim to model Intersections 8-10 and Synchro/SimTraffic to model Intersections 12-15, consistent with the existing-conditions and 2040 No-Build Alternative analyses. The analysis anticipates that all the intersections would operate at LOS D or better, and it found the following queuing issue:

- **White Bear Avenue/Old Hudson Road:** For the northbound left-turn movement in the PM peak; the existing left-turn lane is only 50 feet long due to the proximity to the White Bear Avenue/I-94 westbound ramps intersection. The anticipated 95th percentile queue length is expected to exceed the storage length in the PM peak hour. This issue also occurs in the existing and 2040 No-Build Alternative conditions.

Table 3-4 lists the 2040 Build Alternative 1 analysis results for the intersections in Alignment B.

TABLE 3-4: ALIGNMENT B 2040 AM AND PM PEAK HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
8. Kellogg Blvd/Mounds Blvd	30.1	C	29.9	C
9. Mounds Blvd/I-94 WB off-ramp	24.3	C	16.5	B
10. Mounds Blvd/I-94 EB on-ramp	5.1	A	7.5	A
12. White Bear Ave/Old Hudson Rd[b]	13.5	B	20.1	C
13. White Bear Ave/I-94 WB Ramps[b]	10.5	B	15.2	B
14. White Bear Ave/I-94 EB Ramps[b]	16.7	B	24.0	C
15. White Bear Ave/Suburban Ave[b]	14.6	B	15.9	B

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

Alignment C (White Bear Avenue to I-694) for 2040 Build Alternative 1

The Council used Vissim to model Intersections 24-26, and Synchro/SimTraffic to model Intersections 16-18, 20-23 and 27-29, consistent with the existing-conditions and 2040 No-Build Alternative analyses. The analysis anticipates that all the intersections would operate at LOS D or better, and it found the following queuing issues:

- **Century Avenue/Hudson SR/I-94 westbound off-ramp**: Northbound left-turn movement queues through the I-94 eastbound ramps intersection in the AM peak due to heavy traffic volumes accessing I-94 westbound; this issue also occurs in the existing and 2040 No-Build Alternative conditions.
- **Century Avenue/I-94 eastbound ramps:** Eastbound left-turn movement exceeds the lane storage length in the PM peak due to signal timing that favors the heavier southbound movements on Century Avenue; however, the queue does not reach the mainline freeway; the same issue occurs in the 2040 No-Build Alternative conditions.

Table 3-5 lists the 2040 Build Alternative 1 analysis results for the intersections in Alignment C.

The station location for the Hazel Street Station Option would not affect traffic operations at any of the intersections; therefore, the Council did not model this option.

TABLE 3-5: ALIGNMENT C 2040 AM AND PM PEAK HOUR INTERSECTION OPERATIONS

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
16. Ruth St/Old Hudson Rd[b]	13.0	B	25.2	C
17. Ruth St/I-94 WB on-ramp[b]	2.5	A	11.2	B

Intersection	Weekday AM Peak Hour Avg. Vehicle Delay[a]	Weekday AM Peak Hour Intersection LOS	Weekday PM Peak Hour Avg. Vehicle Delay[a]	Weekday PM Peak Hour Intersection LOS
18. Ruth St/I-94 EB off-ramp[b]	7.5	A	11.0	B
20. McKnight Rd/1st St[b]	2.9	A	3.6	A
21. McKnight Rd/Hudson SR[b]	2.3	A	20.6	C
22. McKnight Rd/Hudson Rd/I-94 WB on-ramp[b]	12.7	B	21.2	C
23. McKnight Rd/Burns Ave[b]	10.4	B	17.1	B
24. Hudson Rd/4th St	0.7	A	0.1	A
25. Hudson Rd/8th St	4.6	A	1.7	A
26. Hudson Rd/19th St	3.4	A	3.5	A
27. Century Ave/Hudson Rd/Hudson Blvd[b]	3.7	A	7.3	A
28. Century Ave/Hudson SR/I-94 WB off-ramp[b]	26.4	C	15.0	B
29. Century Ave/I-94 EB Ramps[b]	22.6	C	52.2	D

[a] *Delay measured in seconds per vehicle.*

[b] *Intersection modeled in Synchro/SimTraffic (all other intersections modeled in Vissim).*

2040 Build Alternative 1 Conditions Summary

The 2040 Build Alternative 1 analysis factored the following improvements to provide LOS D or better traffic operations at all intersections, and to provide safe and efficient traffic and BRT operations:

- Alignment B
  - New traffic signal at the Mounds Boulevard/I-94 westbound off-ramp intersection
- Alignment C
  - New traffic signal at the Hudson Road/4th Street intersection
  - New traffic signal at the Hudson Road/8th Street intersection
  - New traffic signal at the Hudson Road/19th Street intersection

The 15% Concept Plans in **Attachment 4** show all traffic signal modifications/reconstructions, grade crossings, one-way streets, and other infrastructure changes that are part of the Project.

With these improvements the Council anticipates that all intersections included in this memorandum would operate at overall LOS D or better in the 2040 Build Alternative 1 AM and PM peak hour conditions.

3.3 2040 Build Alternative 2 (A2-BC-D3)

Build Alternative 2 includes an alternative alignment (Alignment A2) in downtown Saint Paul that would terminate at Union Depot instead of at the Smith Avenue Transit Center. All the intersections included in this memorandum

are the same in Build Alternative 2 as in Build Alternative 1, therefore no additional analysis is included for 2040 Build Alternative 2.

4. SUMMARY

Based on measures incorporated as part of the Project design, the Council does not anticipate long-term impacts to traffic; therefore, they do not propose additional avoidance, minimization or mitigation measures for either Build Alternative 1 or Build Alternative 2. As part of its design, the Project would incorporate improvements to roadways and intersections to provide LOS D or better traffic operations in the Project corridor, and to provide safe and efficient traffic and BRT operations. Both Build Alternatives would achieve an acceptable LOS D or better with these improvements in place.

The Project is not expected to negatively impact traffic operations or safety conditions on any freeway facilities or at freeway interchange areas. Queue lengths are not expected to extend onto the mainline freeway on any ramps within the study area, and all freeway ramp intersections are expected to operate at LOS D or better.

To address short-term impacts, the Council will develop a detailed construction staging plan for the Project. It will also develop maintenance of traffic (MOT) plans during the Engineering Phase to address construction phasing, traffic signal operations, and access through the work zone, road closures and traffic detours.

ATTACHMENT 1 - TRAFFIC VOLUMES

2018 Existing AM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
	Alignment B												
8	Kellogg Blvd & Mounds Blvd	735	830	30	75	195	125	130	105	35	20	390	275
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	160	--	--	250	--	--	--	--	177	1440	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	160	105	200	225	--	--	--	--	--	--	--
12	White Bear Ave & Old Hudson Rd	75	625	50	15	575	15	15	25	100	150	55	85
13	White Bear Ave & I-94 Westbound Ramps	100	500	--	--	375	450	--	--	--	100	85	250
14	White Bear Ave & I-94 Eastbound Ramps	--	300	80	175	300	--	300	5	120	--	--	--
15	White Bear Ave & Suburban Ave	10	170	50	145	215	60	60	20	10	180	15	150
	Alignment C												
16	Ruth St & Old Hudson Rd	70	190	25	15	230	15	10	20	30	150	210	75
17	Ruth St & I-94 Westbound On-Ramp	140	285	--	--	175	235	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	325	--	--	175	--	100	--	90	--	--	--
20	McKnight Rd & 1st St	--	860	25	100	620	--	--	--	--	0	--	5
21	McKnight Rd & Hudson Service Rd	--	855	680	--	570	50	30	--	40	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	210	1425	--	--	355	255	--	--	--	45	45	110
23	McKnight Rd & Burns Ave	35	585	55	115	335	45	50	45	30	5	5	10
24	Hudson Rd & 4th St	--	--	--	--	--	5	--	--	--	--	195	50
25	Hudson Rd & 8th St	--	--	--	--	--	10	--	--	--	--	235	475
26	Hudson Rd & 19th St	--	--	--	--	--	30	--	--	--	--	625	555
27	Century Ave & Hudson Rd / Hudson Blvd	--	1295	165	15	305	220	--	--	--	--	--	100
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	465	755	--	--	300	5	--	--	--	85	490	705
29	Century Ave & I-94 Eastbound Ramps	--	1005	75	105	280	--	215	0	175	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

2018 Existing PM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
	Alignment B												
8	Kellogg Blvd & Mounds Blvd	50	340	170	205	815	50	135	315	550	35	185	180
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	145	--	--	1395	--	--	--	--	100	415	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	145	155	970	520	--	--	--	--	--	--	--
12	White Bear Ave & Old Hudson Rd	120	850	70	60	765	10	50	35	140	100	40	50
13	White Bear Ave & I-94 Westbound Ramps	150	840	--	--	600	405	--	--	--	100	5	200
14	White Bear Ave & I-94 Eastbound Ramps	--	475	125	250	450	--	515	5	275	--	--	--
15	White Bear Ave & Suburban Ave	15	150	125	300	225	200	175	100	30	120	40	275
	Alignment C												
16	Ruth St & Old Hudson Rd	25	375	225	50	280	20	25	100	50	275	65	10
17	Ruth St & I-94 Westbound On-Ramp	100	625	--	--	300	275	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	405	--	--	300	--	320	--	180	--	--	--
20	McKnight Rd & 1st St	--	775	5	5	1300	--	--	--	--	5	--	0
21	McKnight Rd & Hudson Service Rd	--	710	25	--	1145	160	70	--	175	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	210	620	--	--	770	550	--	--	--	215	245	115
23	McKnight Rd & Burns Ave	45	425	50	375	690	115	65	75	70	5	5	15
24	Hudson Rd & 4th St	--	--	--	--	--	95	--	--	--	--	480	5
25	Hudson Rd & 8th St	--	--	--	--	--	90	--	--	--	--	395	20
26	Hudson Rd & 19th St	--	--	--	--	--	450	--	--	--	--	400	20
27	Century Ave & Hudson Rd / Hudson Blvd	--	555	220	90	1830	235	--	--	--	--	--	105
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	145	675	--	--	1815	15	--	--	--	100	25	100
29	Century Ave & I-94 Eastbound Ramps	--	405	130	1125	790	--	415	0	300	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

2040 No-Build AM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Alignment B													
8	Kellogg Blvd & Mounds Blvd	770	870	30	80	205	130	135	110	35	20	410	290
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	170	--	--	265	--	--	--	--	185	1510	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	170	110	210	235	--	--	--	--	--	--	--
12	White Bear Ave & Old Hudson Rd	80	655	55	15	605	15	15	25	105	160	60	90
13	White Bear Ave & I-94 Westbound Ramps	105	525	--	--	395	475	--	--	--	105	90	265
14	White Bear Ave & I-94 Eastbound Ramps	--	315	85	185	315	--	315	5	125	--	--	--
15	White Bear Ave & Suburban Ave	10	180	55	150	225	65	65	20	10	190	15	160
Alignment C													
16	Ruth St & Old Hudson Rd	75	200	25	15	240	15	10	20	35	160	220	80
17	Ruth St & I-94 Westbound On-Ramp	150	300	--	--	185	250	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	340	--	--	185	--	105	--	95	--	--	--
20	McKnight Rd & 1st St	--	900	30	100	655	--	--	--	--	0	--	10
21	McKnight Rd & Hudson Service Rd	--	895	715	--	600	55	35	--	45	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	220	1480	--	--	375	270	--	--	--	55	50	130
23	McKnight Rd & Burns Ave	40	615	60	120	345	50	55	50	35	10	10	15
24	Hudson Rd & 4th St	--	--	--	--	--	10	--	--	--	--	225	55
25	Hudson Rd & 8th St	--	--	--	--	--	15	--	--	--	--	265	490
26	Hudson Rd & 19th St	--	--	--	--	--	35	--	--	--	--	665	570
27	Century Ave & Hudson Rd / Hudson Blvd	--	1395	165	15	320	210	--	--	--	--	--	125
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	480	820	--	--	315	5	--	--	--	100	540	740
29	Century Ave & I-94 Eastbound Ramps	--	1085	85	115	300	--	215	0	185	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

2040 No-Build PM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
	Alignment B												
8	Kellogg Blvd & Mounds Blvd	55	355	180	215	855	55	140	330	580	35	195	190
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	150	--	--	1465	--	--	--	--	105	435	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	150	165	1020	545	--	--	--	--	--	--	--
12	White Bear Ave & Old Hudson Rd	125	895	75	65	805	10	55	40	150	105	45	55
13	White Bear Ave & I-94 Westbound Ramps	160	880	--	--	630	425	--	--	--	105	5	210
14	White Bear Ave & I-94 Eastbound Ramps	--	500	130	265	475	--	540	5	290	--	--	--
15	White Bear Ave & Suburban Ave	15	160	130	315	235	210	185	105	35	125	45	290
	Alignment C												
16	Ruth St & Old Hudson Rd	25	395	235	55	265	20	25	105	55	290	70	10
17	Ruth St & I-94 Westbound On-Ramp	105	655	--	--	315	290	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	425	--	--	315	--	335	--	190	--	--	--
20	McKnight Rd & 1st St	--	805	10	10	1360	--	--	--	--	10	--	0
21	McKnight Rd & Hudson Service Rd	--	740	30	--	1200	170	75	--	185	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	220	650	--	--	810	575	--	--	--	220	250	120
23	McKnight Rd & Burns Ave	50	445	55	385	710	120	70	85	75	10	10	20
24	Hudson Rd & 4th St	--	--	--	--	--	100	--	--	--	--	490	10
25	Hudson Rd & 8th St	--	--	--	--	--	95	--	--	--	--	405	25
26	Hudson Rd & 19th St	--	--	--	--	--	465	--	--	--	--	410	25
27	Century Ave & Hudson Rd / Hudson Blvd	--	620	220	90	1930	235	--	--	--	--	--	130
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	155	725	--	--	1915	15	--	--	--	115	30	115
29	Century Ave & I-94 Eastbound Ramps	--	445	150	1190	840	--	435	0	315	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

2040 Build AM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
	Alignment B												
8	**Kellogg Blvd & Mounds Blvd**	770	870	30	80	205	130	135	115	35	20	410	290
9	**Mounds Blvd & I-94 Westbound Off-Ramp**	--	170	--	--	265	--	--	--	--	185	1510	--
10	**Mounds Blvd & I-94 Eastbound On-Ramp**	--	170	110	210	235	--	--	--	--	--	--	--
12	**White Bear Ave & Old Hudson Rd**	80	655	55	15	605	15	15	25	105	160	60	90
13	**White Bear Ave & I-94 Westbound Ramps**	105	525	--	--	395	475	--	--	--	105	90	265
14	**White Bear Ave & I-94 Eastbound Ramps**	--	315	85	185	315	--	315	5	125	--	--	--
15	**White Bear Ave & Suburban Ave**	10	180	55	150	225	65	65	20	10	190	15	160
	Alignment C												
16	**Ruth St & Old Hudson Rd**	75	200	25	15	240	15	10	20	35	160	220	80
17	**Ruth St & I-94 Westbound On-Ramp**	150	300	--	--	185	250	--	--	--	--	--	--
18	**Ruth St & I-94 Eastbound Off-Ramp**	--	340	--	--	185	--	105	--	95	--	--	--
20	**McKnight Rd & 1st St**	--	900	30	100	665	--	--	--	--	0	--	10
21	**McKnight Rd & Hudson Service Rd**	--	895	715	--	600	65	35	--	55	--	--	--
22	**McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp**	230	1480	--	--	385	270	--	--	--	55	100	130
23	**McKnight Rd & Burns Ave**	40	625	60	130	345	50	55	50	35	10	10	15
24	**Hudson Rd & 4th St**	--	--	--	--	--		--	--	--	--	285	55
25	**Hudson Rd & 8th St**	--	--	--	--	--	25	--	--	--	--	315	490
26	**Hudson Rd & 19th St**	--	--	--	--	--	35	--	--	--	--	715	570
27	**Century Ave & Hudson Rd / Hudson Blvd**	--	1395	165	15	530	--	--	--	--	--	--	125
28	**Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp**	480	820	--	--	315	215	--	--	--	100	540	740
29	**Century Ave & I-94 Eastbound Ramps**	--	1085	85	115	300	--	215	0	185	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

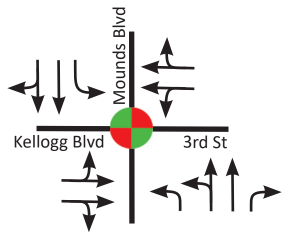
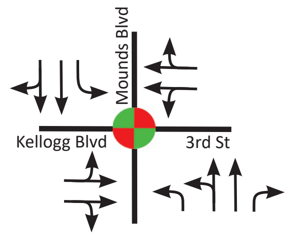
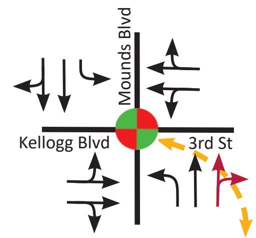
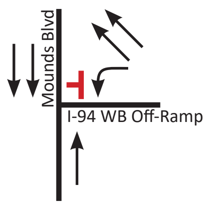
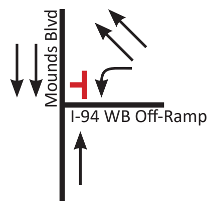
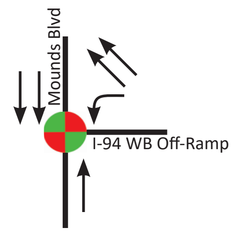
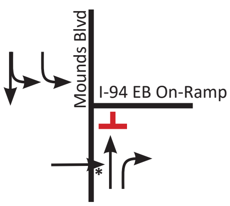
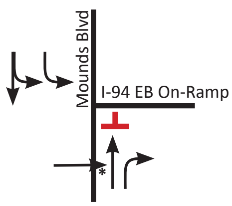
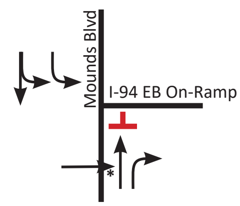
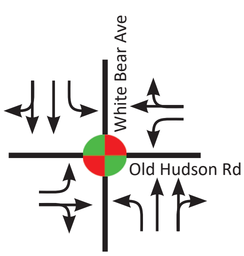
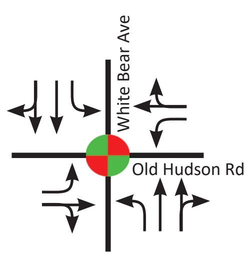
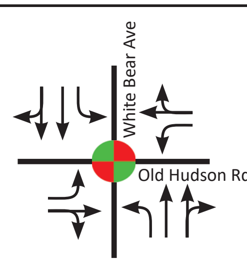
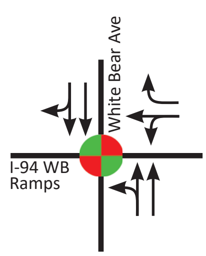
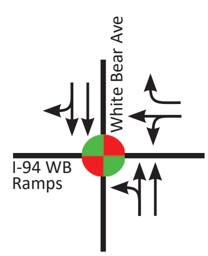
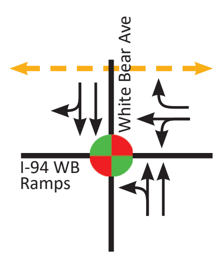
2040 Build PM Peak Hour Volumes

#	Intersection	Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Alignment B													
8	Kellogg Blvd & Mounds Blvd	55	355	180	215	855	55	140	330	585	35	195	190
9	Mounds Blvd & I-94 Westbound Off-Ramp	--	150	--	--	1465	--	--	--	--	105	435	--
10	Mounds Blvd & I-94 Eastbound On-Ramp	--	150	165	1020	545	--	--	--	--	--	--	--
12	White Bear Ave & Old Hudson Rd	125	895	75	65	805	10	55	40	150	105	45	55
13	White Bear Ave & I-94 Westbound Ramps	160	880	--	--	630	425	--	--	--	105	5	210
14	White Bear Ave & I-94 Eastbound Ramps	--	500	130	265	475	--	540	5	290	--	--	--
15	White Bear Ave & Suburban Ave	15	160	130	315	235	210	185	105	35	125	45	290
Alignment C													
16	Ruth St & Old Hudson Rd	25	395	235	55	265	20	25	105	55	290	70	10
17	Ruth St & I-94 Westbound On-Ramp	105	655	--	--	315	290	--	--	--	--	--	--
18	Ruth St & I-94 Eastbound Off-Ramp	--	425	--	--	315	--	335	--	190	--	--	--
20	McKnight Rd & 1st St	--	815	10	10	1360	--	--	--	--	10	--	0
21	McKnight Rd & Hudson Service Rd	--	740	30	--	1200	170	85	--	235	--	--	--
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp	220	650	--	--	860	575	--	--	--	220	260	120
23	McKnight Rd & Burns Ave	50	445	55	425	720	120	70	85	75	10	10	20
24	Hudson Rd & 4th St	--	--	--	--	--		--	--	--	--	600	10
25	Hudson Rd & 8th St	--	--	--	--	--	195	--	--	--	--	415	25
26	Hudson Rd & 19th St	--	--	--	--	--	465	--	--	--	--	420	25
27	Century Ave & Hudson Rd / Hudson Blvd	--	620	220	90	2165	--	--	--	--	--	--	130
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp	155	725	--	--	1915	250	--	--	--	115	30	115
29	Century Ave & I-94 Eastbound Ramps	--	445	150	1190	840	--	435	0	315	--	--	--

X'd out box indicates a turn movement or intersection was eliminated or did not yet exist

ATTACHMENT 2 - INTERSECTION GEOMETRICS AND CONTROL

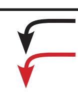
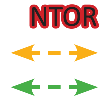
Gold Line BRT Intersection Layout Table

Intersection	Existing	No Build	Build	Notes
Kellogg Blvd / Mounds Blvd	 N-S Prot + Perm / E-W Perm *NOTE: Eastbound right turn lane currently closed due to bridge structural rating*	 N-S Prot + Perm / E-W Perm *NOTE: Eastbound right turn lane currently closed due to bridge structural rating*	 N-S Prot + Perm / E-W Perm *NOTE: Eastbound right turn lane currently closed due to bridge structural rating*	WB BRT operates on exclusive phase. EB BRT operates in mixed traffic with the EB TH and RT movements.
Mounds Blvd / I-94 Westbound Off-Ramp			 W Perm	Pedestrian crossing of Mounds Blvd added in Build Alternatives 1 and 2
Mounds Blvd / I-94 Eastbound On-Ramp				
White Bear Ave / Old Hudson Rd	 N-S Prot + Perm / E-W Perm	 N-S Prot + Perm / E-W Perm	 N-S Prot + Perm / E-W Perm	
White Bear Ave / I-94 Westbound Ramps	 N Prot + Perm / W Perm	 N Prot + Perm / W Perm	 N Prot + Perm / W Perm	BRT grade-separated

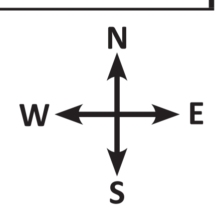
Legend

Traffic Signal
Stop Control

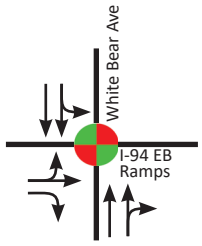
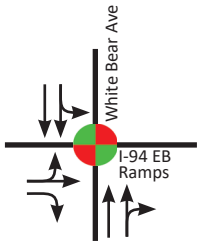
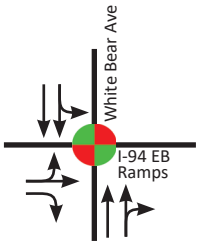
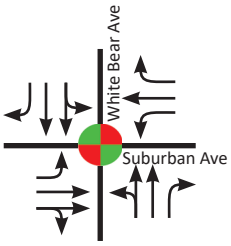
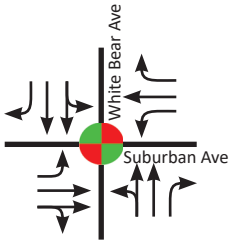
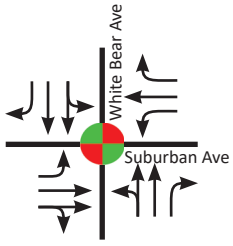
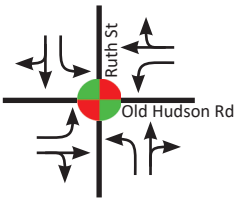
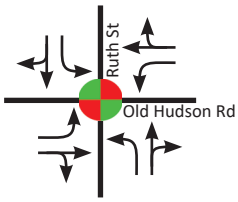
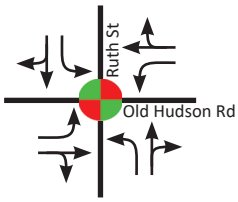
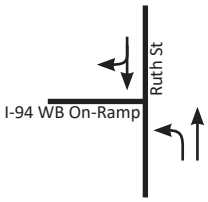
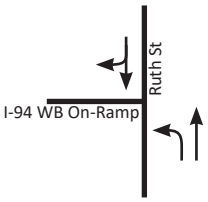
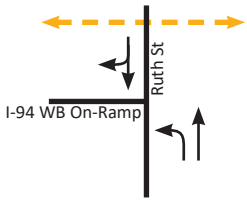
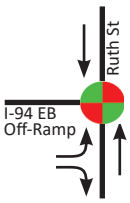
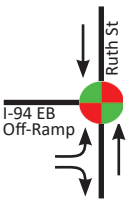
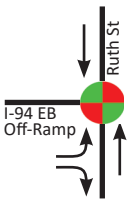
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

Lane Use
Lane Use Change

No Turn on Red — NTOR
BRT Guideway
LRT


Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase



Gold Line BRT Intersection Layout Table

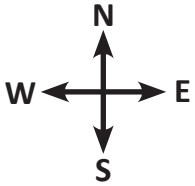
Intersection	Existing	No Build	Build	Notes
White Bear Ave / I-94 Eastbound Ramps	 S Prot + Perm / E Perm	 S Prot + Perm / E Perm	 S Prot + Perm / E Perm	
White Bear Ave / Suburban Ave	 N Perm / S Prot + Perm / E Prot + Perm / W Perm	 N Perm / S Prot + Perm / E Prot + Perm / W Perm	 N Perm / S Prot + Perm / E Prot + Perm / W Perm	
Ruth St / Old Hudson Rd	 N-S Perm / E Prot + Perm / W Perm	 N-S Perm / E Prot + Perm / W Perm	 N-S Perm / E Prot + Perm / W Perm	
Ruth St / I-94 Westbound On-Ramp				BRT is grade-separated
Ruth St / I-94 Eastbound Off-Ramp	 E Perm	 E Perm	 E Perm	

Legend

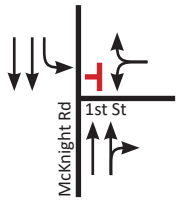
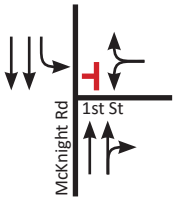
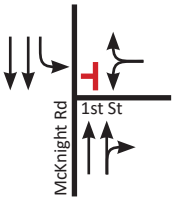
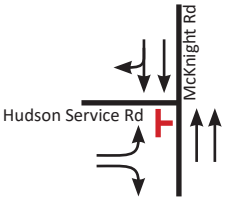
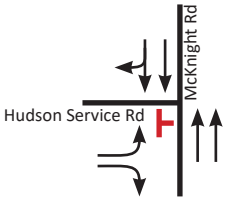
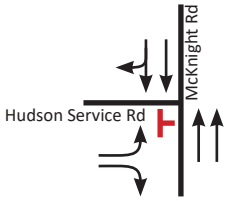
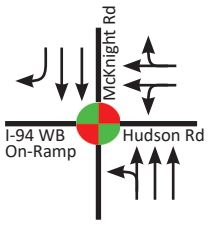
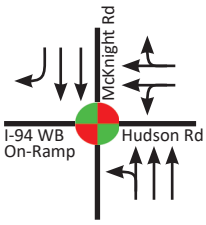
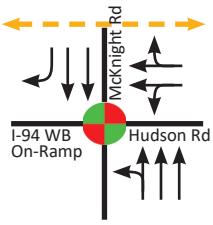
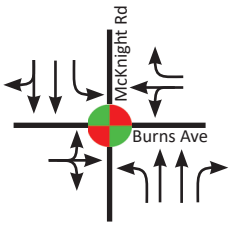
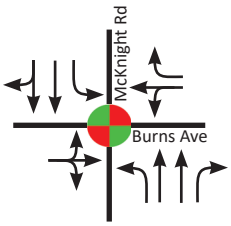
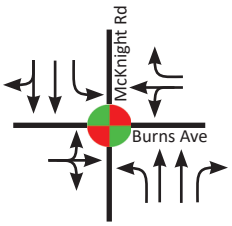
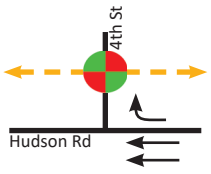
Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase



Gold Line BRT Intersection Layout Table

Intersection	Existing	No Build	Build	Notes
McKnight Rd / 1st St				
McKnight Rd / Hudson Service Rd				
McKnight Rd / Hudson Rd / I-94 Westbound On-Ramp	 **N Prot + Perm / W Perm**	 **N Prot + Perm / W Perm**	 **N Prot + Perm / W Perm**	BRT is grade-separated
McKnight Rd / Burns Ave	 **N-S Prot + Perm / E-W Perm**	 **N-S Prot + Perm / E-W Perm**	 **N-S Prot + Perm / E-W Perm**	
Hudson Rd / 4th St				Partial signal installed and southbound right-turn restricted in Build Alternatives 1 and 2

Legend

Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

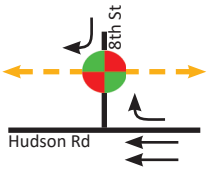
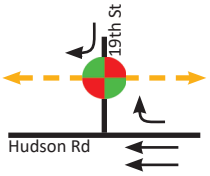
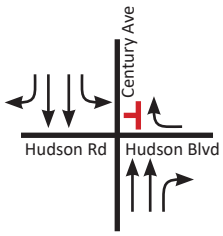
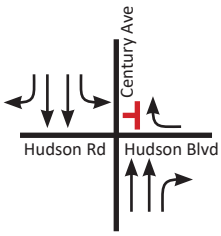
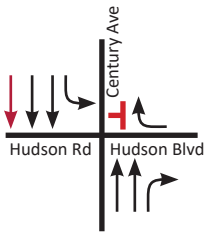
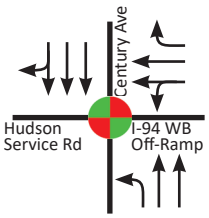
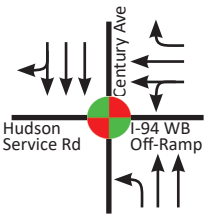
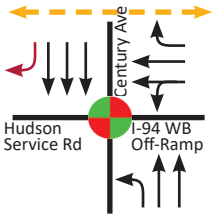
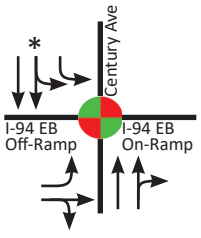
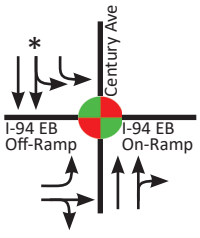
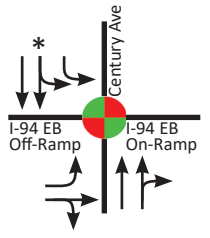
Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

NTOR

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase

N
W E
S

Gold Line BRT Intersection Layout Table

Intersection	Existing	No Build	Build	Notes
Hudson Rd / 8th St				Partial signal installed in Build Alternatives 1 and 2
Hudson Rd / 19th St				Partial signal installed in Build Alternatives 1 and 2
Century Ave / Hudson Rd / Hudson Blvd				
Century Ave / Hudson Service Rd / I-94 Westbound Off-Ramp	 **N Prot + Perm / W Perm**	 **N Prot + Perm / W Perm**	 **N Prot + Perm / W Perm**	BRT grade-separated
Century Ave / I-94 Eastbound Ramps	 **S Prot + Perm / W Perm**	 **S Prot + Perm / W Perm**	 **S Prot + Perm / W Perm**	*Dynamic Lane Use AM - Thru PM - Shared Left/Thru

Legend

Traffic Signal
Stop Control
N = NB Approach
S = SB Approach
E = EB Approach
W = WB Approach

Lane Use
Lane Use Change
No Turn on Red
BRT Guideway
LRT

NTOR

Perm = Permissive Left-Turn Phase
Prot = Protected Left-Turn Phase
Prot+Perm = Protected/ Permissive Left-Turn Phase

N
W E
S

ATTACHMENT 3 - INTERSECTION DELAY AND LEVEL OF SERVICE

AM Level of Service and Intersection Delay

Scenario			2018 Existing Conditions			2040 No Build			2040 Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
Alignment B											
8	Kellogg Blvd & Mounds Blvd	EB	C	C	24.5	C	C	24.9	D	C	30.1
		WB	B			B			B		
		NB	C			C			C		
		SB	C			C			C		
9	Mounds Blvd & I-94 Westbound Off-Ramp	EB	--	A	1.9	--	A	2.1	--	C	24.3
		WB	A			A			C		
		NB	A			A			D		
		SB	A			A			C		
10	Mounds Blvd & I-94 Eastbound On-Ramp	EB	--	A	4.7	--	A	4.9	--	A	5.1
		WB	--			--			--		
		NB	B			B			B		
		SB	A			A			A		
12	White Bear Ave & Old Hudson Rd [a]	EB	B	B	13.2	B	B	13.7	B	B	13.5
		WB	C			C			C		
		NB	A			A			A		
		SB	A			B			B		
13	White Bear Ave & I-94 Westbound Ramps [a]	EB	--	A	9.7	--	B	10.4	--	B	10.5
		WB	B			B			B		
		NB	A			A			A		
		SB	A			A			A		
14	White Bear Ave & I-94 Eastbound Ramps [a]	EB	C	B	16.2	C	B	16.3	C	B	16.7
		WB	--			--			--		
		NB	A			A			A		
		SB	B			B			B		
15	White Bear Ave & Suburban Ave [a]	EB	B	B	14.4	B	B	14.7	B	B	14.6
		WB	C			B			C		
		NB	A			A			A		
		SB	B			B			B		
Alignment C											
16	Ruth St & Old Hudson Rd [a]	EB	B	B	12.8	B	B	13.4	B	B	13.0
		WB	B			B			B		
		NB	B			B			B		
		SB	B			B			B		
17	Ruth St & I-94 Westbound On-Ramp [a]	EB	--	A	2.8	--	A	3.0	--	A	2.5
		WB	--			--			--		
		NB	A			A			A		
		SB	A			A			A		
18	Ruth St & I-94 Eastbound Off-Ramp [a]	EB	B	A	7.3	B	A	7.4	B	A	7.5
		WB	--			--			--		
		NB	A			A			A		
		SB	A			A			A		
20	McKnight Rd & 1st St [a]	EB	-	A	2.4	-	A	2.4	-	A	2.9
		WB	A			A			A		
		NB	A			A			A		
		SB	A			A			A		
21	McKnight Rd & Hudson Service Rd [a]	EB	A	A	1.6	B	A	1.8	B	A	2.3
		WB	-			-			-		
		NB	A			A			A		
		SB	A			A			A		
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp [a]	EB	-	A	7.7	-	B	10.3	-	B	12.7
		WB	C			C			C		
		NB	A			A			A		
		SB	A			B			B		
23	McKnight Rd & Burns Ave [a]	EB	C	A	9.0	C	A	9.3	C	B	10.4
		WB	B			C			B		
		NB	A			A			A		
		SB	A			A			A		
24	Hudson Rd & 4th St	EB	-	A	0.3	-	A	0.4	-	A	0.7
		WB	A			A			A		
		NB	-			-			-		
		SB	A			A			-		
25	Hudson Rd & 8th St	EB	-	A	0.9	-	A	1.0	-	A	4.6
		WB	A			A			A		
		NB	-			-			-		
		SB	A			A			A		
26	Hudson Rd & 19th St	EB	-	A	0.8	-	A	1.0	-	A	3.4
		WB	A			A			A		
		NB	A			A			A		
		SB	A			A			A		
27	Century Ave & Hudson Rd / Hudson Blvd [a]	EB	-	A	2.8	-	A	3.2	-	A	3.7
		WB	A			B			B		
		NB	A			A			A		
		SB	A			A			A		
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp [a]	EB	-	C	27.7	-	C	26.0	-	C	26.4
		WB	B			C			C		
		NB	D			C			C		
		SB	C			C			C		
29	Century Ave & I-94 Eastbound Ramps [a]	EB	E	C	21.6	C	B	18.3	C	C	22.6
		WB	-			-			-		
		NB	B			B			C		
		SB	B			B			B		

[a] *Indicates intersection was modeled in Synchro/SimTraffic. All other intersections were modeled in VISSIM.*

PM Level of Service and Intersection Delay

Scenario			2018 Existing Conditions			2040 No Build			2040 Build		
			LOS		Delay	LOS		Delay	LOS		Delay
#	Intersection	Appr	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter	by Appr	by Inter	by Inter
Alignment B											
8	Kellogg Blvd & Mounds Blvd	EB	B	C	20.8	B	C	21.1	C	C	29.9
		WB	B			B			B		
		NB	C			C			C		
		SB	C			C			C		
9	Mounds Blvd & I-94 Westbound Off-Ramp	EB	--	A	1.5	--	A	1.6	--	B	16.5
		WB	A			A			B		
		NB	A			A			B		
		SB	A			A			B		
10	Mounds Blvd & I-94 Eastbound On-Ramp	EB	--	A	8.3	--	A	8.6	--	A	7.5
		WB	--			--			--		
		NB	E			E			D		
		SB	A			A			A		
12	White Bear Ave & Old Hudson Rd [a]	EB	C	B	19.7	D	C	21.1	C	C	20.1
		WB	E			E			E		
		NB	A			A			A		
		SB	B			C			C		
13	White Bear Ave & I-94 Westbound Ramps [a]	EB	--	B	13.8	--	B	14.2	--	B	15.2
		WB	B			B			B		
		NB	B			B			B		
		SB	B			B			B		
14	White Bear Ave & I-94 Eastbound Ramps [a]	EB	C	C	21.5	C	C	23.9	C	C	24.0
		WB	--			--			--		
		NB	C			C			C		
		SB	B			B			C		
15	White Bear Ave & Suburban Ave [a]	EB	C	B	15.5	C	B	15.6	C	B	15.9
		WB	B			B			B		
		NB	C			C			C		
		SB	A			A			A		
Alignment C											
16	Ruth St & Old Hudson Rd [a]	EB	D	C	22.8	D	C	25.1	D	C	25.2
		WB	D			D			D		
		NB	A			A			A		
		SB	C			C			C		
17	Ruth St & I-94 Westbound On-Ramp [a]	EB	--	B	10.2	--	B	12.7	--	B	11.2
		WB	--			--			--		
		NB	C			C			C		
		SB	A			A			A		
18	Ruth St & I-94 Eastbound Off-Ramp [a]	EB	B	B	10.7	B	B	13.3	B	B	11.0
		WB	--			--			--		
		NB	B			B			B		
		SB	B			B			B		
20	McKnight Rd & 1st St [a]	EB	-	A	3.8	-	A	3.6	-	A	3.6
		WB	E			D			D		
		NB	A			A			A		
		SB	A			A			A		
21	McKnight Rd & Hudson Service Rd [a]	EB	E	B	10.9	F	B	14.1	F	C	20.6
		WB	-			-			-		
		NB	A			A			A		
		SB	A			A			A		
22	McKnight Rd & Hudson Rd / I-94 Westbound On-Ramp [a]	EB	-	C	20.7	-	C	20.7	-	C	21.2
		WB	C			D			D		
		NB	B			B			C		
		SB	B			B			B		
23	McKnight Rd & Burns Ave [a]	EB	D	B	15.1	D	B	16.5	D	B	17.1
		WB	B			B			B		
		NB	B			B			B		
		SB	B			B			B		
24	Hudson Rd & 4th St	EB	-	A	1.4	-	A	1.3	-	A	0.1
		WB	A			A			A		
		NB	-			-			-		
		SB	A			A			-		
25	Hudson Rd & 8th St	EB	-	A	0.4	-	A	0.4	-	A	1.7
		WB	A			A			A		
		NB	-			-			-		
		SB	A			A			A		
26	Hudson Rd & 19th St	EB	-	A	0.1	-	A	0.1	-	A	3.5
		WB	A			A			A		
		NB	A			A			A		
		SB	A			A			A		
27	Century Ave & Hudson Rd / Hudson Blvd [a]	EB	-	A	8.4	-	B	10.1	-	A	7.3
		WB	A			A			A		
		NB	A			A			A		
		SB	B			B			A		
28	Century Ave & Hudson Service Rd / I-94 Westbound Off-Ramp [a]	EB	-	B	13.6	-	B	14.8	-	B	15.0
		WB	C			C			C		
		NB	B			B			B		
		SB	B			B			B		
29	Century Ave & I-94 Eastbound Ramps [a]	EB	D	D	36.8	D	D	41.6	D	D	52.2
		WB	-			-			-		
		NB	D			E			F		
		SB	C			C			D		

[a] *Indicates intersection was modeled in Synchro/SimTraffic. All other intersections were modeled in VISSIM.*

ATTACHMENT 4 - 15% CONCEPT PLANS

METROPOLITAN COUNCIL

Metro Transit

METRO Gold Line

15% CONCEPT PLANS

RAMSEY COUNTY

Washington County

DRAFT-WORK IN PROCESS

SUBMITTAL
DATE : REVISED 4/23/2019

Kimley»Horn

LEGEND

	BRT GUIDEWAY		PARK AND RIDE
	BRT IN MIXED TRAFFIC		ROADWAY
	STATION PLATFORM		BRIDGE/UNDERPASS
	SIDEWALK OR MULTI-USE TRAIL OR DRIVEWAY APRON		MEDIAN
	RETAINING WALL		EXISTING METRO GREEN LINE ROUTE
	PROPOSED NOISE WALL		LIMITS OF DISTURBANCE
	EXISTING NOISE WALL TO REMAIN INPLACE		EXISTING WETLAND DELINEATION
	EXISTING PROPERTY LINE		POTENTIAL STORMWATER BMP LOCATION
	EXISTING RIGHT OF WAY		PROPOSED DIRECTIONAL LANE USE
	EXISTING SIGNAL SYSTEM TO REMAIN INPLACE		FULL PROPERTY ACQUISITION (PERMANENT)
	MODIFY EXISTING SIGNAL SYSTEM		PARTIAL PROPERTY ACQUISITION (PERMANENT)
	PROPOSED SIGNAL SYSTEM		

ABBREVIATIONS

AVE	AVENUE	NWL	NORMAL WATER LINE
BGN	BEGIN	PC	POINT OF CURVE
BVC	BEGINNING VERTICAL CURVE	PE	PERMANENT EASEMENT
BLVD	BOULEVARD	PGL	PROFILE GRADE LINE
BRT	BUS RAPID TRANSIT	PI	POINT OF INTERSECTION
BP	BEGIN POINT	PKWY	PARKWAY
C&G	CURB AND GUTTER	POT	POINT ON TANGENT
℄	CENTERLINE	PRC	POINT OF REVERSE CURVATURE
CLR	CLEAR	PROP	PROPOSED
CONC	CONCRETE	PT	POINT OF TANGENT
CR	COUNTY ROAD	PVI	POINT OF VERTICAL INTERSECTION
CSAH	COUNTY STATE AID HIGHWAY	R	RADIUS (FEET)
CT	COURT	RD	ROAD
DR	DRIVE	ROW	RIGHT OF WAY
EB	EAST BOUND	S	SOUTH
EL	ELEVATION	SAN	SANITARY
EP	END POINT	SB	SOUTHBOUND
EVC	ENDING VERTICAL CURVE	ST	STREET
EX	EXISTING	STA	STATION
HP	HIGHPOINT	STM	STORM
HWL	HIGH WATER LINE	TBD	TO BE DETERMINED
LN	LANE	TE	TEMPORARY EASEMENT
LP	LOW POINT	TERR	TERRACE
MAX	MAXIMUM	TH	TRUNK HIGHWAY
ME	MATCH EXISTING	TYP	TYPICAL
MID	MIDPOINT OF CURVE	UG	UNDERGROUND
MIN	MINIMUM	VAR	VARIES
N	NORTH	VC	VERTICAL CURVE
NB	NORTHBOUND	Vd	DESIGN VELOCITY (MPH)
NIC	NOT IN CONTRACT	WB	WEST BOUND
NTS	NOT TO SCALE	WM	WATERMAIN

INDEX

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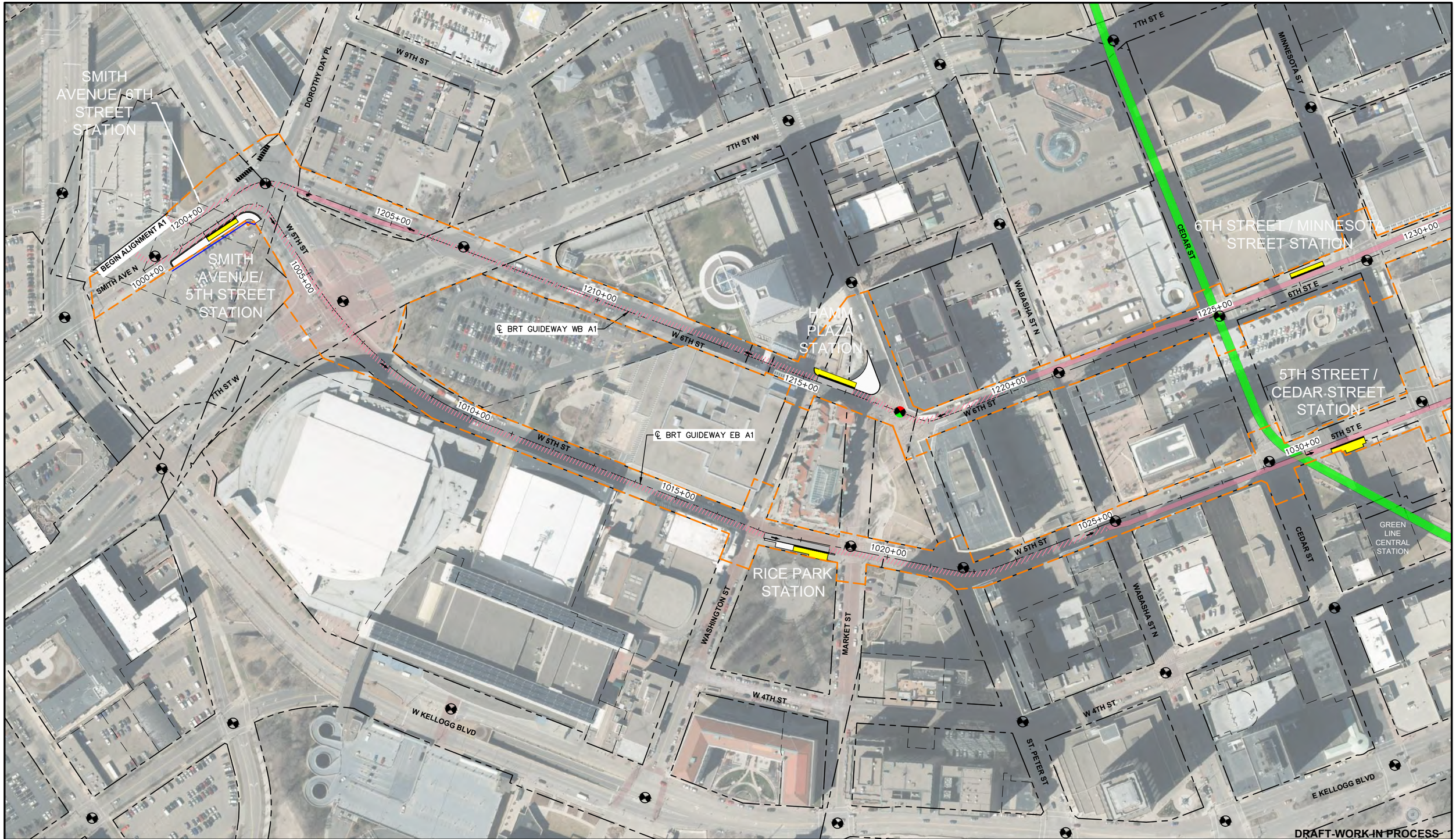
GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

METROPOLITAN COUNCIL

Kimley»Horn



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GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018
BUILD ALTERNATIVE A1

NORTH

0 50 100 200
HORIZONTAL

METRO Gold Line

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SHEET 3 OF 32

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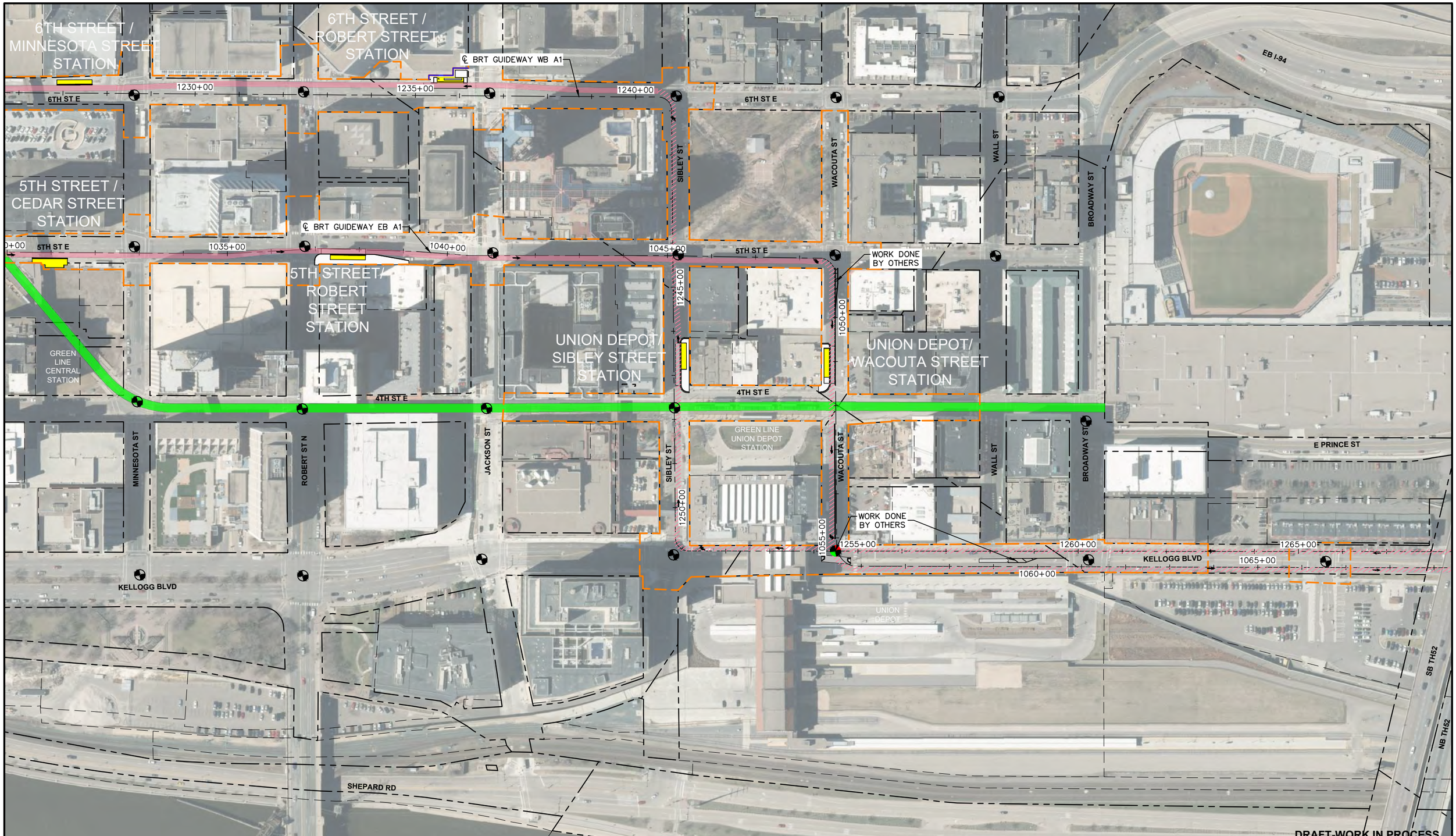

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BUILD ALTERNATIVE A1

NORTH

0 50 100 200
HORIZONTAL

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6TH ST E
5TH ST E
4TH ST E
SIBLEY ST
WACOUTA ST
WALL ST
BROADWAY ST
EB I-94
GREEN LINE CENTRAL STATION
GREEN LINE UNION DEPOT STATION
MINNESOTA ST
ROBERT ST N
JACKSON ST
E PRINCE ST
KELLOGG BLVD
SHEPARD RD
WORK DONE BY OTHERS
℄ BRT GUIDEWAY WB A2
℄ BRT GUIDEWAY EB A2
1615+00
1415+00
1610+00
1410+00
1405+00
1605+00
1600+00
1400+00
UNION DEPOT
BEGIN ALIGNMENT A2
UNION DEPOT STATION
SB TH52
NB TH52
DRAFT-WORK IN PROCESS

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BUILD ALTERNATIVE A2

NORTH

0 50 100 200
HORIZONTAL

METRO Gold Line

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SHEET 5 OF 32

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I-94

4TH ST E

WILLIUS ST

E PRINCE ST

LAYFAYETTE ST

SB TH52

NB TH52

1270+00

1070+00

KELLOGG BLVD

1275+00

1075+00

1280+00

1080+00

1285+00

1085+00

1290+00

1090+00

1295+00

1095+00

KELLOGG BLVD

℄ BRT GUIDEWAY WB

℄ BRT GUIDEWAY EB

COMMERCIAL ST

EB I-94

WB I-94

MOUNDS BLVD

1297+60

3RD ST E

1098+47

END ALIGNMENT A1 / A2

BEGIN ALIGNMENT B

MOUNDS BOULEVARD STATION

CONWAY ST

DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

NORTH

0 50 100 200

HORIZONTAL

METROPOLITAN COUNCIL

Kimley»Horn

SHEET 6 OF 32

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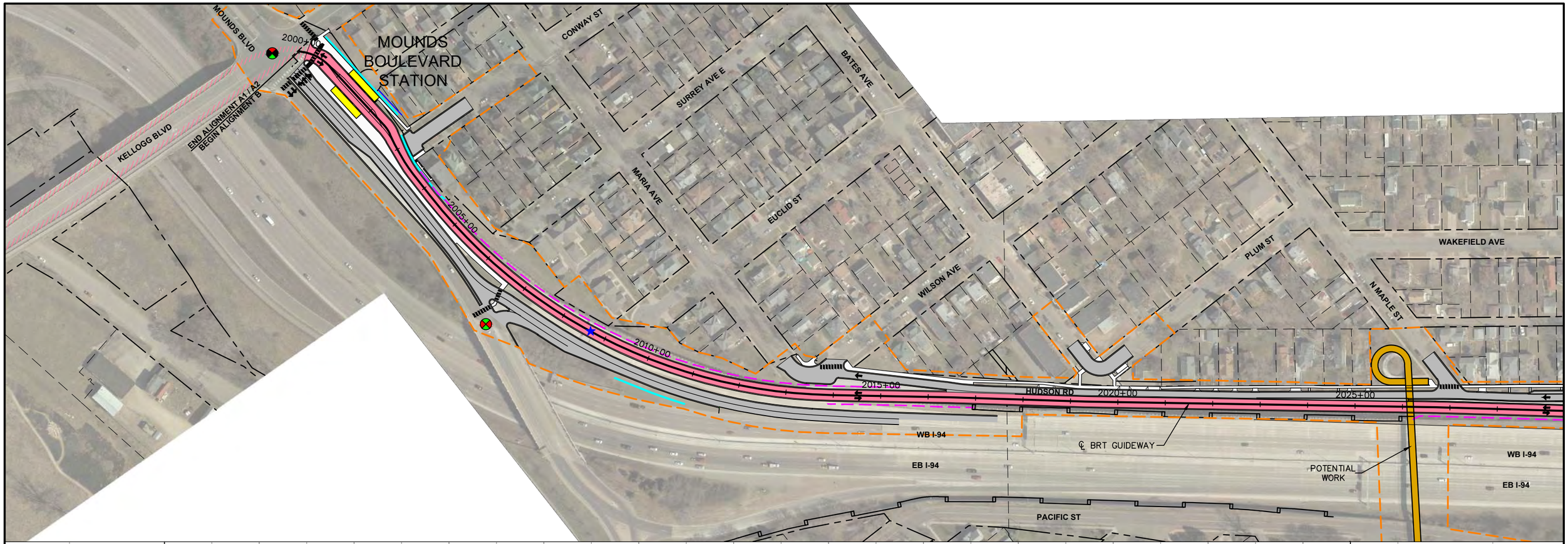

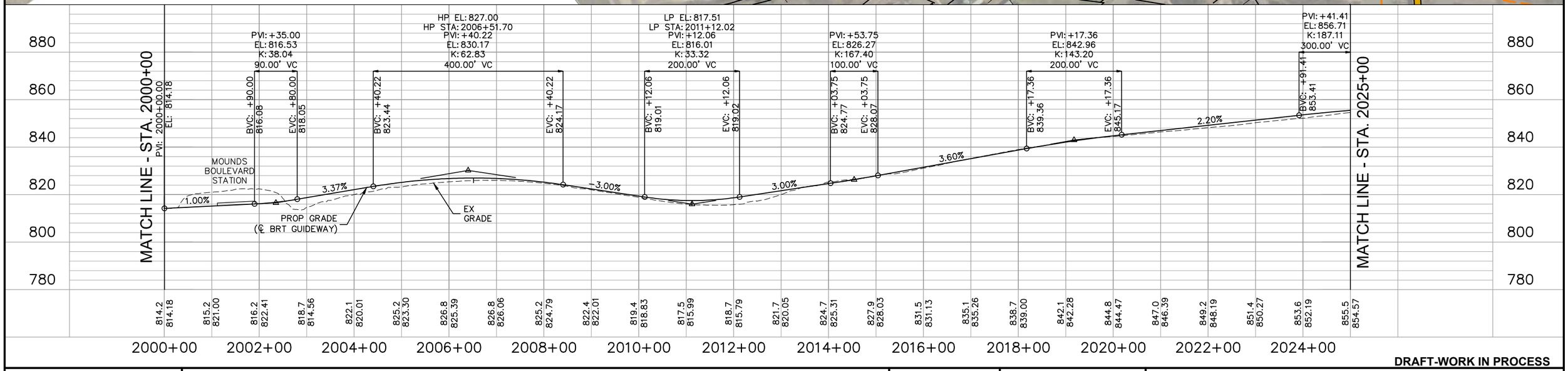

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GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

METRO Gold Line

NORTH

0 50 100 200 HORIZONTAL

0 10 20 40 VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn

SHEET 7 OF 32

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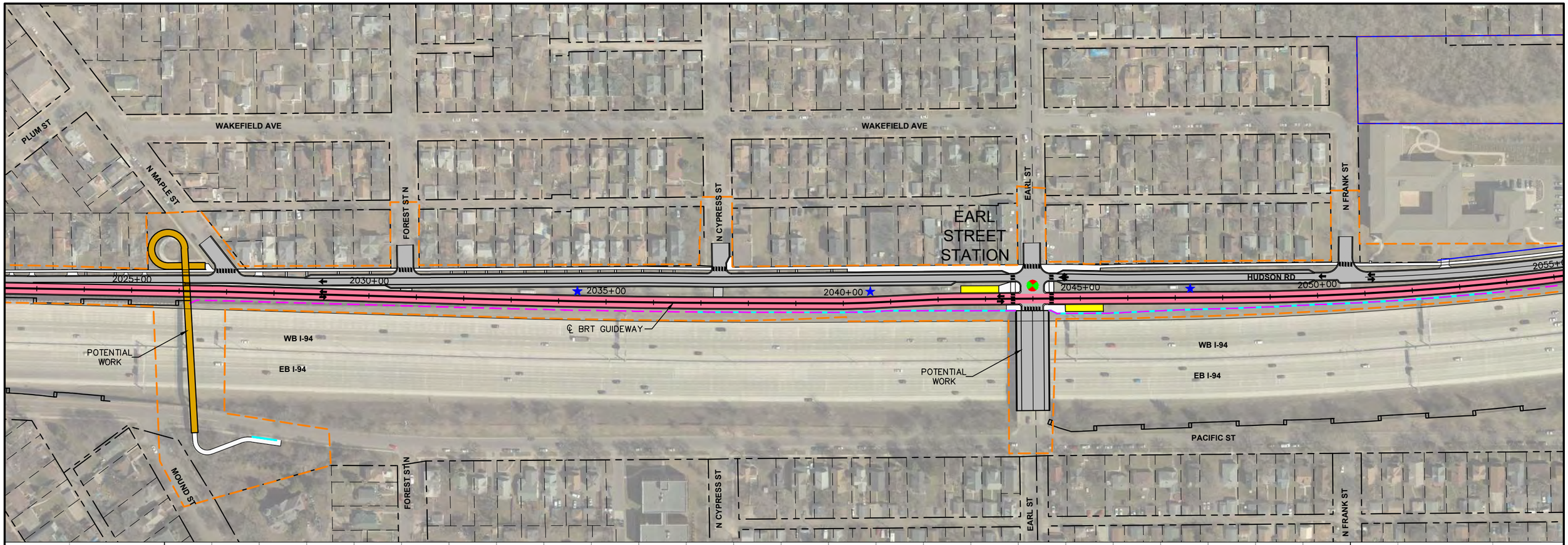
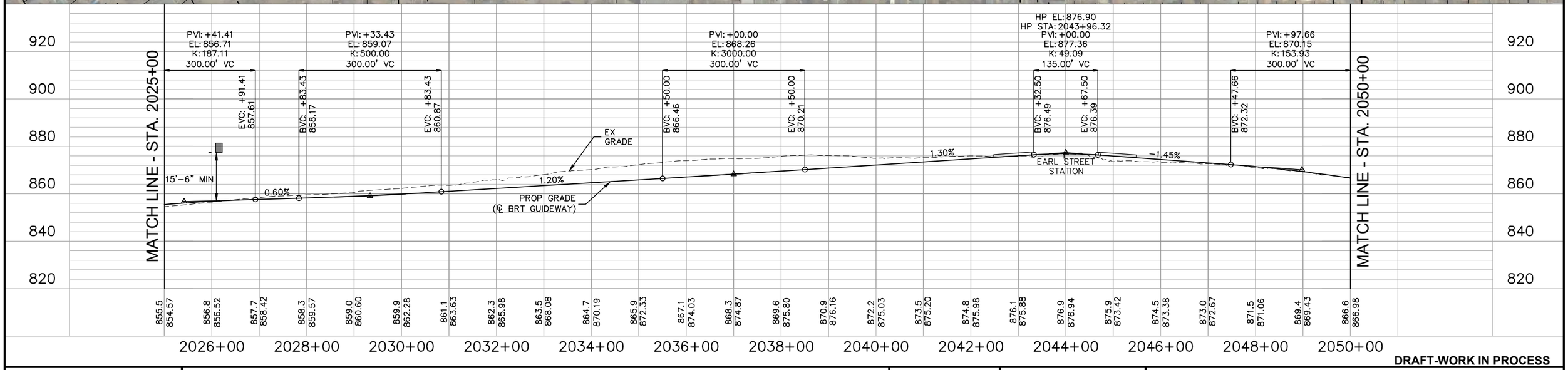




DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

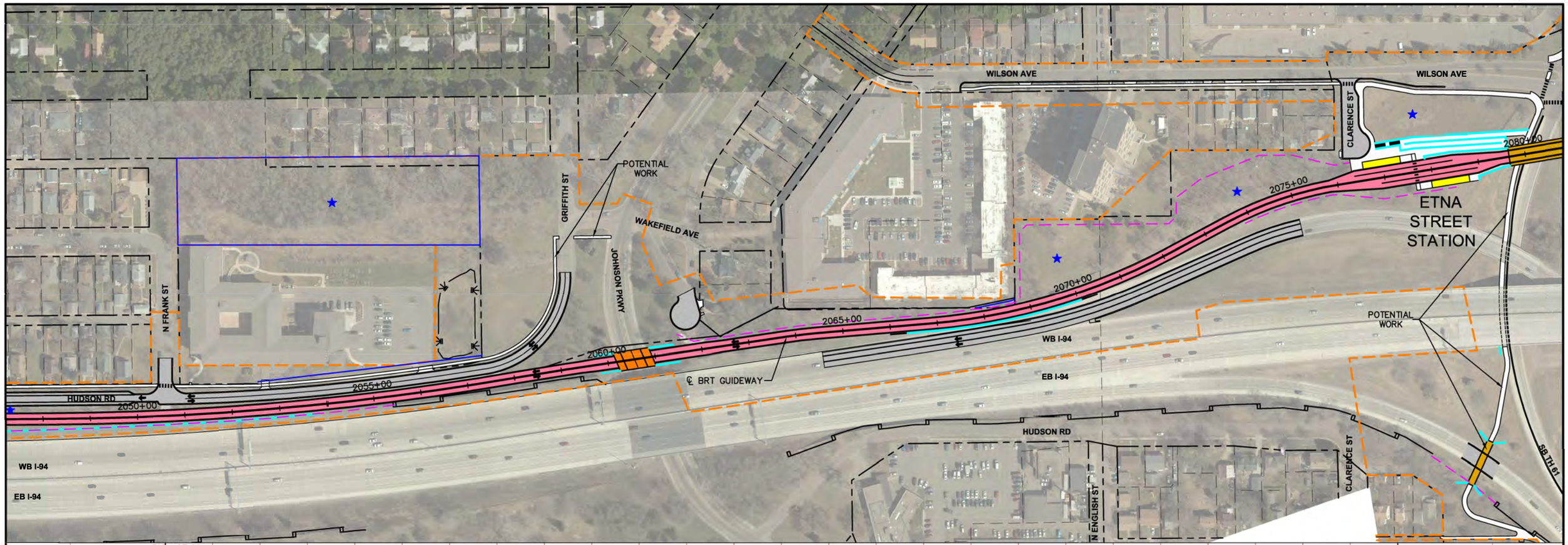
15% CONCEPT PLANS - 12/20/2018

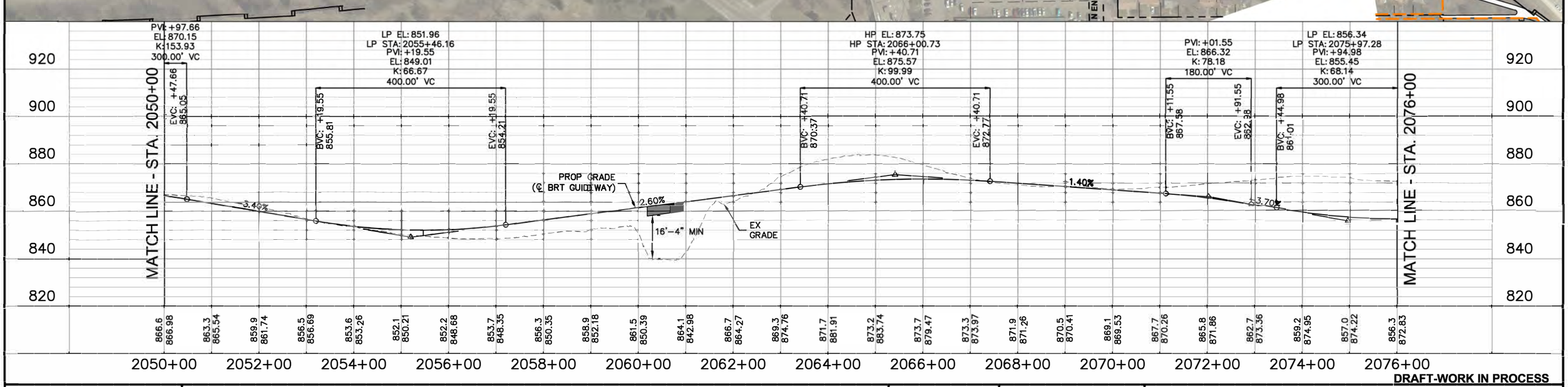
NORTH

0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - REVISED 04/26/2019

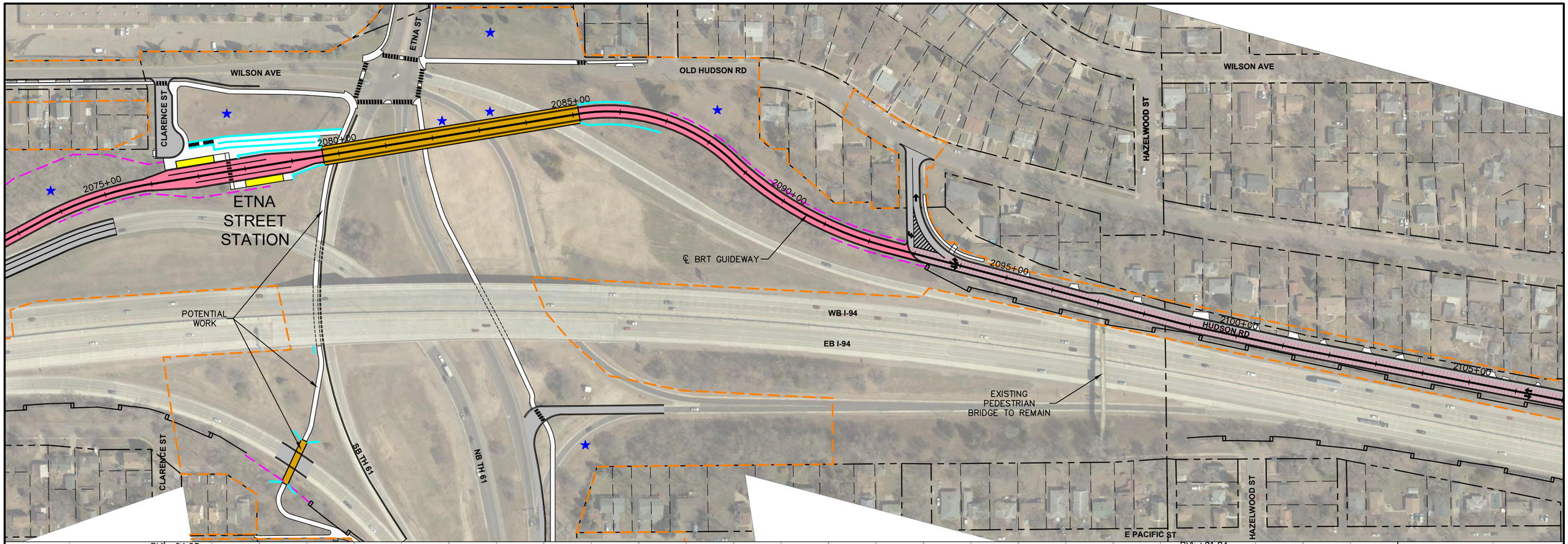
NORTH

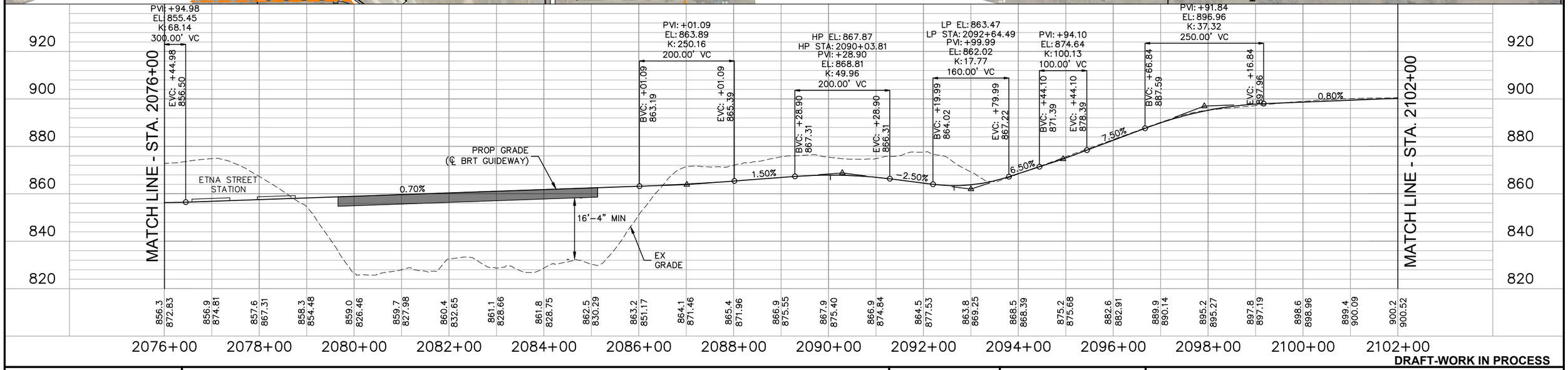
0 50 100 200
HORIZONTAL

0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

NORTH

0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn

SHEET 10 OF 32

Dec, 18 2018 09:29 am C:\Users\KLangford\appdata\local\temp\AcPublish_111988\SE02-CIV-PLN_PRF.dwg By: KLangford

DRAFT-WORK IN PROCESS

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

NORTH

0 50 100 200

HORIZONTAL

SHEET 11 OF 32

3RD ST E
CLARENCE ST
CONWAY ST
N ENGLISH ST
ETNA ST
BIRMINGHAM ST
OLD HUDSON RD
WILSON AVE
WILSON AVE
CLARENCE ST
2085+00
2080+00
2075+00
2090+00
2070+00
2065+00
2060+00
POTENTIAL WORK
GRIFFITH ST
WAKEFIELD AVE
JOHNSON PKWY
ETNA STREET STATION
℄ BRT GUIDEWAY
℄ BRT GUIDEWAY
POTENTIAL WORK
WB I-94
EB I-94
WB I-94
EB I-94
HUDSON RD
DRAFT-WORK IN PROCESS

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

METRO Gold Line

NORTH

0 50 100 200
HORIZONTAL

METROPOLITAN COUNCIL

Kimley»Horn

SHEET 12 OF 32

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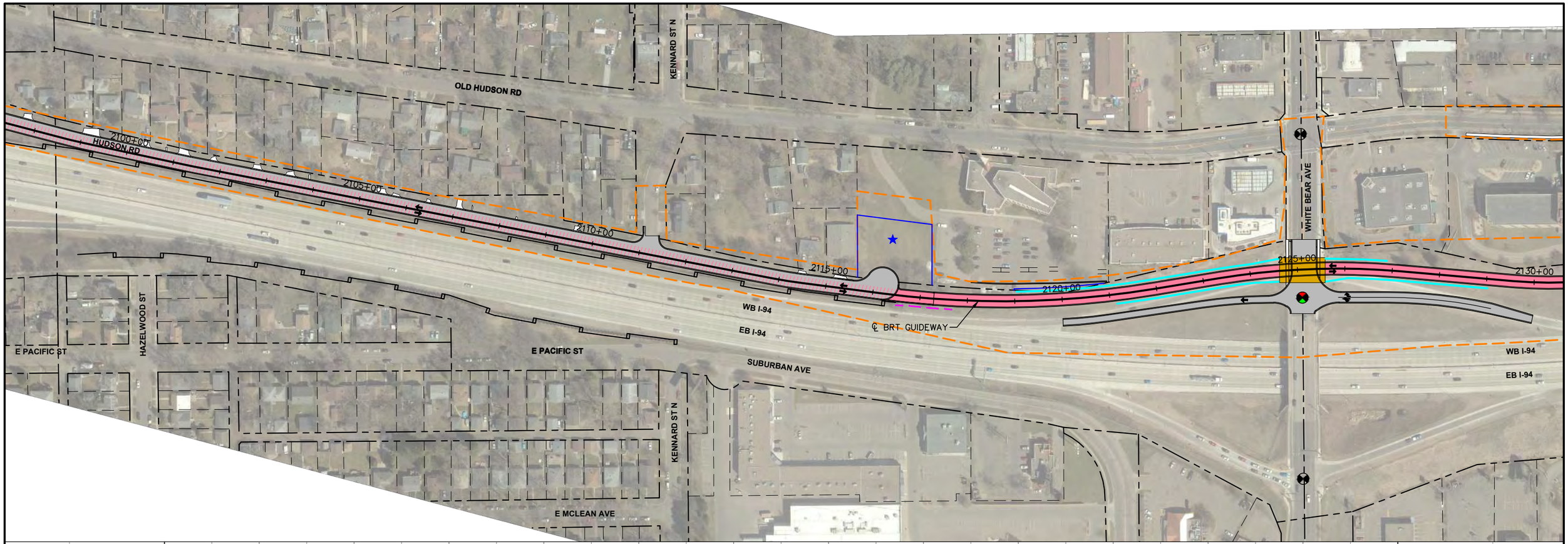
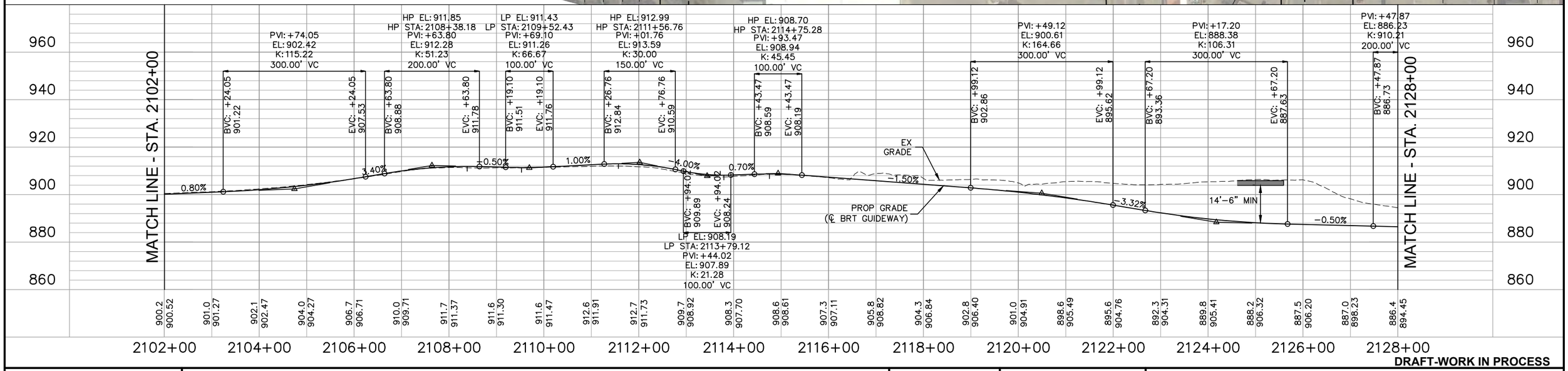




DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

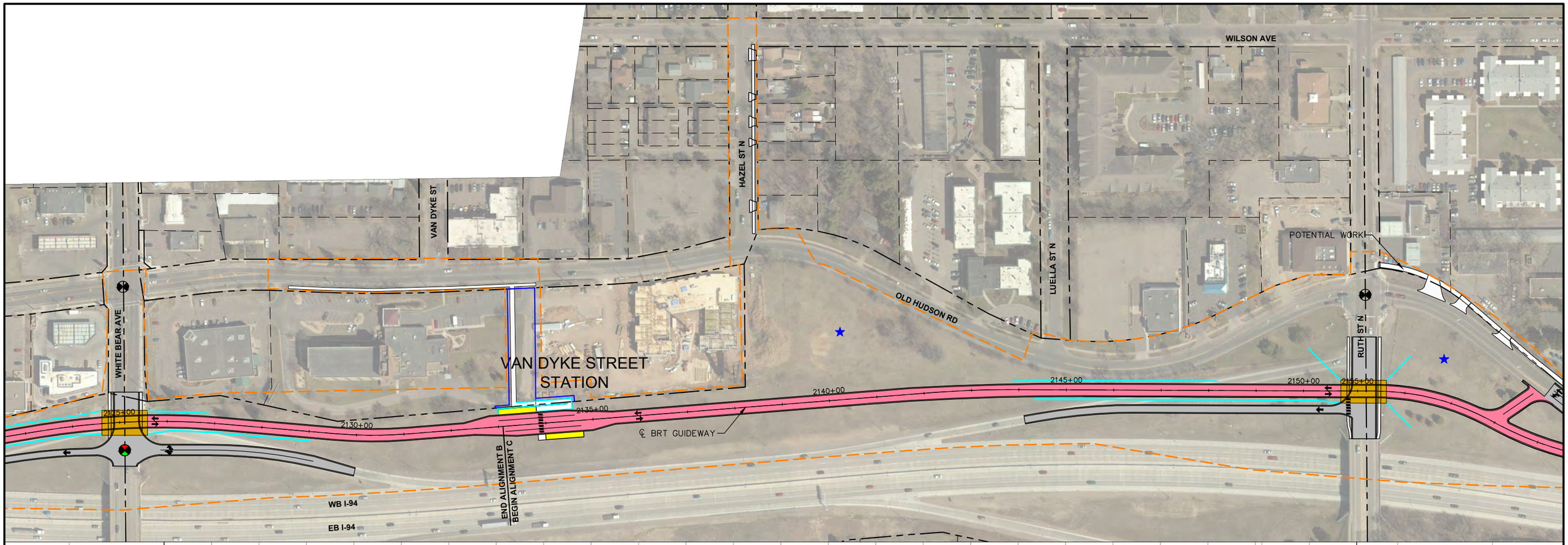
15% CONCEPT PLANS - 12/20/2018

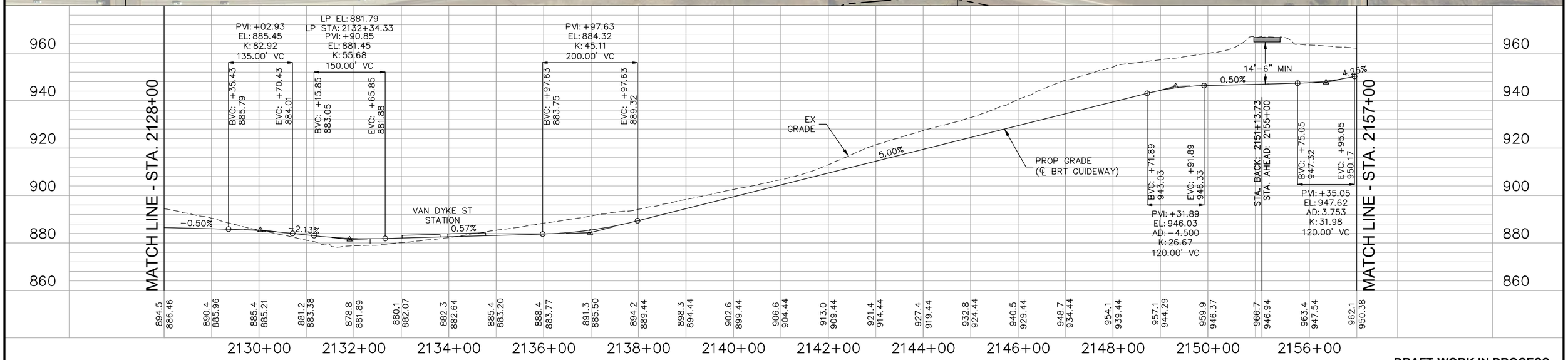
NORTH

0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

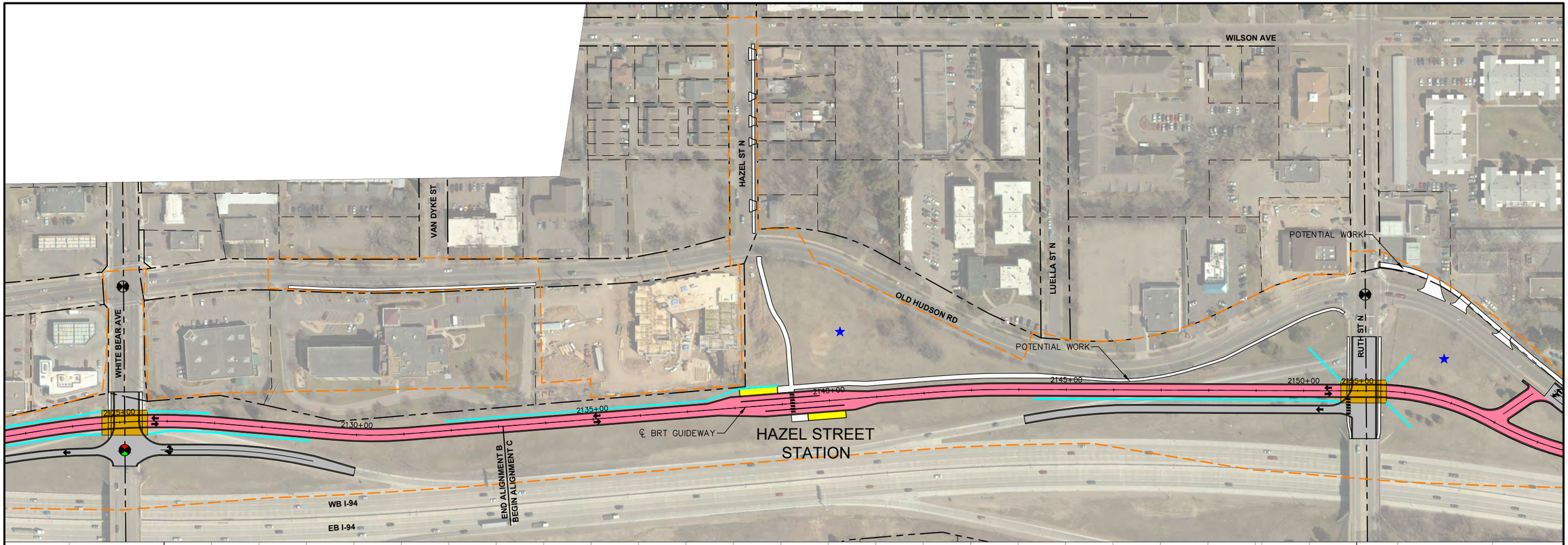
15% CONCEPT PLANS - 12/20/2018

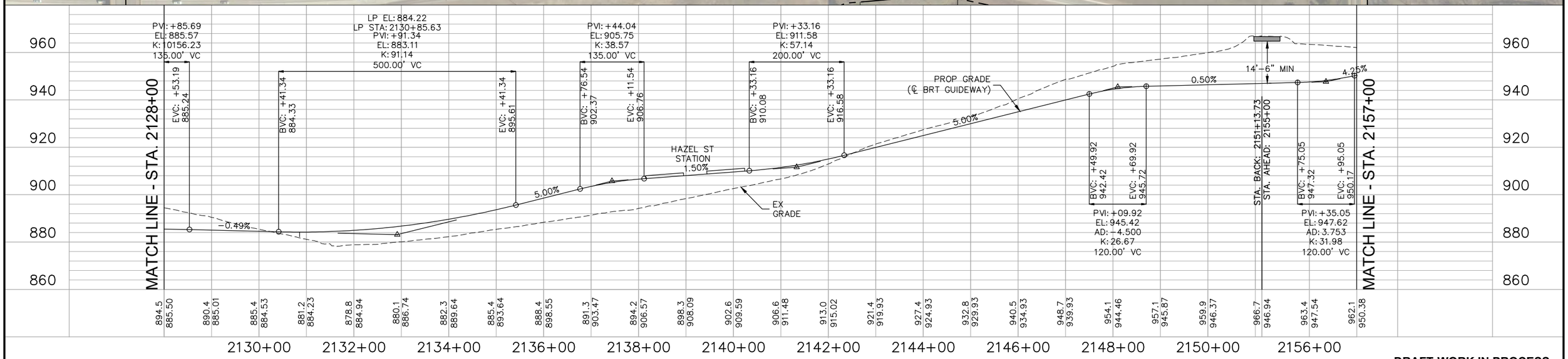
NORTH

0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

HAZEL STREET STATION OPTION

NORTH

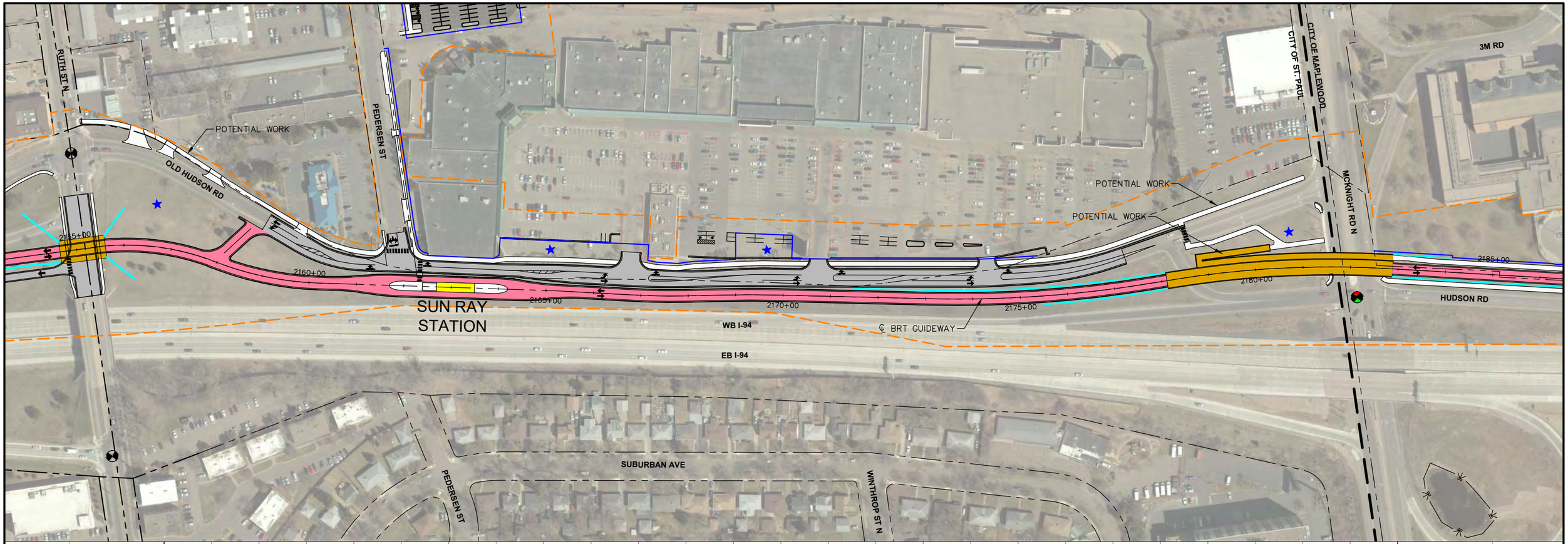
0 50 100 200
HORIZONTAL

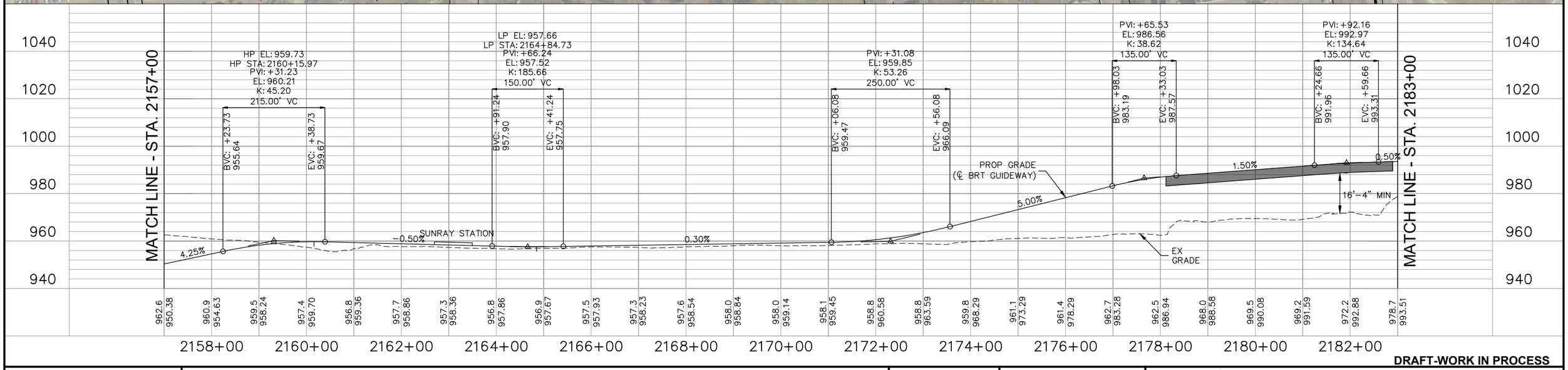
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn

SHEET 15 OF 32





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

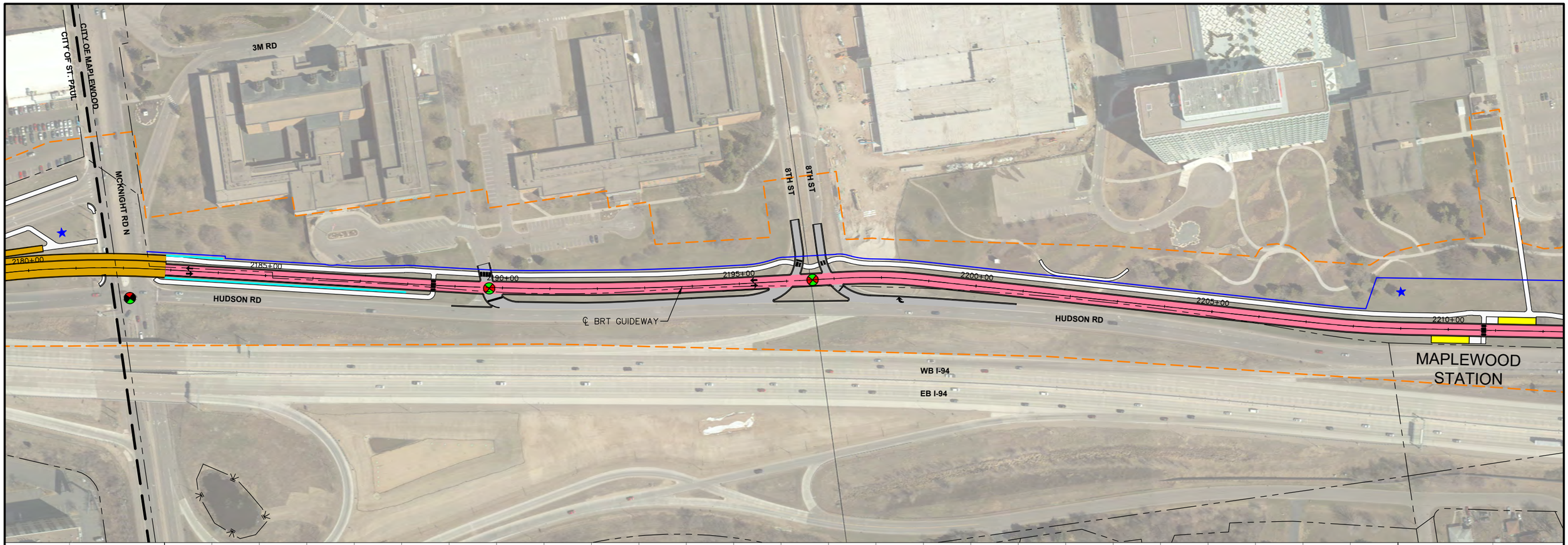
NORTH

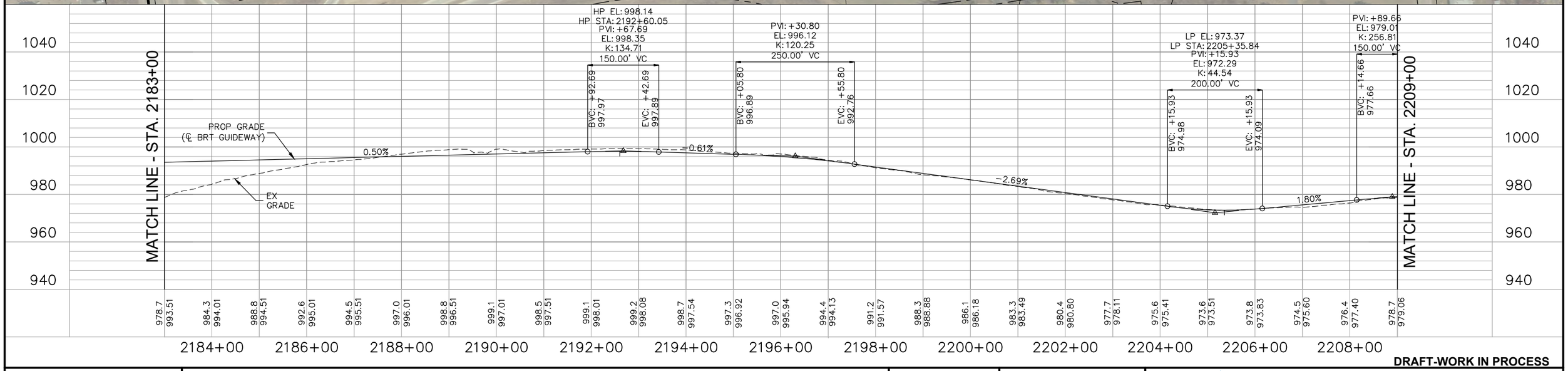
0 50 100 200
HORIZONTAL

0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - REVISED 04/23/2019

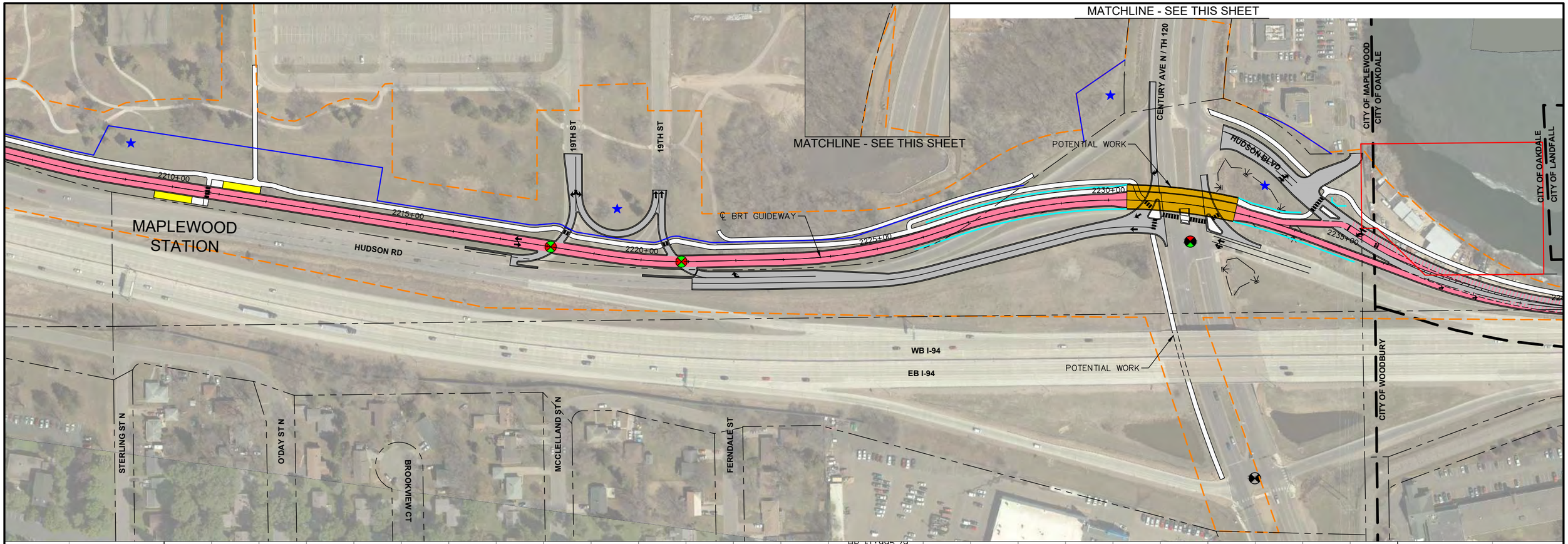
NORTH

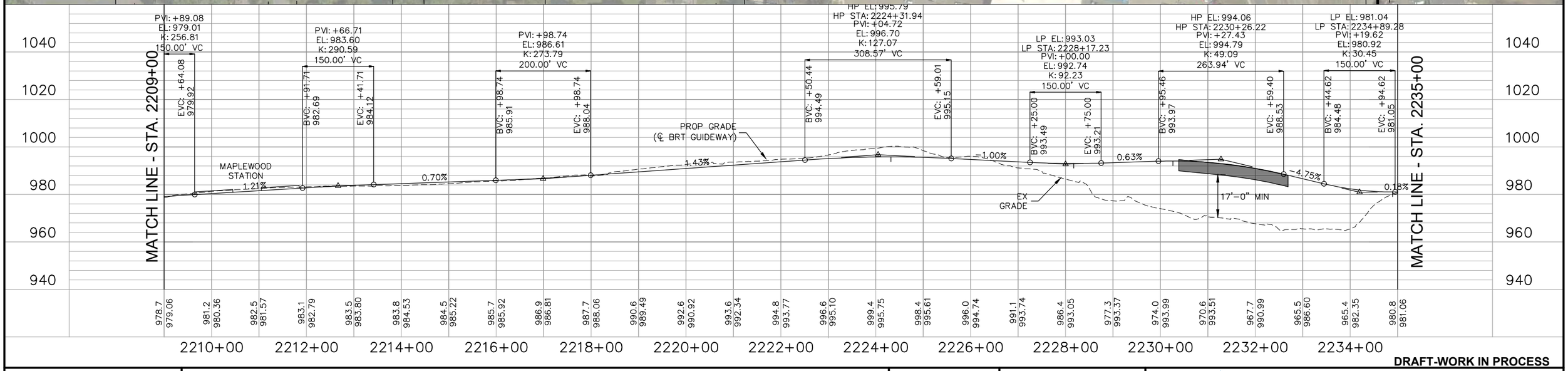
0 50 100 200
HORIZONTAL

0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

NORTH

0 50 100 200
HORIZONTAL

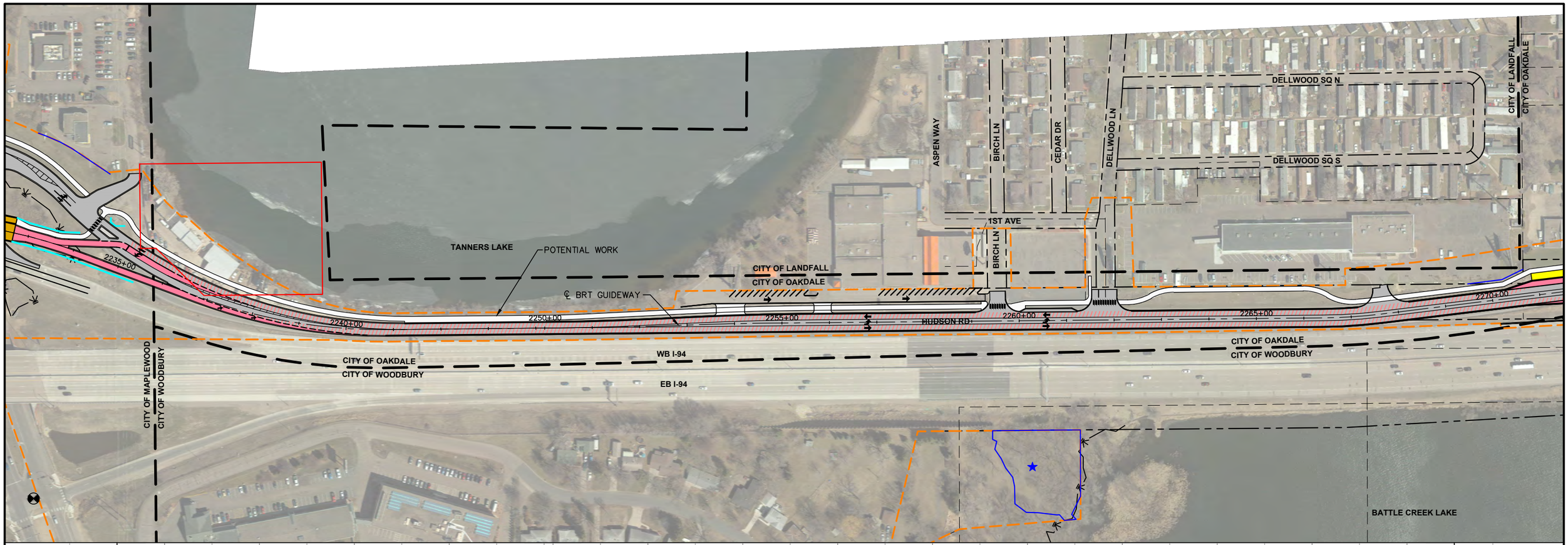
0 10 20 40
VERTICAL

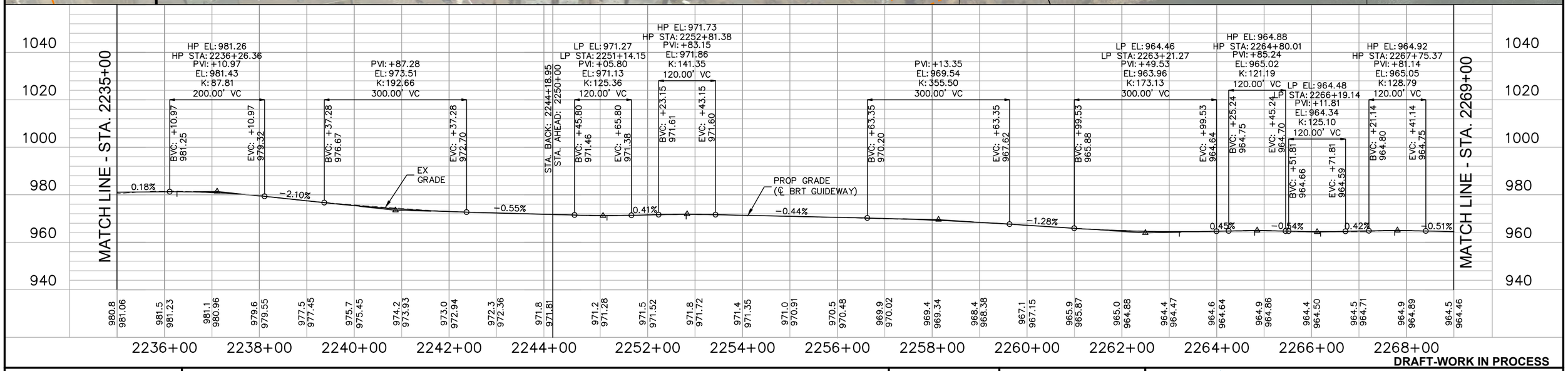
METROPOLITAN COUNCIL

Kimley»Horn

SHEET 18 OF 32

Dec, 13 2018 10:38 am C:\caddlib\pw\ttran\greatlakes\d0181218\SE03-CIV-PLN_PRF.dwg By: ttt020





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

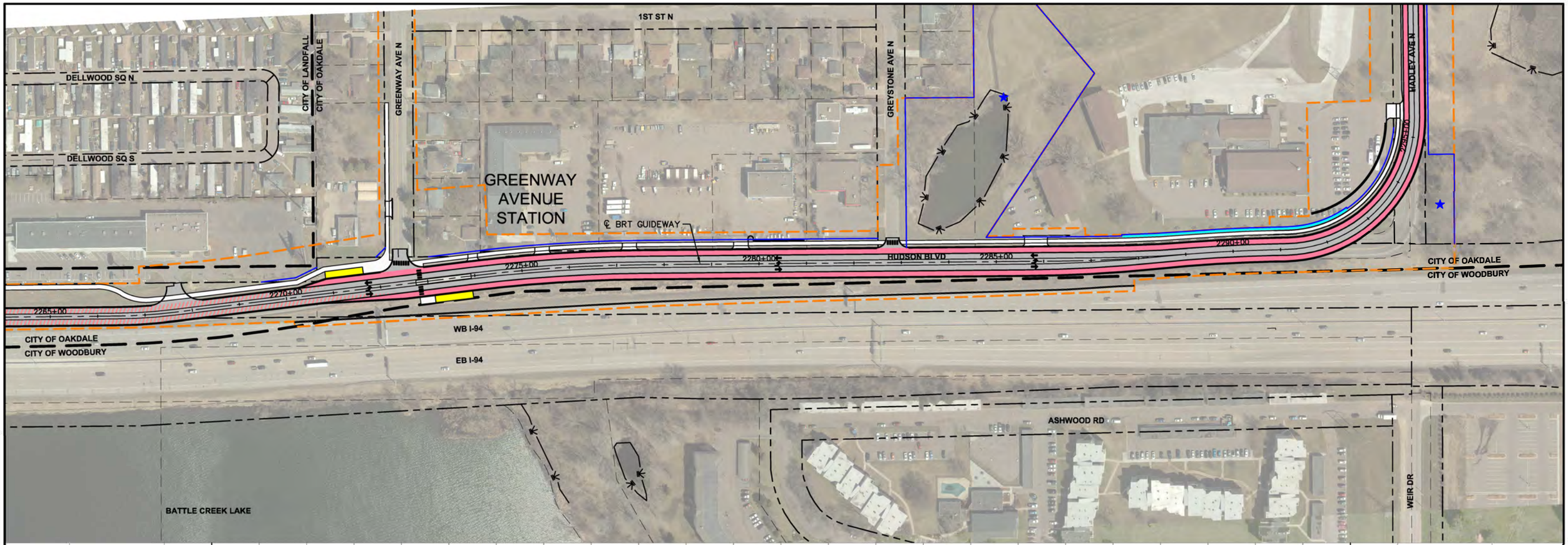
15% CONCEPT PLANS - 12/20/2018

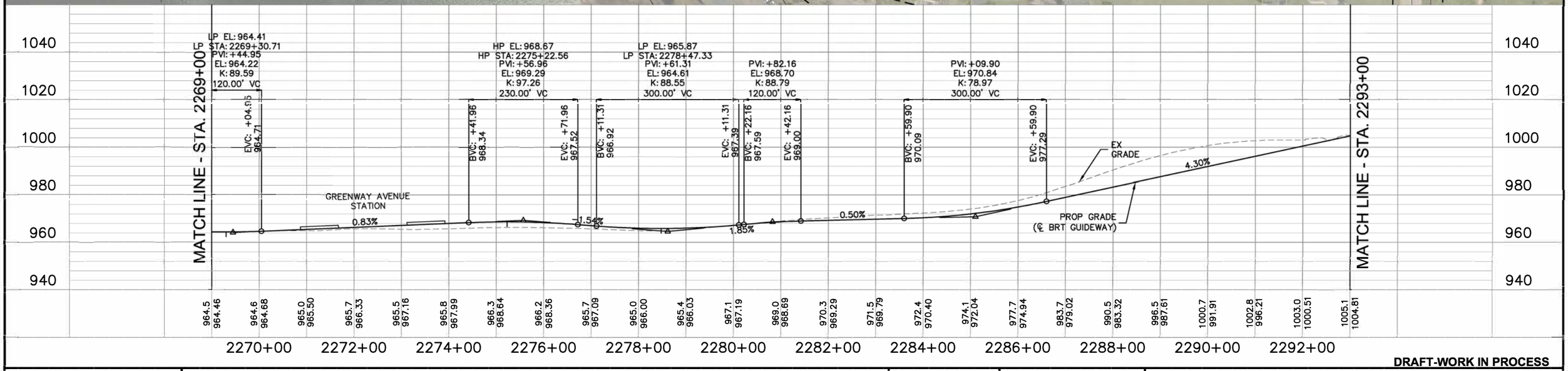
NORTH

0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - REVISED 4/23/2019

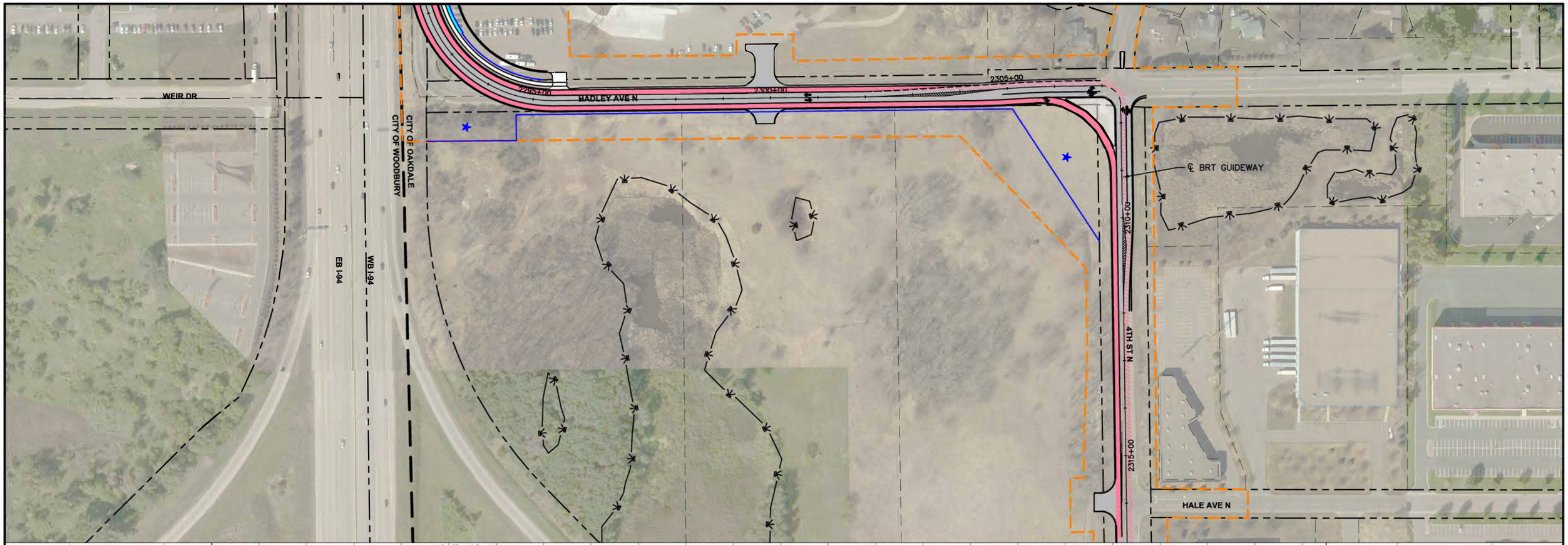
NORTH

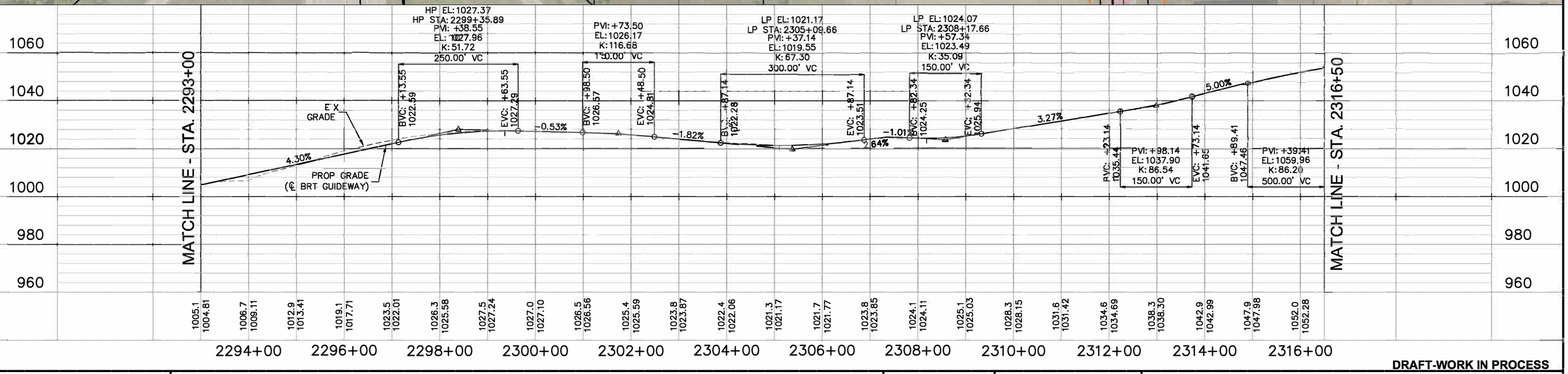
0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn

Apr. 23 2019 09:59 am C:\Users\v-MuelleAL\appdata\local\temp\AcPublish_15456\SEG4-CIV-PLN_PRF.dwg By: V-MuelleAL





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - REVISED 4/23/2019

NORTH

0 50 100 200 HORIZONTAL

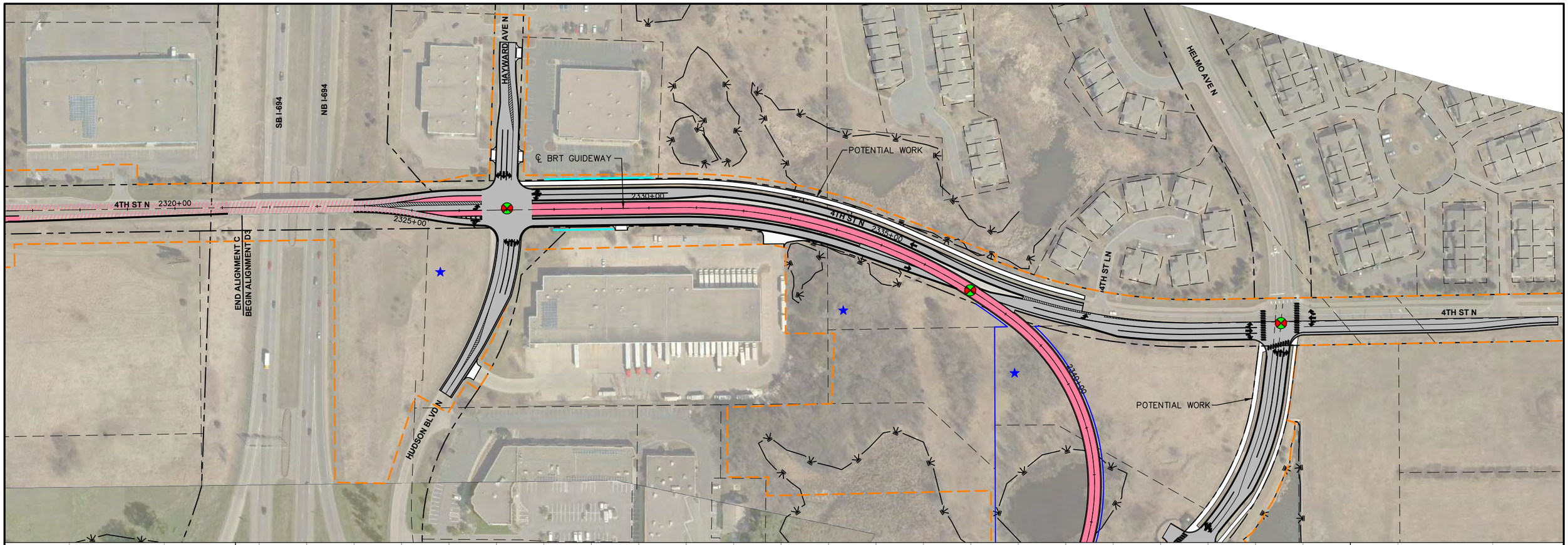
0 10 20 40 VERTICAL

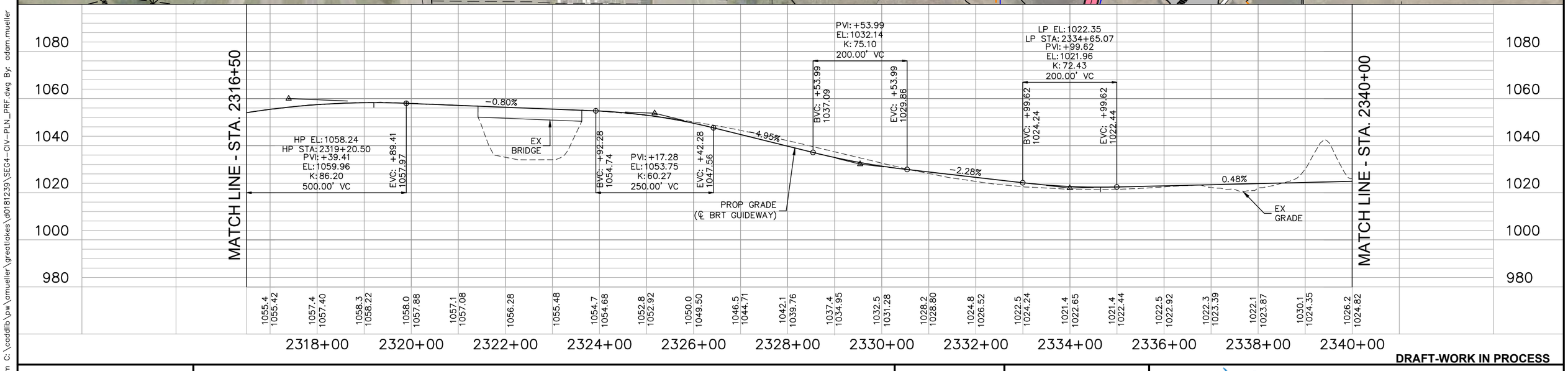
METROPOLITAN COUNCIL

Kimley»Horn

SHEET 21 OF 32

Apr. 23 2019 08:59 am C:\Users\v-MuelleAL\appdata\local\temp\AcPublish_15456\SEG4-CIV-PLN_PRF.dwg By: V-MuelleAL





DRAFT-WORK IN PROCESS

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

NORTH

0 50 100 200
HORIZONTAL

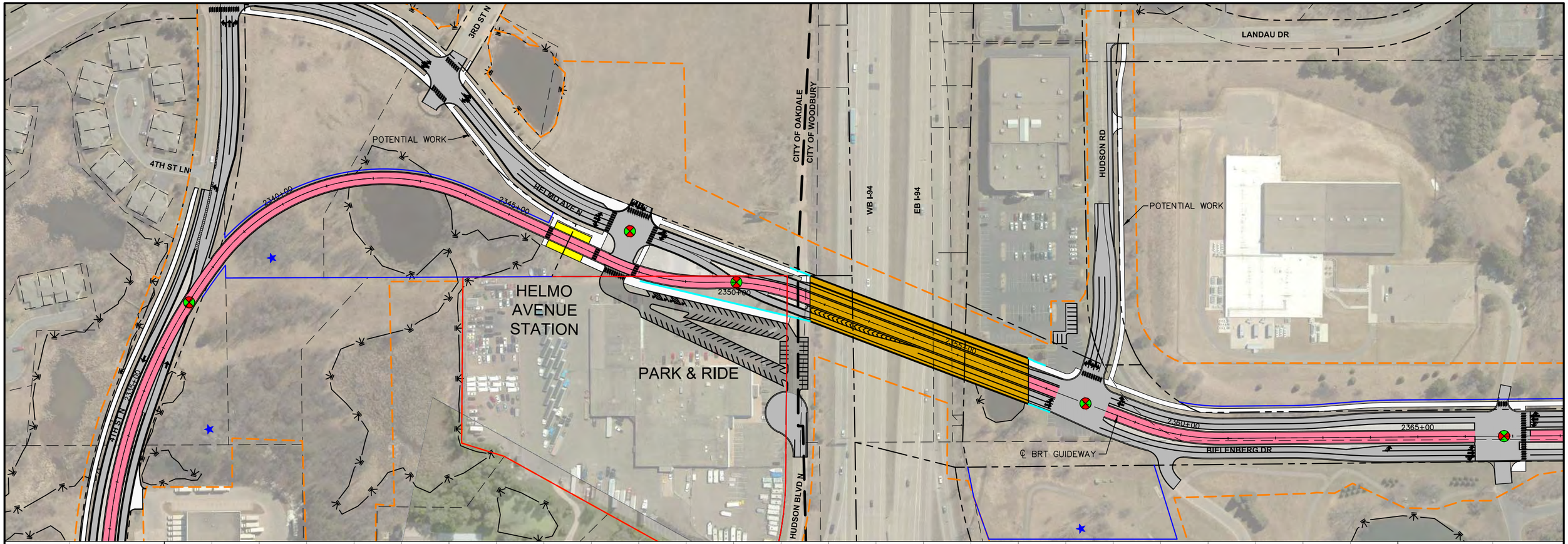
0 10 20 40
VERTICAL

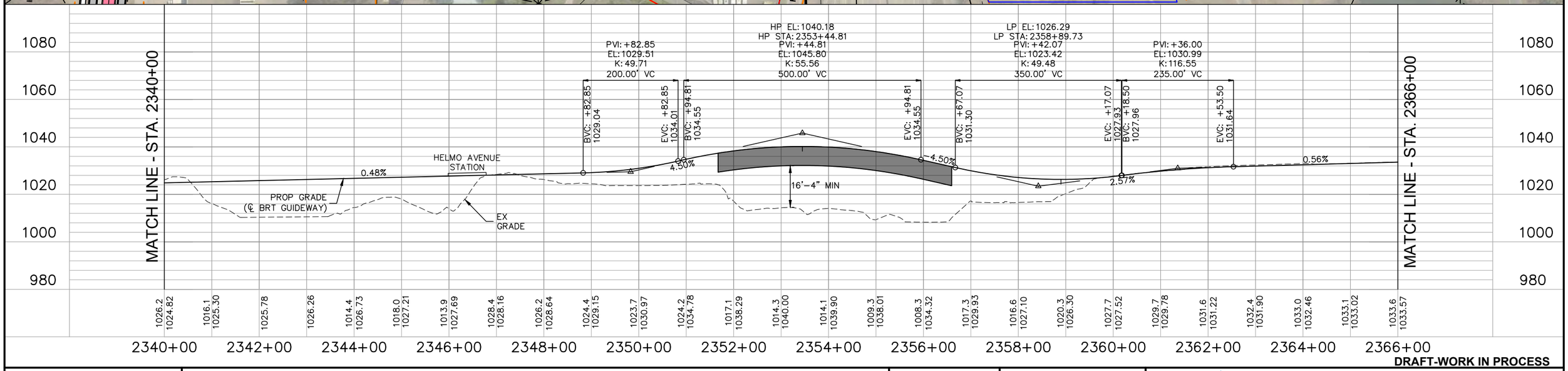
METROPOLITAN COUNCIL

Kimley»Horn

SHEET 22 OF 32

Dec, 11 2018 03:18 pm C:\caddlib\pw\amueller\greatlakes\d0181239\SEC4-CIV-PLN_PRF.dwg By: adam.mueller





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

NORTH

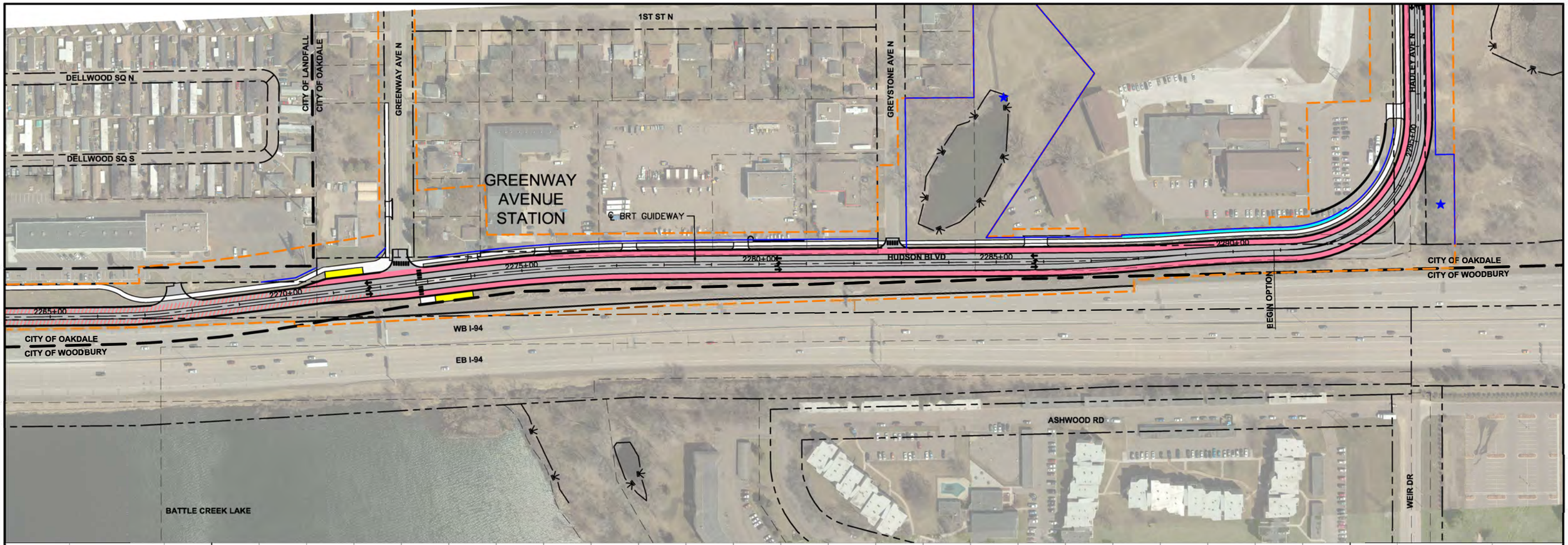
0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

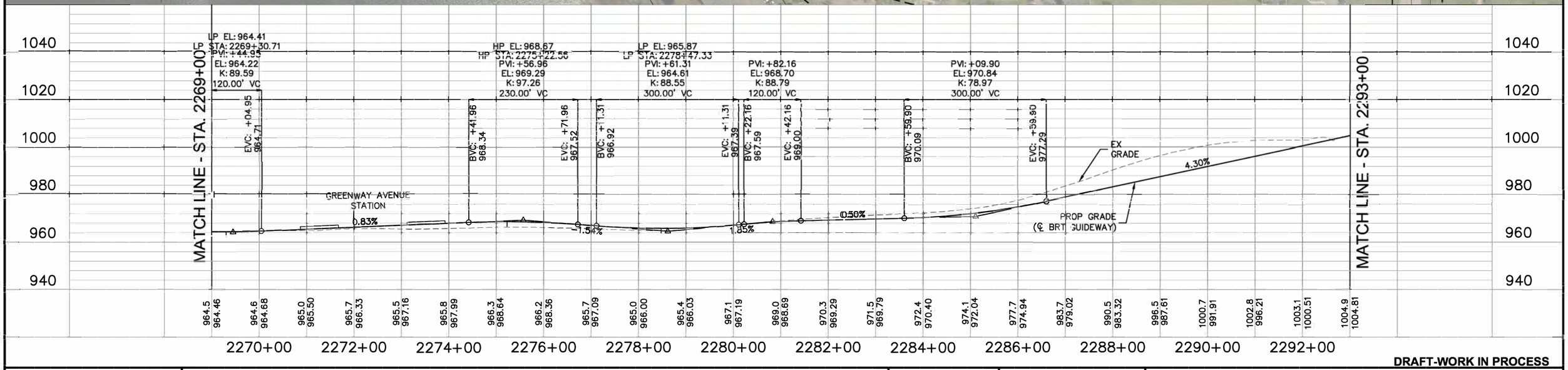
METROPOLITAN COUNCIL

Kimley»Horn

SHEET 23 OF 32

Dec, 11 2018 03:18 pm C:\caddlib\pw\amueller\greatlakes\d0181239\SEC4-CIV-PLN_PRF.dwg By: adam.mueller





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - REVISED 4/23/2019
DEDICATED GUIDEWAY AT 4TH ST & HADLEY AVE OPTION

NORTH

0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn

SHEET 24 OF 32

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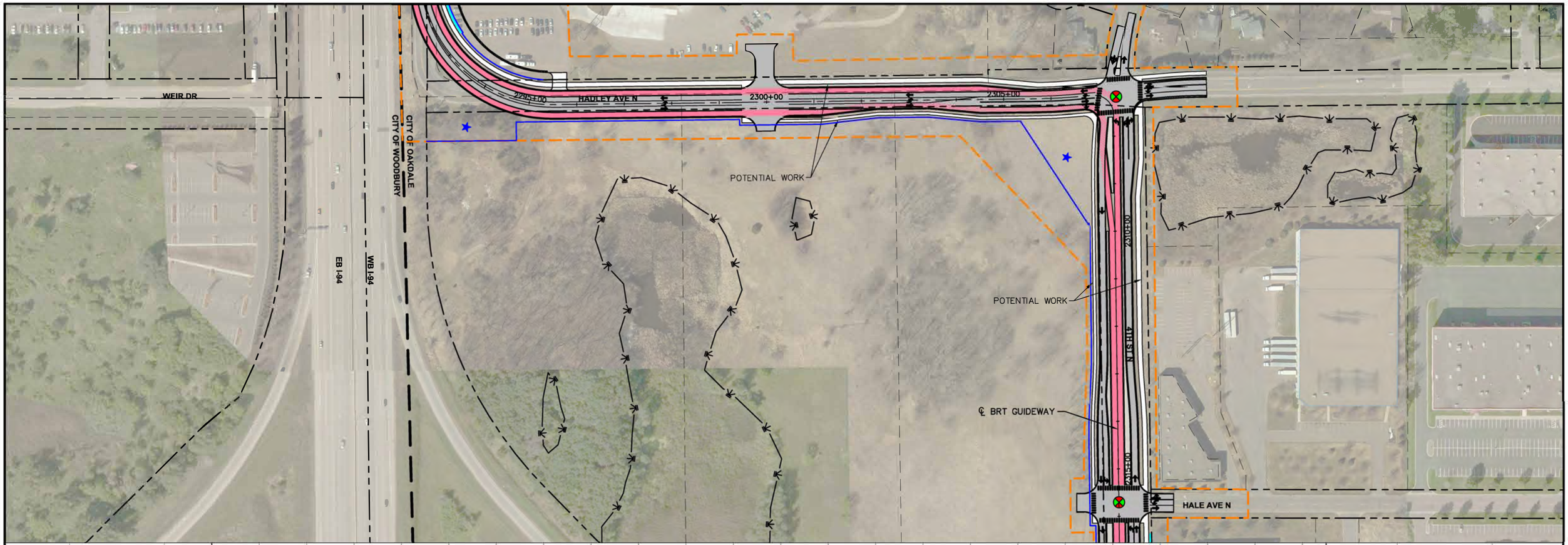
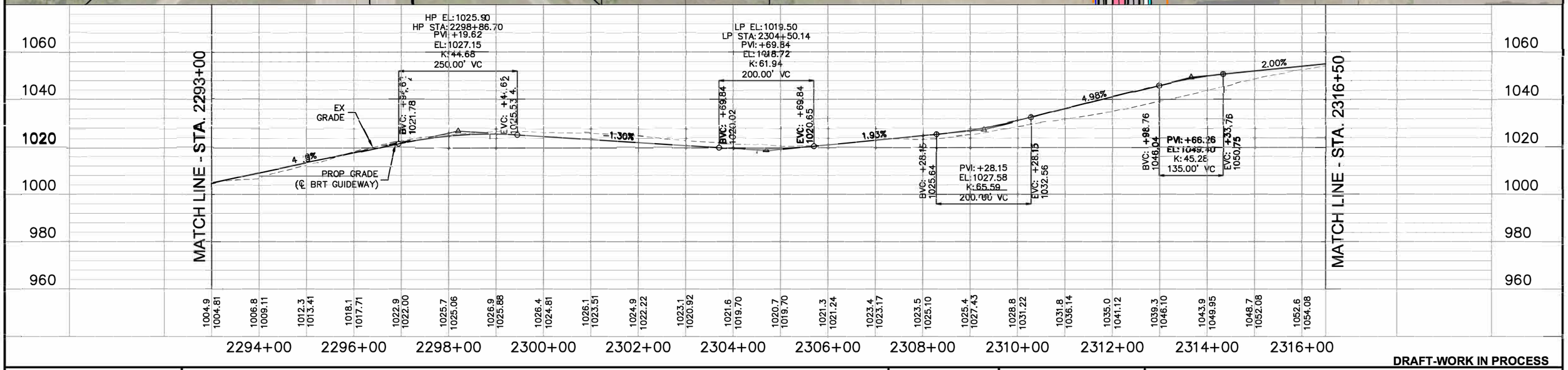




DRAFT-WORK IN PROCESS

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - REVISED 4/23/2019
DEDICATED GUIDEWAY AT 4TH ST & HADLEY AVE OPTION

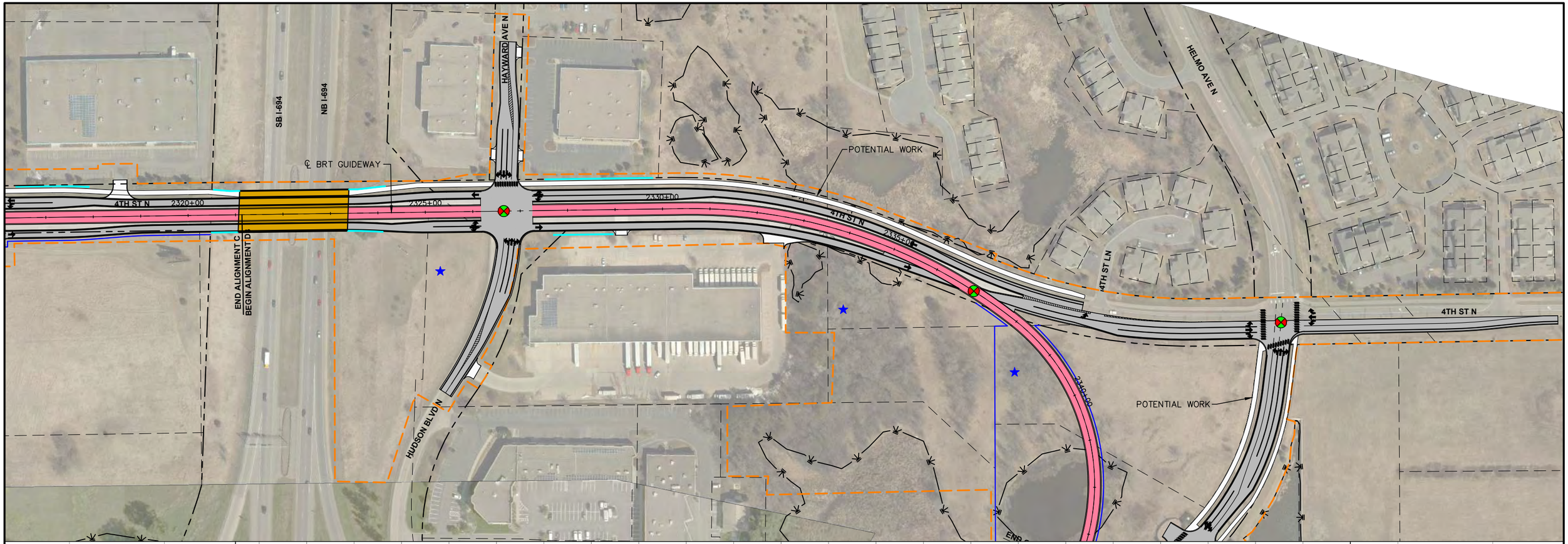
NORTH

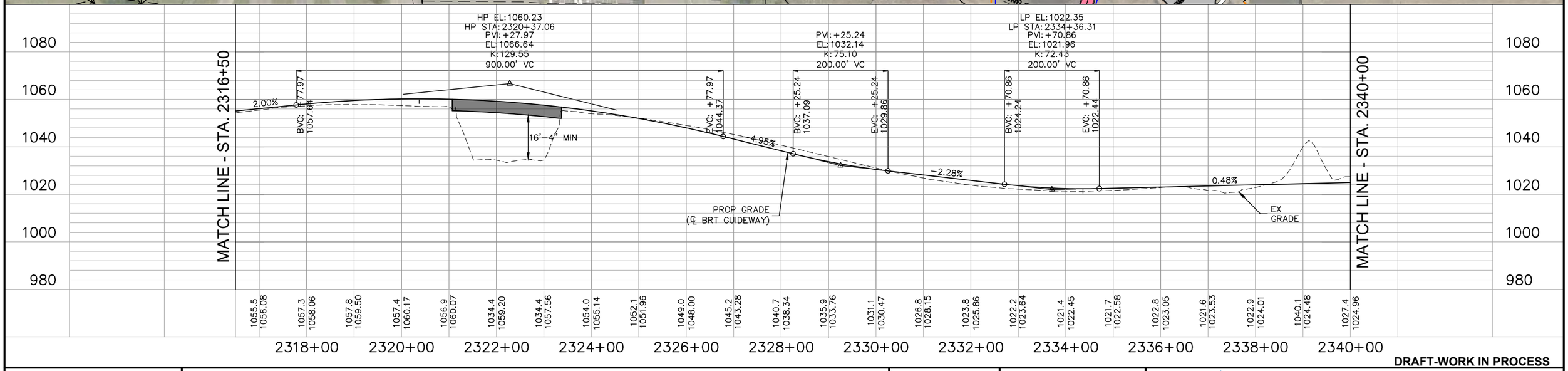
0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn

Apr. 23 2019 10:00 am C:\Users\V-MuelleAL\appdata\local\temp\AcPublish_15456\SEG4-CIV-PLN_PRF.dwg By: V-MuelleAL





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

DEDICATED GUIDEWAY AT 4TH ST & HADLEY AVE OPTION

NORTH

0 50 100 200
HORIZONTAL

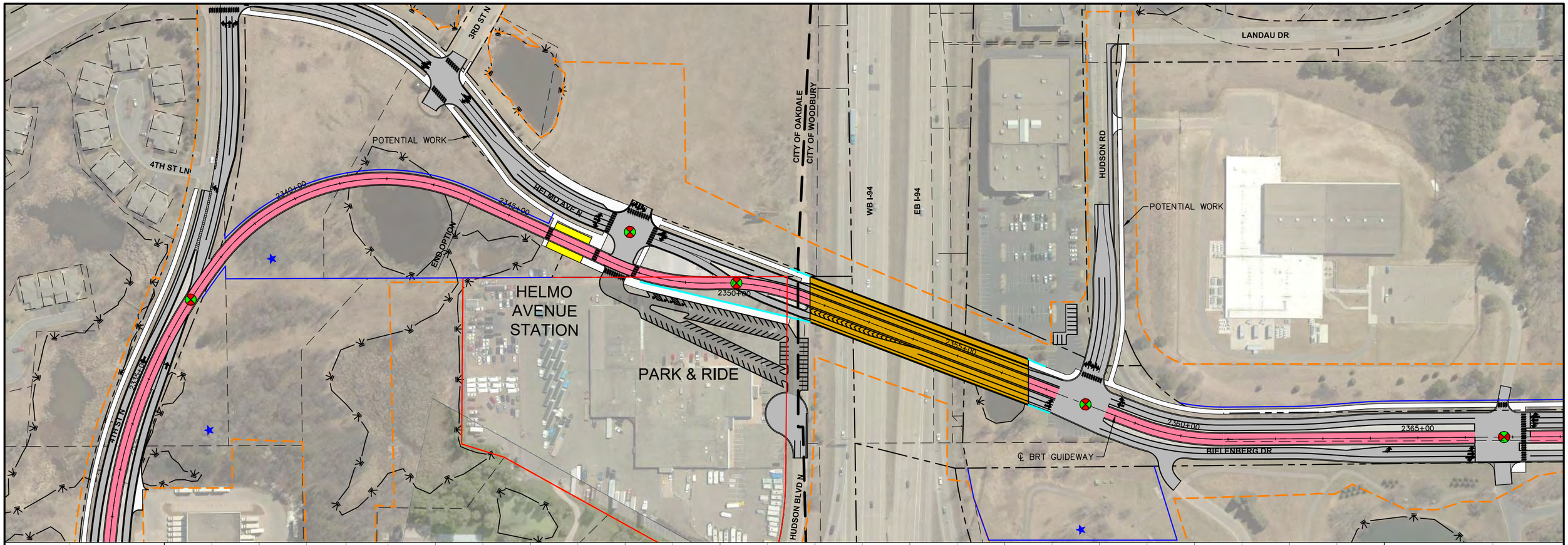
0 10 20 40
VERTICAL

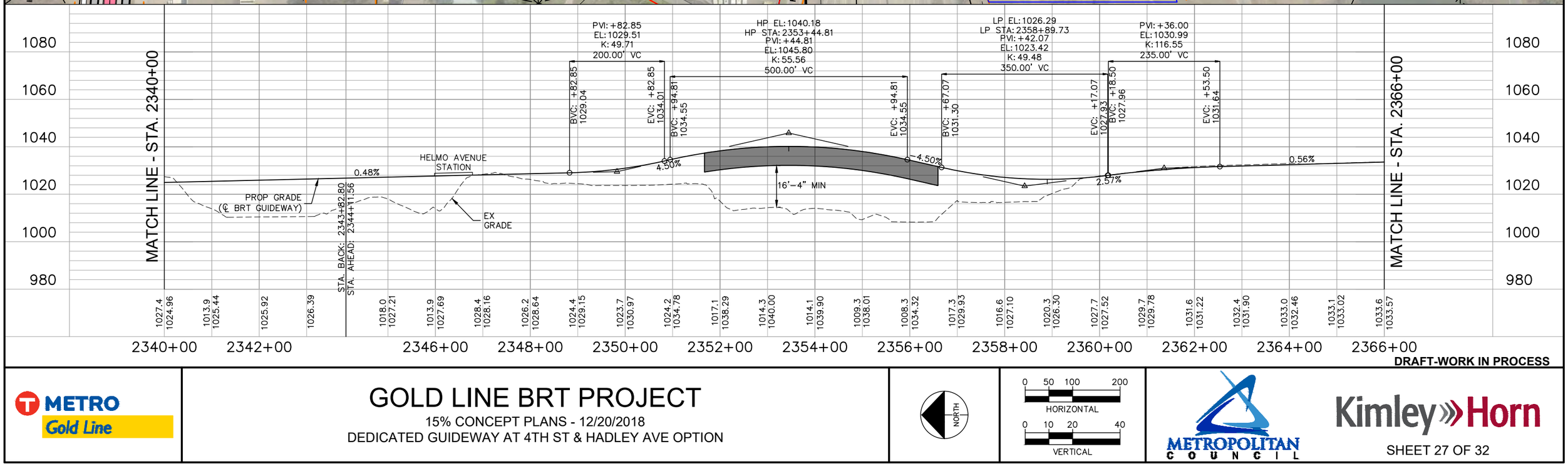
METROPOLITAN COUNCIL

Kimley»Horn

SHEET 26 OF 32

Dec, 11 2018 03:19 pm C:\caddlib\pw\amueller\greatlakes\d0181239\SEC4-CIV-PLN_PRF.dwg By: adam.mueller





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

DEDICATED GUIDEWAY AT 4TH ST & HADLEY AVE OPTION

NORTH

0 50 100 200
HORIZONTAL

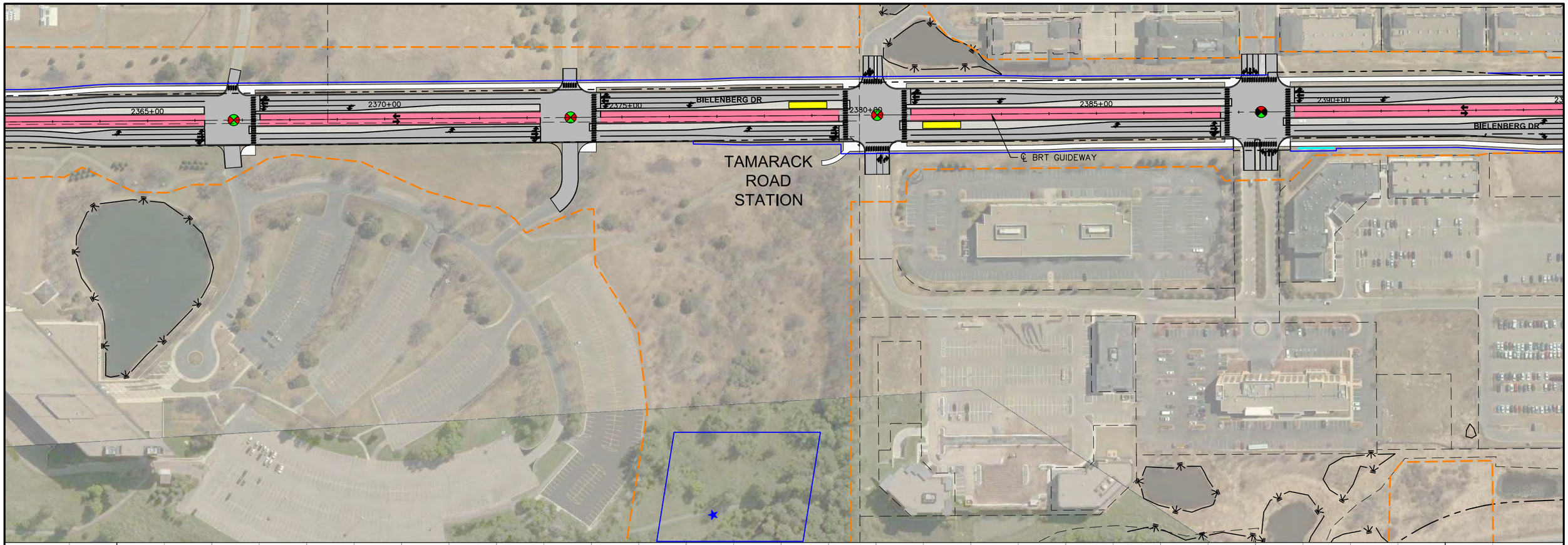
0 10 20 40
VERTICAL

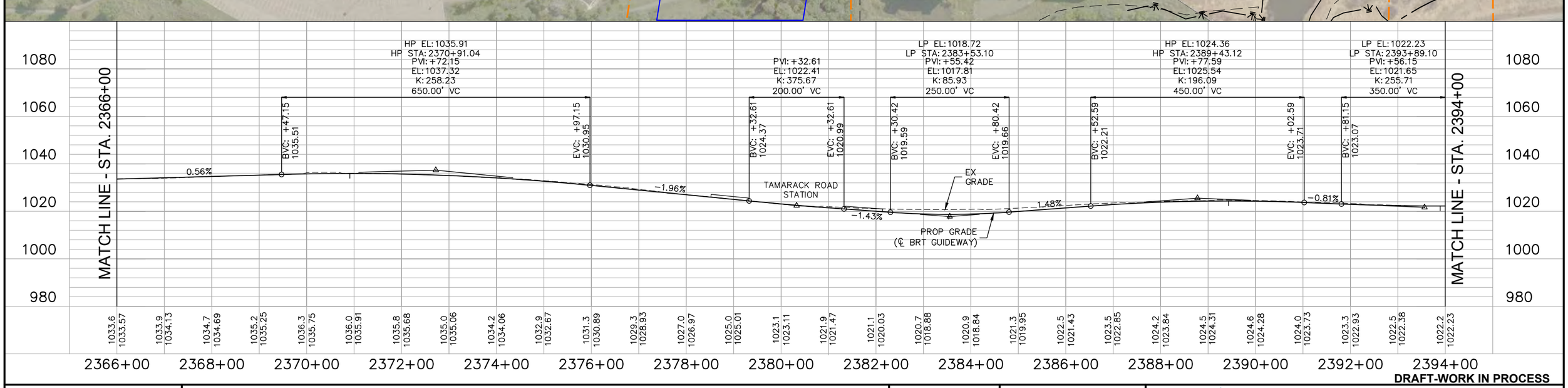
METROPOLITAN COUNCIL

Kimley»Horn

SHEET 27 OF 32

Dec, 11 2018 03:19 pm C:\caddlib\pw\amueller\greatlakes\d0181239\SEC4-CIV-PLN_PRF.dwg By: adam.mueller





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

15% CONCEPT PLANS - 12/20/2018

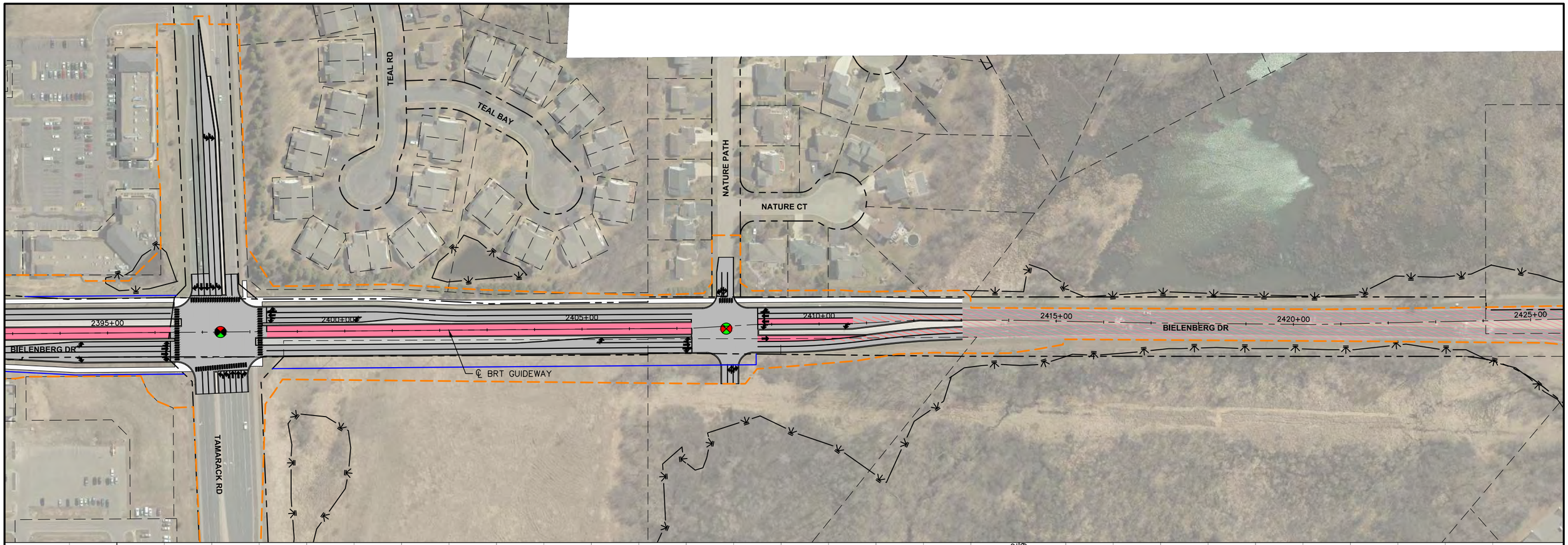
NORTH

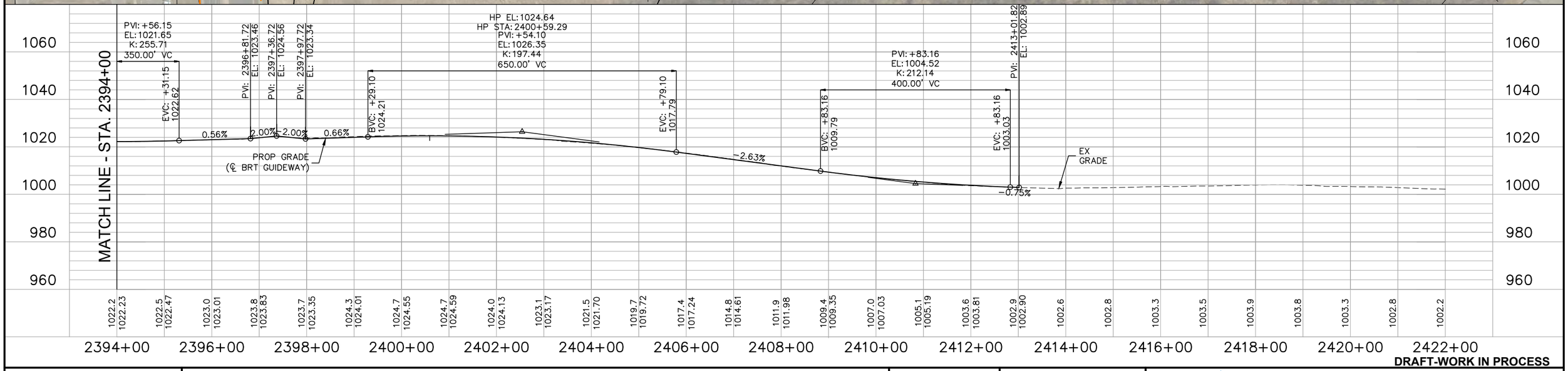
0 50 100 200
HORIZONTAL

0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

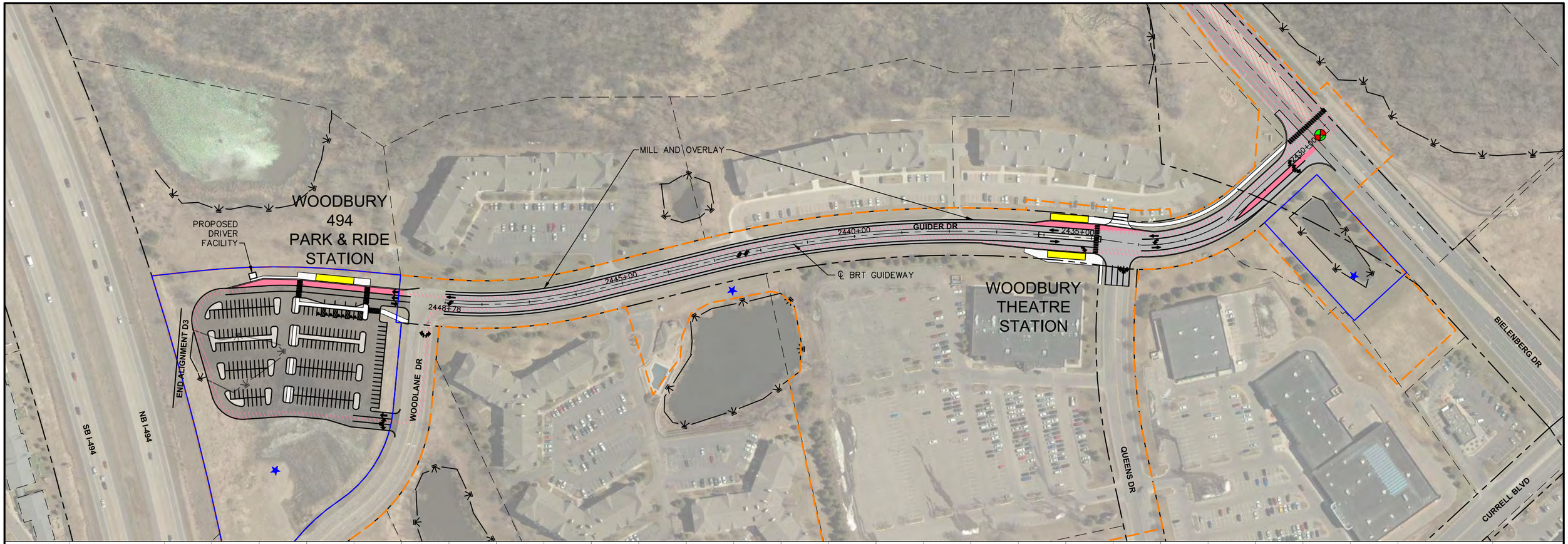
15% CONCEPT PLANS - 12/20/2018

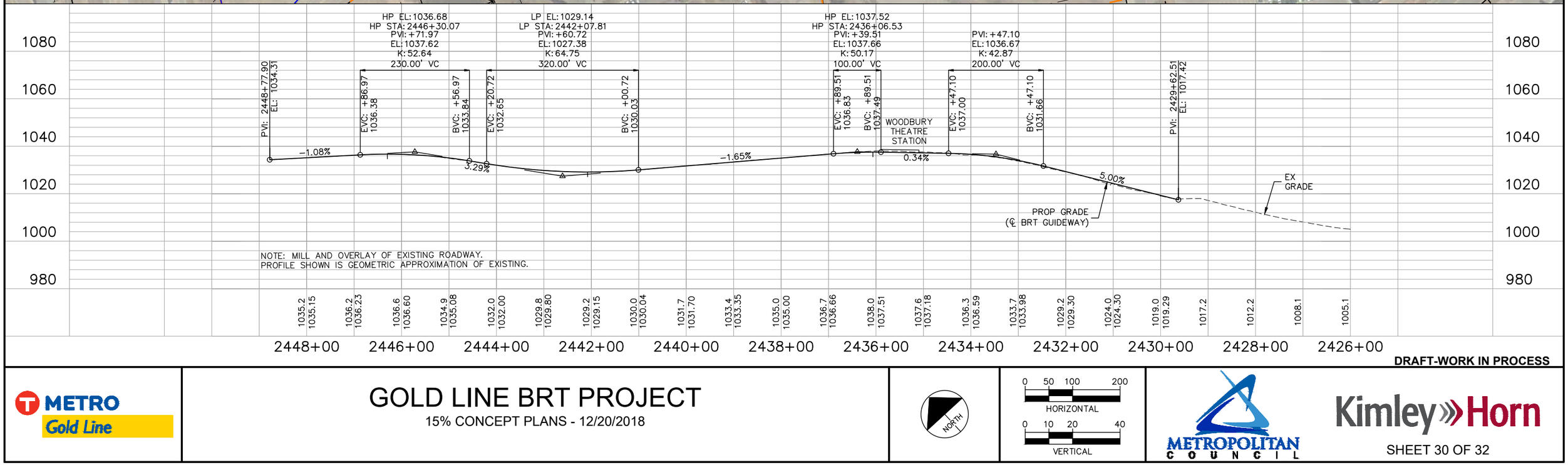
NORTH

0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn





DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

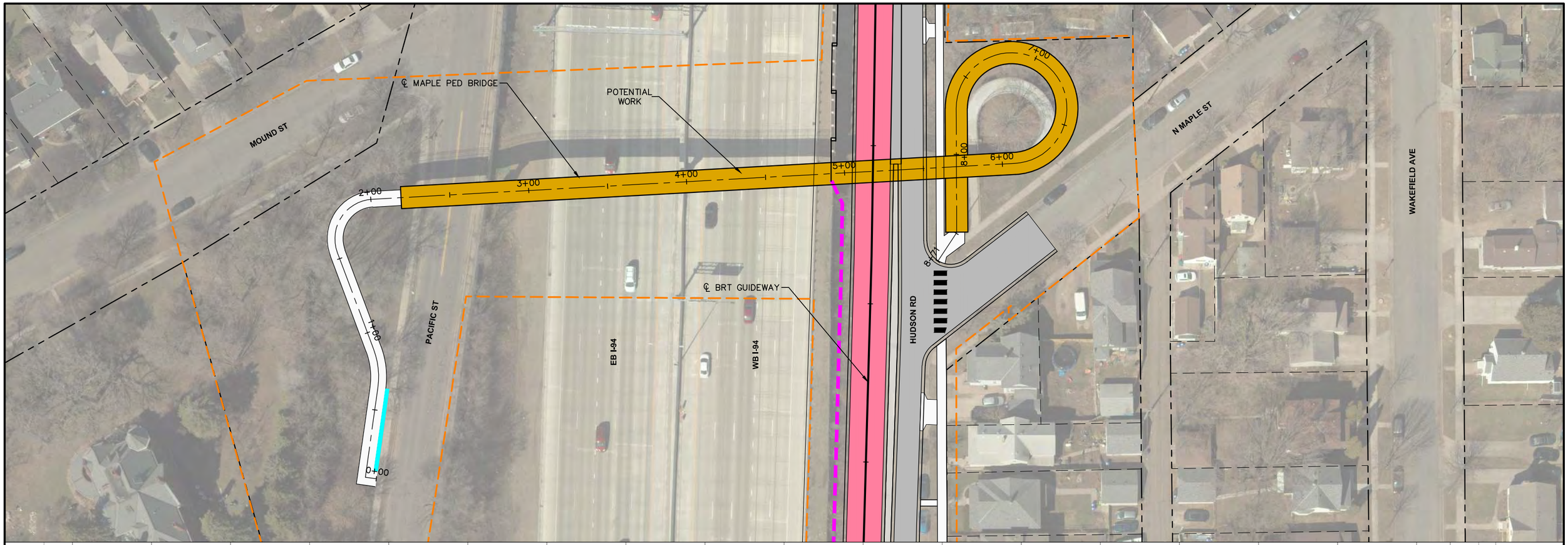
15% CONCEPT PLANS - 12/20/2018

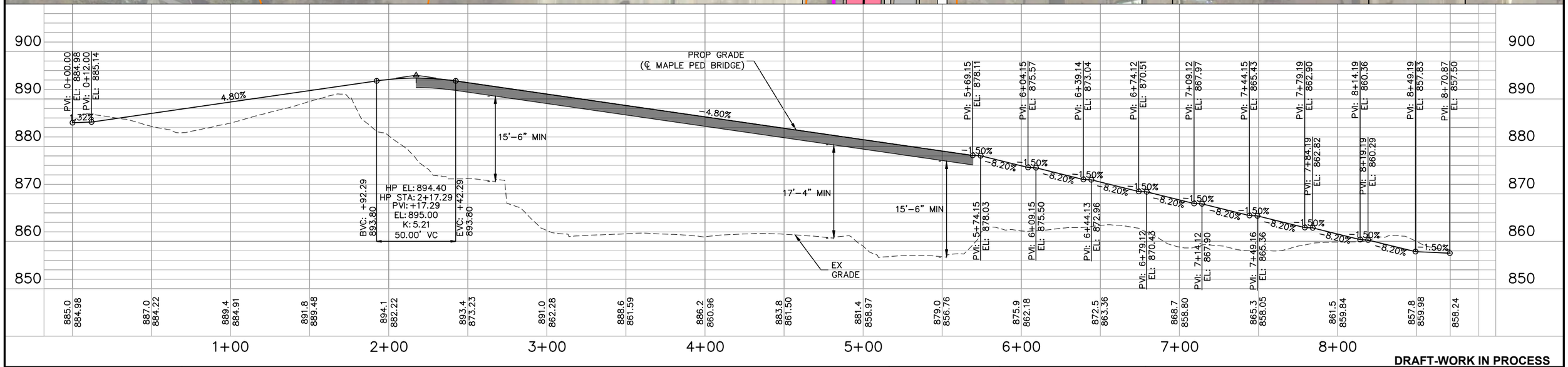
NORTH

0 50 100 200
HORIZONTAL
0 10 20 40
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn


℄ MAPLE PED BRIDGE
POTENTIAL WORK
MOUND ST
PACIFIC ST
℄ BRT GUIDEWAY
EB I-94
WB I-94
HUDSON RD
N MAPLE ST
WAKEFIELD AVE
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00



DRAFT-WORK IN PROCESS

METRO Gold Line

GOLD LINE BRT PROJECT

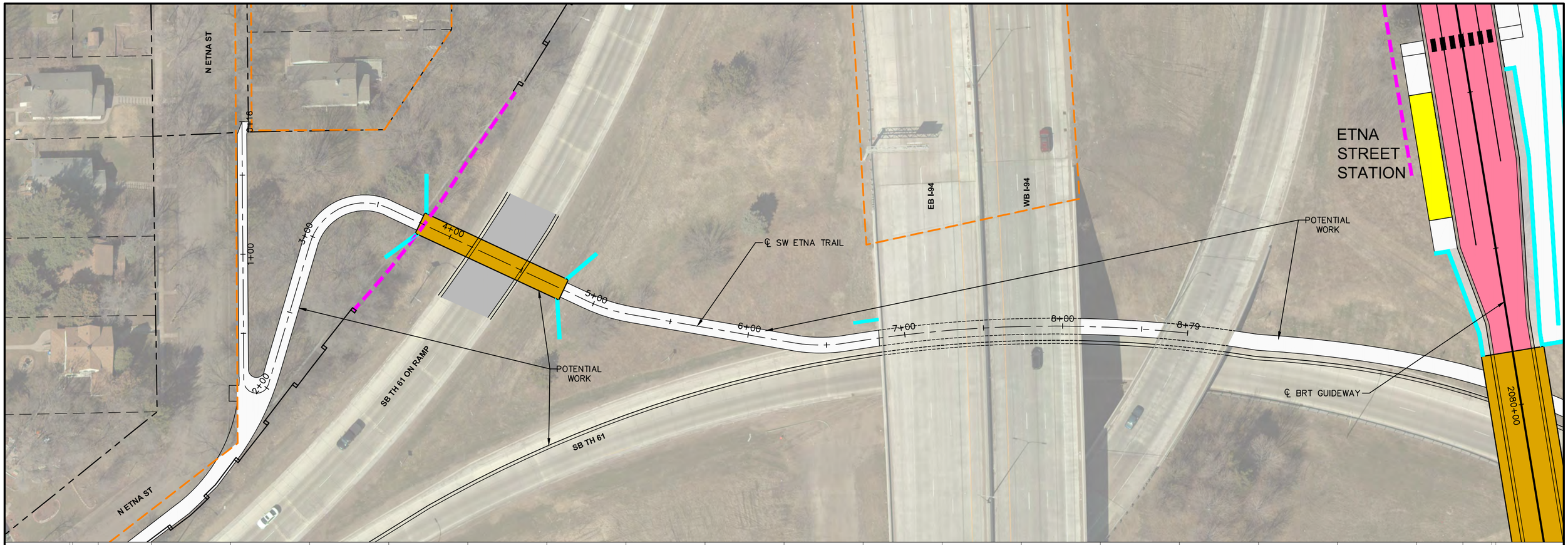
15% CONCEPT PLANS - 12/20/2018

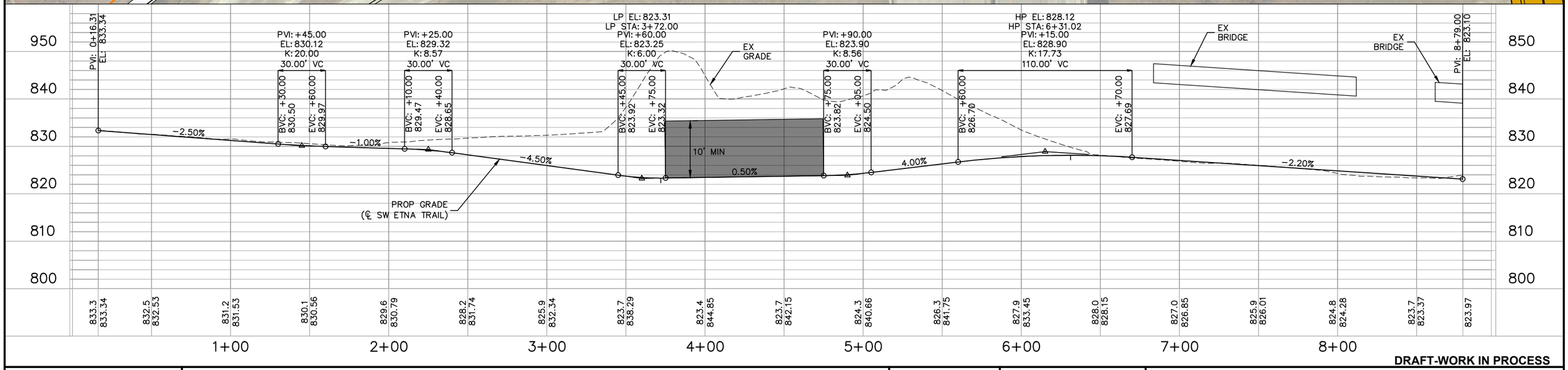
NORTH

0 15 30 60
HORIZONTAL
0 5 10 20
VERTICAL

METROPOLITAN COUNCIL

Kimley»Horn





DRAFT-WORK IN PROCESS

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