

Memorandum

DATE: June 29, 2015
TO: Jim Alexander
Director of Design and Engineering, Southwest LRT Project

FROM: JoNette Kuhnau, PE, PTOE
Traffic Lead, PEC - East

SUBJECT: PEC-East Traffic Technical Memorandum

1.0 INTRODUCTION

The Southwest Light Rail Transit (SWLRT) project is proposed to be a 16-mile LRT project with 17 new stations that will operate from downtown Minneapolis through St. Louis Park, Hopkins, Minnetonka, and Eden Prairie. The SWLRT line will serve as an extension of the METRO Green Line (Central Corridor) and will also connect to the METRO Blue Line (Hiawatha Corridor) in downtown Minneapolis.

The traffic analysis presented in this memorandum was based on the project scope shown in the SWLRT Preliminary Engineering (PE) plans dated September 2014. Recent discussions and evaluations have occurred relative to potential reductions in the length of the SWLRT line, the number of stations, and the number and size of park-and-ride facilities. However, the traffic analysis and discussion presented in the following sections reflect the full build-out of the SWLRT project.

1.1 Purpose of Memorandum

This technical memorandum has been prepared in support of the SWLRT project PE design and the Final Environmental Impact Statement (FEIS). The objective of the traffic analysis is to define the scope of the project improvements and evaluate the potential traffic impacts of the project, including the following:

- Evaluate the project's impacts on traffic operations at existing and proposed intersections and at-grade rail crossings along or near the SWLRT alignment.
- Identify proposed improvements to address operational issues identified in the traffic analysis.

The methodology, assumptions, and results of the analysis are presented in the following sections.

1.2 Study Areas

The location of the overall SWLRT alignment and the East and West segments of the project are shown in **Figure 1**. The East segment of the SWLRT analysis includes all intersections and at-grade crossings from east of 11th Ave in Hopkins to Target Field Station in Minneapolis. The West segment of the SWLRT analysis includes all intersections and at-grade crossings from Mitchell Station in Eden Prairie to east of 11th Ave in Hopkins. The proposed SWLRT guideway will be at-grade for most of its alignment and includes segments with the LRT operating in an exclusive guideway and semi-exclusive street-running operation. In the East segment, the LRT guideway operates next to an active freight rail alignment for most of its length, from approximately TH 169 to Glenwood Ave.

1.3 Data Collection

Multiple data elements were collected for each of the areas analyzed:

- 13-hour weekday counts at intersections including passenger vehicles, heavy vehicles, pedestrians, and bicycles
- Freight rail train lengths and crossing times
- On-site field survey to collect the following information:
 - Existing intersection geometry
 - Lane widths
 - Lane utilizations
 - Approximate peak hour queue lengths
 - Storage bay lengths to the nearest 10-ft increment
 - Approach speed limits
 - Traffic signal infrastructure, including emergency vehicle preemption
 - Relevant signage and pavement markings
- Timing and coordination plans for existing signalized intersections
- Bus routes, stops, and passenger loading/unloading

This data was used to assemble a comprehensive model of the existing conditions.

In addition, existing gate timings at station and non-station intersections were collected along the METRO Blue Line for use in the modeling of the future SWLRT operations.

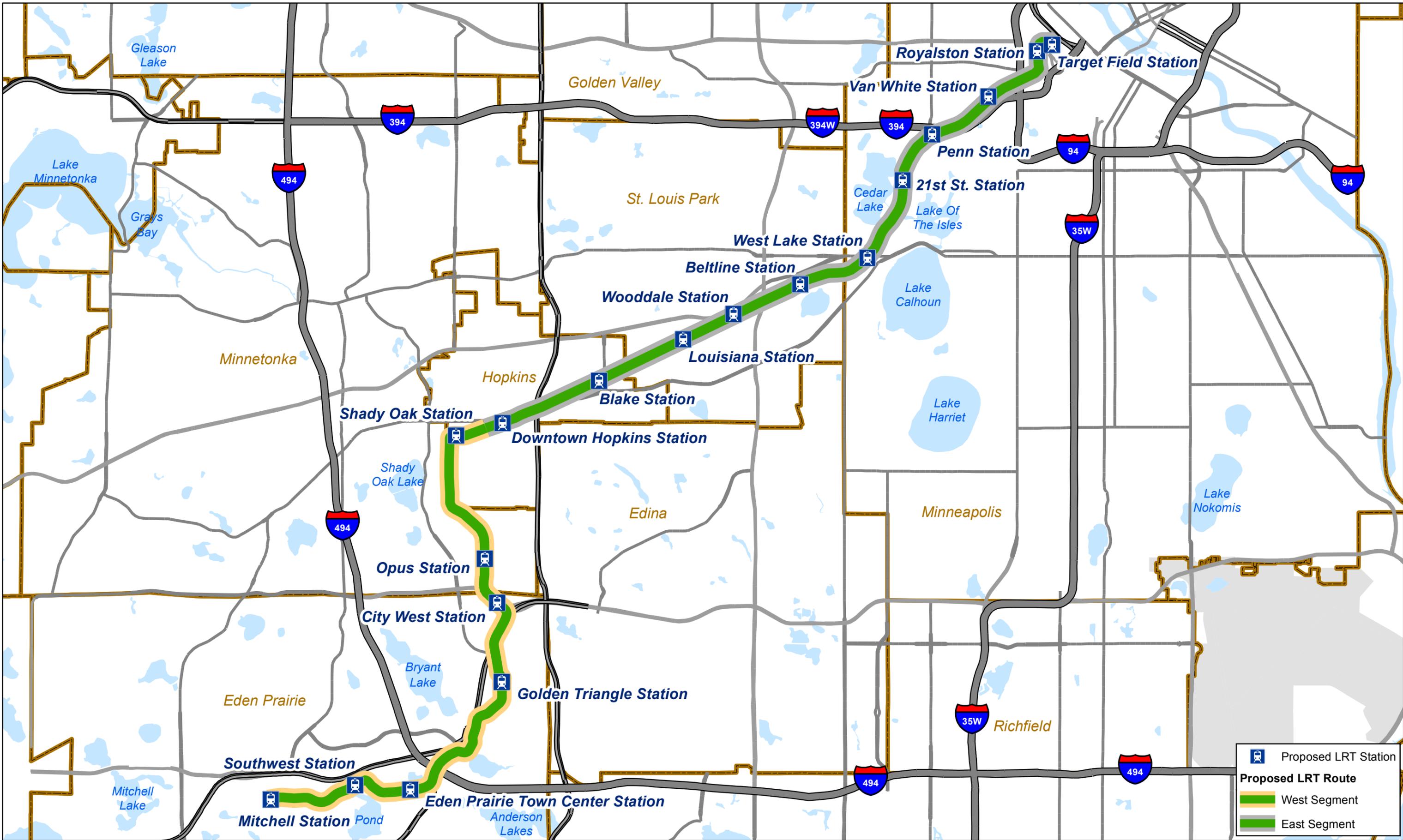


Figure 1. SWLRT Project Study Area

2.0 METHODOLOGY

2.1 Key Intersections and At-Grade Crossings

To determine the impacts of the SWLRT project on the local roadway network, a traffic operations analysis was conducted for signalized and unsignalized intersections within the vicinity of the new SWLRT alignment or that would be expected to have increased traffic due to the SWLRT stations, such as stations with park-and-ride facilities. The analysis area included signalized intersections with an LRT crossing in the intersection, the closest signalized or unsignalized intersections on both sides of an at-grade mid-block LRT crossing, and the intersections that provide access to a LRT station park-and-ride facility. At least two intersections were analyzed for each at-grade LRT crossing or park-and-ride facility. Grade separated crossings were not modeled because the LRT does not interact with pedestrian, bicycle, or vehicle traffic.

2.2 Forecast Traffic Volumes

The development of 2040 traffic forecasts for use in the simulation modeling was based on the preliminary 2040 socioeconomic data prepared by local communities and consistent with the Metropolitan Council's Thrive MSP 2040. This data was used as input to the Metropolitan Council's Regional Travel Demand Model. The outputs from the 2040 Regional Travel Demand Model were then compared to existing and historic traffic counts, as well as to the previous 2030 forecast roadway volumes contained in the 2030 Comprehensive Plans of each city and Hennepin County. This information, combined with the expected changes in land use and density, was utilized at a localized level to develop growth rates for each roadway segment within the project area. This information was also reviewed in combination with anticipated developments within each city to determine if different annual growth rates should be applied in calculating the opening year forecast volumes compared to the 2040 forecast volumes. This would be done if, for example, more rapid growth was expected at the beginning or end of the forecast horizon. The growth rates were then applied to existing turning movement counts to generate opening year and 2040 No Build peak hour turning movement forecasts.

For the study area within the City of Minneapolis, which is a fully built-out community where lower growth is expected, a slightly different methodology was used. As a typical practice the City of Minneapolis utilizes annual growth rates of 0.25 to 0.5 percent per year to develop background traffic forecasts, and a review of published forecasts by Hennepin County within the vicinity of the Minneapolis study area indicated typical growth rates of approximately 0.5 percent per year or less. Therefore, annual growth rates of 0.3 to 0.4 percent per year were utilized for roadways within the City of Minneapolis to develop No-Build forecasts.

Following the development of the baseline No Build forecasts, forecast traffic volumes for the park-and-ride sites were added to produce the Build forecasts. The development of the park-and-ride trip generation rates is documented in the SWLRT technical memorandum *Park-and-Ride Trip Generation* dated August 25, 2014.

Sensitivity testing within the Regional Travel Demand Model showed that the SWLRT alignment would not be expected to significantly reduce traffic volumes on the roadways under study. Therefore, the traffic generated by the park-and-ride sites was added to the No Build forecasts to

produce the Build forecasts, without any reduction in forecast traffic volumes due to LRT. This produces a conservative, worst case analysis in terms of the traffic volumes on the roadway network.

2.3 Traffic Analysis Methodology

The approach to the traffic operations analysis is derived from the established methodologies document in the *Highway Capacity Manual* (HCM). The HCM contains a series of analysis techniques for evaluating the operations of transportation facilities under specified conditions. The models for the SWLRT analysis have been developed using Synchro/SimTraffic and VISSIM, software packages that implement the HCM methodologies. The inputs into the software include lane geometrics, traffic volumes, pedestrian volumes, transit stations, freight and LRT alignments, freight and LRT volumes, intersection and grade crossing control devices, and signal phase and timing characteristics.

The output of the models are evaluated using the level of service thresholds as defined in the HCM, which are shown in **Table 2.1**. Based on standard practice in the traffic engineering industry, as well as guidance from the American Association of State Highway and Transportation Officials (AASHTO) and conformance with MnDOT practice, level of service D/E is considered to be the threshold of acceptable operations for an overall intersection in an urban or suburban area during peak hours.

The analysis periods included the highest hour of traffic volume during the weekday AM peak period (6-9 AM) and PM peak period (3-7 PM). The AM peak hour was generally identified as 7:30-8:30 AM and the PM peak was generally identified as 4:30-5:30 PM.

Table 2.1. Intersection Level of Service Definitions

Level of Service	Signalized Intersection Delay (seconds per vehicle)	Unsignalized Intersection 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: *Highway Capacity Manual 2010*

2.4 Design Criteria and Assumptions

All full access intersections with the LRT guideway, where all vehicular movements are allowed across the guideway, were assumed to be signalized and/or be controlled with automatic gates to provide safe movement of LRT and vehicles. All at-grade roadway/LRT crossings where LRT speeds are expected to exceed 35 miles per hour (mph) were assumed to have automatic gates in accordance with the guidance and standards contained in the 2009 edition of the *Minnesota Manual on Uniform Traffic Control Devices* (MMUTCD). The operation of automatic gates was also based on the standards in the MUTCD, which includes:

- Gate arms start lowering a minimum of 3 seconds after the flashing-light signals start to operate;
- Gate arms shall reach the horizontal position at least 5 seconds before the arrival of the rail traffic;
- Gate arms shall remain in the down position as long as the rail traffic occupies the grade crossing; and
- Gate arms should ascend to the upright position in 12 seconds or less.

For a typical LRT crossing, the time from the gates being activated until they return to the upright position is approximately 50 seconds.

Signalized intersections within 200 feet of an at-grade crossing, or signalized intersections where queues could potentially extend across an at-grade crossing, were identified for interconnection to the rail crossing. At these locations, the signal is proposed to be preempted by the rail crossing, in order to provide for clearance of queues from the tracks prior to the gate arms being lowered.

2.5 Measures of Effectiveness

The measures of effectiveness used to evaluate the operations results and identify a project impact in need of improvement were based on intersection delay (level of service) and queuing.

The level of service (LOS) criteria used to identify a project impact were as follows:

- Overall intersection LOS E or F in Build conditions, if No Build intersection LOS D or better
- Approach or movement LOS E or F, if the movement negatively impacts upstream operations

Freight events do not typically occur in the peak hour in the existing conditions and are not expected to occur in the future year No Build or Build conditions. Therefore, the need for mitigations or improvements were not based on the peak hour operations with a freight event.

The criteria used to identify a queuing issue were as follows:

- 95th percentile queue length that exceeds storage length, if any of the following are also met:
 - Average back-of-queue exceeds storage length
 - Movement operates at LOS E or LOS F
 - 95th percentile queue blocks upstream full-access intersection(s)
- 95th percentile queue length exceeds 500 feet on a stop-controlled approach

Then, for locations where a queuing issue was identified, the need for mitigation was based on a comparison to the No Build conditions, the severity of the issue, the potential safety/operations implications at the study intersection, and what impacts the queue had on the larger roadway network. Where the need for queue mitigation was identified based on these criteria, improvements were added to the Build modeling and have been incorporated into the SWLRT project. These improvements are listed in Section 5.1, along with all improvements that have been identified to be built as part of the SWLRT project.

3.1 EXISTING CONDITIONS ANALYSIS

The existing conditions models were developed to validate and calibrate the simulation models, which would then be used to model the future year conditions. The assumptions, methodology, and results of the existing conditions analysis are presented in the following sections.

3.2 Assumptions

The existing conditions analysis was based on traffic volumes, roadway geometrics, rail crossing treatments, and signal operations as existed in 2013 when the data collection was completed. No improvements were assumed in the existing analysis. The existing peak hour traffic volumes, which are based on the counts conducted in 2013, are provided in **Appendix A**. The geometrics and intersection control for the existing conditions are shown in the intersection layout tables provided in **Appendix B**.

The AM peak hour was assumed to be 7:30-8:30 AM and the PM peak hour was assumed to be 4:30-5:30 PM for all intersections, based on the turning movement data collected within the study area.

Current information from the Twin Cities and Western Railroad (TC&W) indicates that 14 weekly trains (2 per day) with 65 to 75 cars and 5 to 6 weekly trains (no more than 1 per day) with 80 to 125 cars are expected on the Canadian Pacific (CP) Bass Lake Spur. Data collected along the existing freight rail alignment in 2013 showed that freight trains, 30 to 40 cars in length, typically travel through the corridor after the AM peak hour and after the PM peak hour. Longer 80 to 125 car freight trains can arrive at any time during the day, including overnight. For the purposes of the analysis, all freight railcars were assumed to be 85 feet in length. This is a conservative assumption given that a typical grain railcar is approximately 65 feet in length.

The factors of train length and travel speed are integrally related, because together they determine the amount of time a crossing is blocked. Freight speeds of 25 mph were assumed for the at-grade freight crossings at 5th Ave S, Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St, Blake Rd, Wooddale Ave, and Beltline Blvd on the Bass Lake Spur, and freight speeds of 10 mph were assumed for the at-grade freight crossings at Cedar Lake Pkwy and 21st St W on the Kenilworth Corridor. The arrival of any freight train in the peak hour would represent the worst case condition in terms of time of day. However, this is not likely to occur, given the current schedules of the freight rail operators and the Northstar Commuter Rail on other connecting lines in the Twin Cities area. Northstar trains travel on the BNSF tracks between Target Field in Minneapolis and Big Lake on the BNSF Wayzata Subdivision. The Wayzata Subdivision is also a single track line, so the commuter train operation impacts how many freight trains can operate on the Wayzata Subdivision during the AM and PM peak hours.

If a freight event on CP's Bass Lake Spur crossing were to occur during the peak hours, the likely train length would be 65 to 75 cars based on the frequency of these trains. A train length of 75 cars was chosen for all scenarios for all the modeling areas with an at-grade freight crossing to capture the impacts of the most likely freight event to occur during the peak hours.

Relative to time of day, the current data shows it is rare for a train to arrive during the peak hour. Even if the overall number of freight trains per day were to increase, the arrival of more than one freight train during the peak hour is extremely unlikely due to the distance that trains must travel on the single track configuration through the corridor. Therefore the analysis of one train arriving in the peak hour is still considered to be the worst case.

3.3 Traffic Modeling Overview and Results

The study area was broken into eight modeling areas based on where the SWLRT alignment or SWLRT facilities such as park-and-rides or passenger drop-off areas would be expected to interact with the roadway network. The locations of the intersections and at-grade crossings studied as part of the East segment are shown in **Figure 2**. The following modeling areas were used through the analysis of the East segment of the SWLRT project:

- Downtown Hopkins Station and Blake Station
- Louisiana Station
- Wooddale Station
- Beltline Station
- Penn Station
- West Lake Station
- Cedar Lake Parkway and 21st St Station
- Royalston Station

The operations results are presented by modeling areas in the following sections.

No modeling was completed for the Van White Station area in the existing, No Build, or Build conditions based on the low volume of existing traffic in that area, and the very small volume of traffic expected to be generated at the station.

At locations where there is no freight rail crossing or where freight rail is grade separated, the No Freight Event and 75-car Freight Event scenarios would have the same operations since the freight rail does not interact with vehicle traffic. Therefore, only results for the No Freight Event scenarios are presented at these locations.

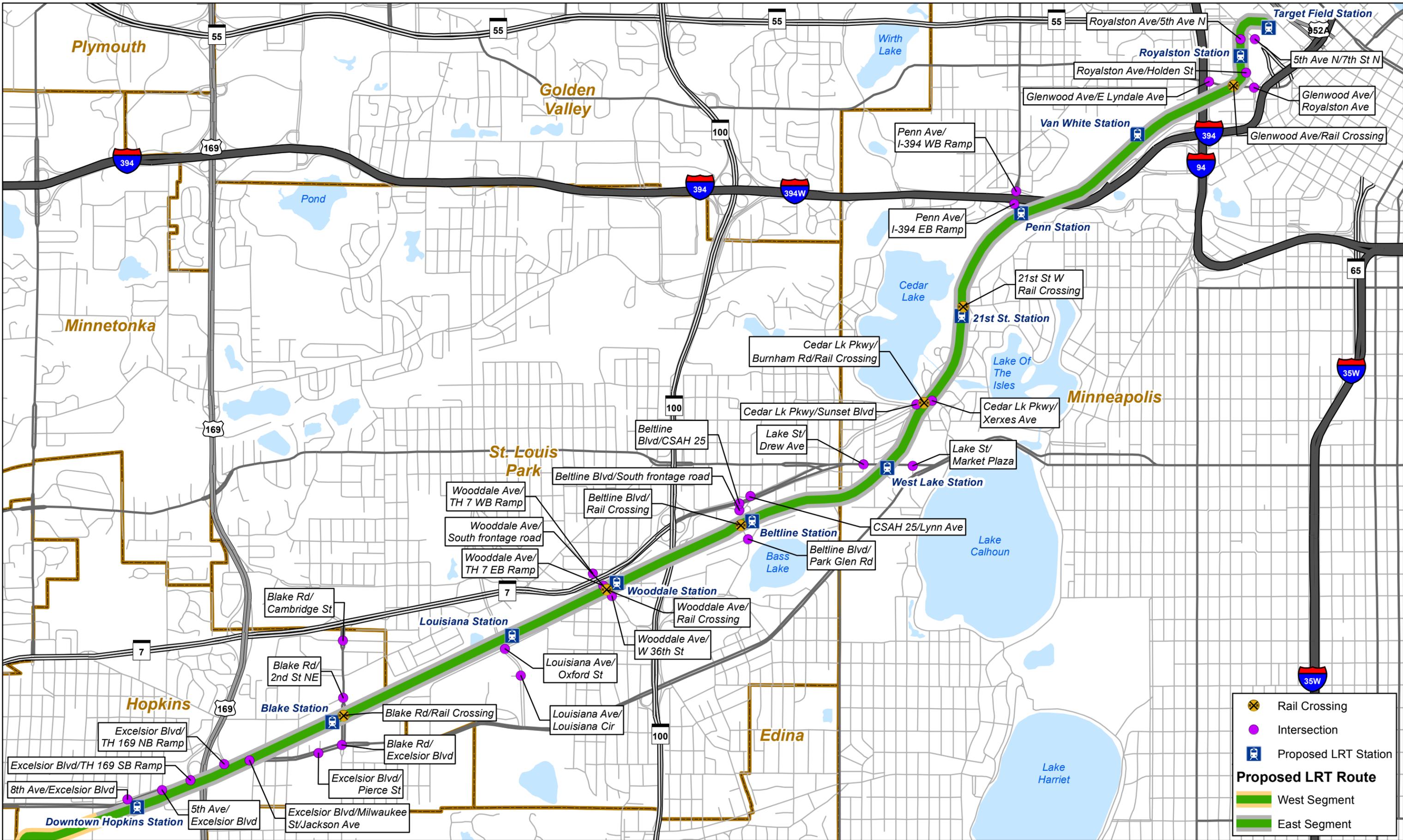


Figure 2. East Segment Analysis Area



3.2.1 Downtown Hopkins Station and Blake Station

The Downtown Hopkins Station and Blake Station areas are primarily connected by Excelsior Blvd (County State Aid Highway (CSAH) 3), which is a signalized corridor with an interchange at TH 169 between the two station areas. There are existing at-grade freight rail crossings at the following locations:

- 5th Ave south of Excelsior Blvd (CSAH 3) – Crossing has cantilevered railroad flashers and does not preempt any adjacent signals.
- Excelsior Blvd (CSAH 3) at Jackson Ave/Milwaukee St – Crossing has automatic gates and flashers, and preempts the signal.
- Blake Road (CSAH 20) north of Excelsior Blvd (CSAH 3) – Crossing has automatic gates and flashers and does not preempt any adjacent signals.

This area was modeled in VISSIM due to the interactions with freight and future interactions with LRT. The results of the existing AM and PM peak hour analysis showed that all intersections currently operate at LOS D or better during the peak hour scenarios, including a 75-car freight event. The overall intersection results are shown in **Table 3.1** below.

Movements for which queuing issues were identified in one or more scenarios were as follows:

- Excelsior Blvd (CSAH 3)/ 8th Ave – Southbound left-turn
- Excelsior Blvd (CSAH 3)/ 5th Ave – Northbound left-turn; Southbound left-turn and right-turn
- Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St – Westbound through
- Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20) – Northbound left-turn; Southbound left-turn
- Blake Rd (CSAH 20)/ 2nd St NE – Eastbound left-turn

The full table of existing conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 3.1. Downtown Hopkins Station and Blake Station – Existing Conditions Results

Intersection	Overall Intersection Delay and LOS			
	AM No Freight Event	AM 75-Car Freight	PM No Freight Event	PM 75-Car Freight
Excelsior Blvd (CSAH 3)/ 8 th Ave	19.0 B	19.0 B	22.6 C	22.3 C
Excelsior Blvd (CSAH 3)/ 5 th Ave	18.8 B	19.0 B	21.1 C	21.3 C
Excelsior Blvd (CSAH 3)/ TH 169 SB Ramps	23.3 C	22.9 C	15.5 B	15.5 B
Excelsior Blvd (CSAH 3)/ TH 169 NB Ramps	37.3 D	39.8 D	29.4 C	34.6 C
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	38.5 D	44.0 D	29.2 C	40.6 D
Excelsior Blvd (CSAH 3)/ Pierce Ave*	2.1 A	2.5 A	4.5 A	4.7 A
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	37.4 D	38.7 D	36.0 D	35.8 D
Blake Rd (CSAH 20)/ Rail Crossing	0.3 A	6.2 A	0.2 A	5.6 A
Blake Rd (CSAH 20)/ 2 nd St NE	10.3 B	10.4 B	14.4 B	14.8 B
Blake Rd (CSAH 20)/ Cambridge St	11.7 B	11.9 B	14.4 B	14.3 B

*Side street stop-controlled intersection

3.2.2 Louisiana Station

The Louisiana Station area has a grade-separated freight crossing and the analysis area included adjacent signalized intersections on Louisiana Ave.

This area was modeled in Synchro/SimTraffic because the freight rail does not interact with vehicle traffic, and the LRT is also proposed to be grade separated. The results of the existing AM and PM peak hour analysis showed that all intersections currently operate at LOS A or better during the peak hour scenarios. The overall intersection results are shown in **Table 3.2** below.

No queuing issues were identified in the existing conditions.

The full table of existing conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 3.2. Louisiana Station – Existing Conditions Results

Intersection	Overall Intersection Delay and LOS	
	AM No Freight Event	PM No Freight Event
Louisiana Ave/ Oxford St	6.7 A	9.2 A
Louisiana Ave/ Louisiana Cir	5.9 A	7.3 A

3.2.3 Wooddale Station

The Wooddale Station area includes Wooddale Ave and the interchange with TH 7. Wooddale Ave at TH 7 was reconstructed in 2012 and was designed to accommodate a 4-lane section, but is currently striped as two lanes at the rail crossing. The interchange ramps at Wooddale Ave/TH 7 are currently unsignalized, with stop control on the ramp approaches. The existing at-grade freight rail crossing of Wooddale Ave has railroad flashers and preempts the Wooddale Ave/W 36th St intersection.

This area was modeled in VISSIM due to the interactions with freight and future interactions with LRT. The results of the existing AM and PM peak hour analysis showed that all intersections currently operate at LOS C or better during the peak hour scenarios, including a 75-car freight event. The overall intersection results are shown in **Table 3.3** below.

Movements for which queuing issues were identified in one or more scenarios were as follows:

- Wooddale Ave/ TH 7 EB Ramps – Eastbound right-turn
- Wooddale Ave/ South Frontage Rd – Southbound left-turn and through
- Wooddale Ave/ Rail Crossing – Northbound through, Southbound through
- Wooddale Ave/ W 36th St – Southbound left-turn and through; Westbound right-turn

The full table of existing conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 3.3. Wooddale Station – Existing Conditions Results

Intersection	Overall Intersection Delay and LOS			
	AM No Freight Event	AM 75-Car Freight	PM No Freight Event	PM 75-Car Freight
Wooddale Ave/ TH 7 WB Ramps*	1.7 A	2.2 A	3.8 A	5.2 A
Wooddale Ave/ TH 7 EB Ramps*	3.8 A	6.4 A	7.8 A	19.3 C
Wooddale Ave/ South Frontage Rd*	2.2 A	3.3 A	3.4 A	5.3 A
Wooddale Ave/ Rail Crossing	1.8 A	3.2 A	3.2 A	4.6 A
Wooddale Ave/ W 36 th St	15.5 B	17.6 B	19.7 B	24.8 C

*Side street stop-controlled intersection

3.2.4 Beltline Station

The Beltline Station area includes the portions of Beltline Blvd and CSAH 25 near the proposed Beltline Station. The area has an existing at-grade freight rail crossing of Beltline Blvd, which has cantilevered railroad flashers and automatic gates but does not preempt any signalized intersections.

This area was modeled in VISSIM due to the interactions with freight and future interactions with LRT. The results of the existing AM and PM peak hour analysis showed that all intersections currently operate at LOS D or better during the peak hour scenarios, including a 75-car freight event. The overall intersection results are shown in **Table 3.4** below.

Movements for which queuing issues were identified in one or more scenarios were as follows:

- Beltline Blvd/ CSAH 25 – Northbound left-turn, through, right-turn; Southbound through
- Beltline Blvd/ South Frontage Rd – Eastbound right-turn

The full table of existing conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 3.4. Beltline Station – Existing Conditions Results

Intersection	Overall Intersection Delay and LOS			
	AM No Freight Event	AM 75-Car Freight	PM No Freight Event	PM 75-Car Freight
Beltline Blvd/ CSAH 25	29.4 C	29.1 C	38.2 D	37.9 D
Beltline Blvd/ South Frontage Rd*	12.3 B	11.7 B	18.4 C	18.7 C
Beltline Blvd/ Rail Crossing	1.0 A	6.9 A	2.1 A	8.3 A
Beltline Blvd/ Park Glen Rd*	3.5 A	5.6 A	2.5 A	4.0 A
CSAH 25/ Lynn Ave*	0.4 A	0.4 A	0.6 A	0.6 A

*Side street stop-controlled intersection

3.2.5 West Lake Station

The West Lake Station area does not have any vehicular connections to W Lake St (CSAH 5), but was included in the traffic modeling due to proposed bus stops on W Lake St over the LRT station.

This area was modeled in VISSIM due to the interactions between buses and vehicle traffic. No LRT or freight traffic was included in the modeling, since they are grade separated at W Lake St (CSAH 5).

The results of the existing AM and PM peak hour analysis showed that all intersections currently operate at LOS C or better during the peak hour scenarios. The overall intersection results are shown in **Table 3.5** below.

Movements for which queuing issues were identified in one or more scenarios were as follows:

- W Lake St/ Market Plaza – Westbound left-turn

The full table of existing conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 3.5. West Lake Station – Existing Conditions Results

Intersection	Overall Intersection Delay and LOS	
	AM No Freight Event	PM No Freight Event
W Lake St/ Drew Ave	2.4 A	3.1 A
W Lake St/ Market Plaza	23.9 C	33.6 C

3.2.6 Cedar Lake Pkwy and 21st St Station

The 21st St Station area includes freight rail crossings at both 21st St W and Cedar Lake Pkwy. The existing freight crossing at Cedar Lake Pkwy has railroad flashers and the existing freight crossing at 21st St W has crossbucks and stop signs.

This area was modeled in VISSIM due to the interactions with freight and future interactions with LRT. The results of the existing AM and PM peak hour analysis showed that all intersections currently operate at LOS D or better during the peak hour scenarios, with the following exception:

- 21st St W/Rail Crossing in the existing PM peak 75-car Freight event

The overall intersection results are shown in **Table 3.6** below.

Movements for which queuing issues were identified in one or more scenarios were as follows:

- Cedar Lake Pkwy/ Sunset Blvd – Northbound left-turn/right-turn
- Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd – Eastbound through; Westbound through
- Cedar Lake Pkwy/ Xerxes Ave – Westbound through
- Cedar Lake Pkwy/ Benton Blvd – Westbound through

The full table of existing conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 3.6. Cedar Lake Pkwy and 21st St Station – Existing Conditions Results

Intersection	Overall Intersection Delay and LOS			
	AM No Freight Event	AM 75-Car Freight	PM No Freight Event	PM 75-Car Freight
Cedar Lake Pkwy/ Sunset Blvd*	1.2 A	14.5 B	2.6 A	34.4 D
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd*	1.3 A	10.3 B	1.4 A	9.8 A
Cedar Lake Pkwy/ Xerxes Ave*	1.2 A	11.7 B	0.8 A	5.4 A
Cedar Lake Pkwy/ Benton Blvd*	0.8 A	32.4 D	0.7 A	13.8 B
21 st St W/ Rail Crossing*	1.1 A	25.3 D	1.1 A	38.4 E

*Side street stop-controlled intersection

3.2.7 Penn Station

The Penn Station area is not directly connected to the adjacent roadway network and there are not proposed interactions with LRT or freight, but was included in the traffic modeling due to a proposed passenger drop-off area near the interchange of Penn Ave and I-394.

This area was modeled in Synchro/SimTraffic because the rail does not interact with vehicle traffic, and the LRT is also proposed to be grade separated. The results of the existing AM and PM peak hour analysis showed that all intersections currently operate at LOS B or better during the peak hour scenarios. The overall intersection results are shown in **Table 3.7** below.

No queuing issues were identified in the existing conditions.

The full table of existing conditions LOS and queuing analysis can be found in **Appendix C**.

Table 3.7. Penn Station – Existing Conditions Results

Intersection	Overall Intersection Delay and LOS	
	AM No Freight Event	PM No Freight Event
Penn Ave/ I-394 WB Ramps	13.0 B	12.6 B
Penn Ave/ I-394 EB Ramps	9.9 A	16.0 B

3.2.8 Royalston Station

The Royalston Station area does not have any interactions with freight rail, but includes the proposed at-grade LRT crossings of Glenwood Ave and Royalston Ave, as well as the proposed station access at 7th St N/ 5th Ave N.

This area was modeled in VISSIM due to the future interactions with LRT. The results of the existing AM and PM peak hour analysis showed that all intersections currently operate at LOS C or better during the peak hour scenarios. The overall intersection results are shown in **Table 3.8** below.

No queuing issues were identified in the analysis.

The full table of existing conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 3.8. Royalston Station – Existing Conditions Results

Intersection	Overall Intersection Delay and LOS	
	AM No Freight Event	PM No Freight Event
Glenwood Ave/ E Lyndale Ave	20.4 C	22.4 C
Glenwood Ave/ Royalston Ave/ 12 th St N/ Twins Way	20.2 C	20.7 C
Royalston Ave/ Holden St*	0.8 A	0.7 A
Royalston Ave/ 5 th Ave N*	1.7 A	1.3 A
7 th St N/ 5 th Ave N*	1.0 A	0.5 A

*Side street stop-controlled intersection

3.3 Existing Conditions Summary

All intersections operate at LOS D or better in the existing AM and PM peak conditions, with the following exception:

- 21st St W/Rail Crossing in the PM Peak 75-car Freight Event scenario

The 21st St W/Rail Crossing intersection has very low traffic volumes, with less than 20 vehicles in each direction in the peak hour. Therefore the impact of the freight event on a few vehicles has a very significant influence on the average delay at the intersection. However, the delays do not cause queuing issues through upstream intersections.

4.0 NO BUILD ANALYSIS

The No Build modeling was conducted to identify the expected traffic operations at the Opening Year of the SWLRT project (2020) and for the forecast horizon year (2040). The assumptions, methodology, and results of the No Build conditions analysis are presented in the following sections.

4.1 Assumptions

Opening Year and 2040 forecast peak hour volumes were based on the forecast daily traffic volumes for key roadway segments within the study area. **Table 4.1** shows the existing and forecast daily traffic volumes for the East segment.

Table 4.1 – East Segment Existing and Forecast Daily Traffic Volumes

Roadway	Segment	Existing (2013) Daily Traffic	Opening Year Forecast Daily Traffic	2040 Forecasts	
				2040 Forecast Daily Traffic	2013 to 2040 Annual Growth Rate
Excelsior Blvd (CSAH 3)	11th Ave to TH 169	23,200	23,800	25,300	0.3%
	TH 169 to Jackson Ave/ Milwaukee St	23,500	24,100	25,600	0.3%
	Jackson Ave/Milwaukee St to Blake Rd (CSAH 20)	19,700	20,700	23,300	0.6%
	Blake Rd (CSAH 20) to Louisiana Ave	19,000	21,000	26,600	1.3%
	Louisiana Ave to TH 100	22,200	23,900	28,600	0.9%
8 th Ave	North of Excelsior Blvd (CSAH 3)	5,400	5,700	6,400	0.6%
	South of Excelsior Blvd (CSAH 3)	1,200	1,300	1,400	0.6%
5 th Ave	North of Excelsior Blvd (CSAH 3)	4,600	4,800	5,400	0.6%
	South of Excelsior Blvd (CSAH 3)	3,300	3,500	3,900	0.6%
Jackson Ave	North of Excelsior Blvd (CSAH 3)	6,300	6,600	7,500	0.6%
Blake Rd (CSAH 20)	TH 7 to 2nd St NE	13,600	15,000	19,000	1.2%
	2nd St NE to Excelsior Blvd (CSAH 3)	13,700	15,100	19,200	1.3%
	South of Excelsior Blvd (CSAH 3)	9,300	9,800	11,000	0.6%
Louisiana Ave	North of Oxford St	13,800	14,500	16,300	0.6%
	South of Oxford St	9,900	10,700	12,800	1.0%

Table 4.1 – East Segment Existing and Forecast Daily Traffic Volumes (continued)

Roadway	Segment	Existing (2013) Daily Traffic	Opening Year Forecast Daily Traffic	2040 Forecasts	
				2040 Forecast Daily Traffic	2013 to 2040 Annual Growth Rate
Wooddale Ave	Lake St to TH 7	7,300	7,900	9,400	0.9%
	TH 7 to W 36th St	15,700	16,500	18,600	0.6%
	South of W 36th St	10,700	11,500	13,800	0.9%
W 36 th St	TH 100 to Beltline Blvd	14,100	15,200	18,200	0.9%
	Wooddale Ave to TH 100	17,800	18,700	21,100	0.6%
	West of Wooddale Ave	4,000	4,200	4,700	0.6%
Beltline Blvd	Excelsior Blvd (CSAH 3) to CSAH 25	12,700	13,300	17,600	1.2%
	North of CSAH 25	4,500	4,700	5,900	1.0%
CSAH 25	TH 100 to Beltline Blvd	25,500	26,100	28,700	0.4%
	East of Beltline Blvd	21,200	22,300	26,300	0.8%
W Lake St	West of Excelsior Blvd (CSAH 3) split	26,600	27,300	29,000	0.3%
Cedar Lake Pkwy	East of Sunset Blvd	8,900	9,100	9,700	0.3%
	West of Sunset Blvd	4,800	4,900	5,200	0.3%
Sunset Blvd	South of Cedar Lake Pkwy	3,000	3,100	3,300	0.4%
21 st St W	West of Thomas Ave	400	400	450	0.4%
Penn Ave	North of I-394	11,100	11,400	12,100	0.3%
Glenwood Ave	E Lyndale Ave to Royalston Ave	7,200	7,400	7,800	0.3%
	East of Royalston Ave	4,300	4,400	4,700	0.3%
12 th St N	South of Glenwood Ave	7,200	7,400	7,800	0.3%
Royalston Ave	North of Holden St	3,100	3,200	3,400	0.3%

The turning movement volumes for No Build AM and PM peak in the Opening Year and 2040 conditions are provided in **Appendix A**.

In terms of freight train size and volume, current information from the TC&W Railroad indicates that 14 weekly trains (2 per day) with 65 to 75 cars and 5 to 6 weekly trains (no more than 1 per day) with 80 to 125 cars are expected on the Canadian Pacific (CP) Bass Lake Spur. A train length of 75 cars was chosen for all future year scenarios for all the modeling areas with an at-grade freight crossing, to capture the impacts of the most likely freight event to occur during the peak hours.

Freight speeds of 25 mph were assumed for the at-grade freight crossings at 5th Ave S, Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St, Blake Rd, Wooddale Ave, and Beltline Blvd on the Bass Lake Spur, and freight speeds of 10 mph were assumed for the at-grade freight crossings at Cedar Lake Pkwy and 21st St W on the Kenilworth Corridor.

Relative to time of day, the current data shows it is rare for a train to arrive during the peak hour. Even if the overall number of freight trains per day were to increase in the future conditions, the arrival of more than one freight train during the peak hour is extremely unlikely due to the distance that trains must travel on the single track configuration through the corridor. Therefore the analysis of one train arriving in the peak hour is still considered to be the worst case for future No Build and Build conditions.

The No Build analysis was based on the future year No Build traffic volumes, existing roadway geometrics and rail crossing treatments, and existing signal operations. The only geometric improvements assumed in the No Build analysis were based on projects that are currently programmed:

- Route modification of the Cedar Lake Regional Trail to cross the north leg of the Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St intersection and the east leg of the Excelsior Blvd (CSAH 3)/ TH 169 NB Ramps intersection, instead of the east leg and south leg of the Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St intersection.
- Signal reconstruction at Wooddale Ave/W 36th St including the addition of a southbound left-turn phase, a northbound left-turn lane, and the creation of eastbound left-turn and right-turn lanes. Pedestrian movements were also assumed to be added to all legs of the intersection, as part of the improvements.

Signal timing was assumed to be optimized in the 2040 analysis, but no signal phasing changes were assumed.

The geometrics and intersection control for the No Build conditions are shown in the intersection layout tables provided in **Appendix B**.

4.2 Traffic Modeling Overview and Results

The same eight modeling areas created for the existing conditions modeling were used for the No Build analysis. The No Build operations results are presented by modeling area in the following sections.

4.2.1 Downtown Hopkins Station and Blake Station

The results of the Opening Year No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, including a 75-car freight event.

The results of the 2040 No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, including a 75-car freight event.

The overall intersection results for Opening Year are shown in **Table 4.2** and the overall intersection results for 2040 are shown in **Table 4.3** below.

Movements for which queuing issues were identified in one or more Opening Year No Build scenarios were as follows:

- Excelsior Blvd (CSAH 3)/ 8th Ave – Southbound left-turn
- Excelsior Blvd (CSAH 3)/ 5th Ave – Northbound left-turn; Southbound left-turn and right-turn
- Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St – Westbound through
- Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20) – Northbound left-turn; Southbound left-turn
- Blake Rd (CSAH 20)/ 2nd St NE – Eastbound left-turn

Movements for which queuing issues were identified in one or more 2040 No Build scenarios were as follows:

- Excelsior Blvd (CSAH 3)/ 8th Ave – Southbound left-turn
- Excelsior Blvd (CSAH 3)/ 5th Ave – Northbound left-turn; Southbound left-turn and right-turn
- Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St – Westbound through
- Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20) – Northbound left-turn; Southbound left-turn
- Blake Rd (CSAH 20)/ 2nd St NE – Eastbound left-turn
- Blake Rd (CSAH 20)/ Cambridge St – Northbound left-turn

The full table of No Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 4.2. Downtown Hopkins Station and Blake Station – Opening Year No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year No Build AM No Freight Event	Opening Year No Build AM 75-Car Freight	Opening Year No Build PM No Freight Event	Opening Year No Build PM 75-Car Freight
Excelsior Blvd (CSAH 3)/ 8 th Ave	18.5 B	18.4 B	22.5 C	22.1 C
Excelsior Blvd (CSAH 3)/ 5 th Ave	19.1 B	19.1 B	21.2 C	21.4 C
Excelsior Blvd (CSAH 3)/ TH 169 SB Ramps	24.5 C	24.3 C	16.3 B	15.8 B
Excelsior Blvd (CSAH 3)/ TH 169 NB Ramps	38.5 D	41.8 D	31.2 C	36.9 D
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	39.6 D	44.7 D	31.5 C	47.0 D
Excelsior Blvd (CSAH 3)/ Pierce Ave*	1.9 A	2.2 A	4.0 A	4.3 A
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	38.3 D	39.9 D	36.7 D	36.4 D
Blake Rd (CSAH 20)/ Rail Crossing	0.3 A	6.3 A	0.3 A	5.8 A
Blake Rd (CSAH 20)/ 2 nd St NE	10.2 B	10.4 B	14.6 B	15.2 B
Blake Rd (CSAH 20)/ Cambridge St	11.0 B	11.1 B	14.5 B	14.7 B

*Side street stop-controlled intersection

Table 4.3. Downtown Hopkins Station and Blake Station – 2040 No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	2040 No Build AM No Freight Event	2040 No Build AM 75-Car Freight	2040 No Build PM No Freight Event	2040 No Build PM 75-Car Freight
Excelsior Blvd (CSAH 3)/ 8 th Ave	17.8 B	17.6 B	22.0 C	22.1 C
Excelsior Blvd (CSAH 3)/ 5 th Ave	21.5 C	21.1 C	26.7 C	26.4 C
Excelsior Blvd (CSAH 3)/ TH 169 SB Ramps	25.9 C	26.0 C	16.4 B	16.1 B
Excelsior Blvd (CSAH 3)/ TH 169 NB Ramps	41.8 D	48.6 D	32.8 C	41.9 D
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	42.4 D	49.6 D	34.1 C	47.9 D
Excelsior Blvd (CSAH 3)/ Pierce Ave*	2.1 A	2.4 A	5.2 A	5.3 A
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	39.7 D	41.0 D	39.4 D	39.3 D
Blake Rd (CSAH 20)/ Rail Crossing	0.4 A	6.1 A	0.5 A	5.3 A
Blake Rd (CSAH 20)/ 2 nd St NE	11.5 B	11.7 B	18.4 B	20.2 C
Blake Rd (CSAH 20)/ Cambridge St	11.7 B	11.8 B	19.0 B	20.2 C

*Side street stop-controlled intersection

4.2.2 Louisiana Station

The results of the Opening Year No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS A or better during the peak hour scenarios.

The results of the 2040 No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS B or better during the peak hour scenarios.

The overall intersection results are shown in **Table 4.4** below.

No queuing issues were identified in the Opening Year or 2040 No Build conditions.

The full table of No Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 4.4. Louisiana Station – No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year No Build AM No Freight Event	2040 No Build AM No Freight Event	Opening Year No Build PM No Freight Event	2040 No Build PM No Freight Event
Louisiana Ave/ Oxford St	7.0 A	7.9 A	9.4 A	10.6 B
Louisiana Ave/ Louisiana Cir	6.1 A	6.8 A	7.4 A	8.2 A

4.2.3 Wooddale Station

The results of the Opening Year No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, including a 75-car freight event.

The results of the 2040 No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, with the following exceptions:

- Wooddale Ave/ TH 7 EB Ramps in the 2040 No Build PM peak scenario with a 75-car freight event

It was also noted that the TH 7 EB ramp approach operated at LOS F and the TH 7 WB ramp approach operated at LOS E in the 2040 No Build PM peak scenario with no freight event. The poor LOS on the ramp approaches and the resulting queues were due to the two-lane section on Wooddale Ave and the side-street stop control at the ramp intersections.

The overall intersection results for Opening Year are shown in **Table 4.5** and the overall intersection results for 2040 are shown in **Table 4.6** below.

Movements for which queuing issues were identified in one or more Opening Year No Build scenarios were as follows:

- Wooddale Ave/ TH 7 EB Ramps – Eastbound left-turn and right-turn
- Wooddale Ave/ South Frontage Rd – Southbound left-turn and through
- Wooddale Ave/ Rail Crossing – Northbound through, Southbound through
- Wooddale Ave/ W 36th St – Southbound left-turn and through; Westbound right-turn

Movements for which queuing issues were identified in one or more 2040 No Build scenarios were as follows:

- Wooddale Ave/ TH 7 WB Ramps – Westbound right-turn
- Wooddale Ave/ TH 7 EB Ramps – Eastbound left-turn and right-turn
- Wooddale Ave/ South Frontage Rd – Southbound left-turn and through
- Wooddale Ave/ Rail Crossing – Northbound through, Southbound through
- Wooddale Ave/ W 36th St – Southbound left-turn and through; Westbound right-turn; Eastbound left-turn

It was noted that the 95th percentile queue would be expected to extend onto mainline TH 7 in the 2040 No Build PM peak scenarios, which is a safety and operations issue for TH 7. This queuing on the TH 7 EB ramps occurs because of the side-street stop control at Wooddale Ave. As queues on Wooddale Ave clear after the freight event, vehicles on Wooddale Ave have the right-of-way and therefore there are very few gaps for vehicles on the ramp to turn onto Wooddale Ave. An all-way stop condition would not be a good alternative to address this issue, due to the close spacing between the Wooddale Ave/TH 7 EB Ramps intersection and the freight crossing that can result in vehicles queues across the freight crossing in peak hours. The stop control does not provide the ability to clear the freight crossing of vehicles prior to the arrival of a freight train. A traffic signal would better manage the ramp queue by alternating assignment of right-of-way among the intersection approaches while still allowing for clearance of queues on Wooddale Ave across the tracks prior to a freight event.

The full table of No Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 4.5. Wooddale Station – Opening Year No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year No Build AM No Freight Event	Opening Year No Build AM 75-Car Freight	Opening Year No Build PM No Freight Event	Opening Year No Build PM 75-Car Freight
Wooddale Ave/ TH 7 WB Ramps*	2.7 A	4.5 A	4.4 A	8.0 A
Wooddale Ave/ TH 7 EB Ramps*	4.9 A	11.8 B	8.0 A	26.6 D
Wooddale Ave/ South Frontage Rd*	2.7 A	4.6 A	4.0 A	10.4 B
Wooddale Ave/ Rail Crossing	1.9 A	3.3 A	2.2 A	3.4 A
Wooddale Ave/ W 36 th St	15.4 B	17.5 B	16.6 B	20.7 C

*Side street stop-controlled intersection

Table 4.6. Wooddale Station – 2040 No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	2040 No Build AM No Freight Event	2040 No Build AM 75-Car Freight	2040 No Build PM No Freight Event	2040 No Build PM 75-Car Freight
Wooddale Ave/ TH 7 WB Ramps*	3.1 A	5.4 A	8.0 A	15.6 C
Wooddale Ave/ TH 7 EB Ramps*	5.7 A	12.9 B	28.3 D	95.1 F
Wooddale Ave/ South Frontage Rd*	3.5 A	6.4 A	13.2 B	22.7 C
Wooddale Ave/ Rail Crossing	1.9 A	3.3 A	3.0 A	4.1 A
Wooddale Ave/ W 36 th St	15.2 B	18.2 B	19.0 B	24.3 C

*Side street stop-controlled intersection

4.2.4 Beltline Station

The results of the Opening Year No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, including a 75-car freight event.

The results of the 2040 No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, with the following exceptions:

- Beltline Blvd/ CSAH 25 in the 2040 No Build PM peak 75-car Freight Event scenario
- Beltline Blvd/ South Frontage Rd in the 2040 No Build PM peak in the No Freight Event and 75-car Freight Event scenarios
- Beltline Blvd/ Park Glen Rd in the 2040 No Build PM peak 75-car Freight Event scenario

The poor LOS issues at the South Frontage Rd intersection was due to poor operations and queuing on northbound Beltline Blvd at the CSAH 25 intersection. The northbound approaches at the South Frontage Rd and Rail Crossing intersections were reported as operating at LOS E or LOS F in the 2040 No Build PM peak with no freight event, due to congestion from the CSAH 25 intersection. In addition, the Park Glen Rd approaches were reported as operating at LOS F in the 2040 No Build No Freight event scenarios due to the side-street stop control and the lack of available gaps in traffic on Beltline Blvd.

The overall intersection results for Opening Year are shown in **Table 4.7** and the overall intersection results for 2040 are shown in **Table 4.8** below.

Movements for which queuing issues were identified in one or more Opening Year No Build scenarios were as follows:

- Beltline Blvd/ CSAH 25 – Northbound left-turn, through, right-turn; Southbound through
- Beltline Blvd/ South Frontage Rd – Eastbound right-turn

Movements for which queuing issues were identified in one or more 2040 No Build scenarios were as follows:

- Beltline Blvd/ CSAH 25 – Northbound left-turn, through, right-turn; Southbound through
- Beltline Blvd/ South Frontage Rd – Eastbound right-turn and through
- Beltline Blvd/ Rail Crossing – Northbound through
- Beltline Blvd/ Park Glen Rd – Eastbound left-turn, through, right-turn; Westbound left-turn, through, right-turn;

The full table of No Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 4.7. Beltline Station – Opening Year No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year No Build AM No Freight Event	Opening Year No Build AM 75-Car Freight	Opening Year No Build PM No Freight Event	Opening Year No Build PM 75-Car Freight
Beltline Blvd/ CSAH 25	29.9 C	29.7 C	39.1 D	38.8 D
Beltline Blvd/ South Frontage Rd*	14.3 B	13.8 B	20.3 C	22.0 C
Beltline Blvd/ Rail Crossing	1.7 A	8.8 A	3.0 A	9.7 A
Beltline Blvd/ Park Glen Rd*	3.8 A	7.0 A	2.7 A	4.7 A
CSAH 25/ Lynn Ave*	0.4 A	0.4 A	0.6 A	0.6 A

*Side street stop-controlled intersection

Table 4.8. Beltline Station – 2040 No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	2040 No Build AM No Freight Event	2040 No Build AM 75-Car Freight	2040 No Build PM No Freight Event	2040 No Build PM 75-Car Freight
Beltline Blvd/ CSAH 25	34.6 C	34.4 C	52.5 D	55.3 E
Beltline Blvd/ South Frontage Rd*	19.2 B	20.7 C	52.3 F	47.6 E
Beltline Blvd/ Rail Crossing	5.2 A	12.3 B	27.5 D	34.8 D
Beltline Blvd/ Park Glen Rd*	13.2 B	33.8 D	34.3 D	57.8 F
CSAH 25/ Lynn Ave*	0.6 A	0.6 A	0.7 A	0.7 A

*Side street stop-controlled intersection

4.2.5 West Lake Station

The results of the Opening Year No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS C or better during the peak hour scenarios.

The results of the 2040 No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS C or better during the peak hour scenarios.

The overall intersection results are shown in **Table 4.9** below.

Movements for which queuing issues were identified in one or more Opening Year No Build scenarios were as follows:

- W Lake St/ Market Plaza – Westbound left-turn

Movements for which queuing issues were identified in one or more 2040 No Build scenarios were as follows:

- W Lake St/ Market Plaza – Westbound left-turn

The full table of No Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 4.9. West Lake Station – No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year No Build AM No Freight Event	2040 No Build AM No Freight Event	Opening Year No Build PM No Freight Event	2040 No Build PM No Freight Event
W Lake St/ Drew Ave	2.5 A	2.7 A	3.2 A	3.3 A
W Lake St/ Market Plaza	22.2 C	23.0 C	33.8 C	34.9 C

4.2.6 Cedar Lake Pkwy and 21st St Station

The results of the Opening Year No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, with the following exceptions:

- 21st St W/Rail Crossing in the Opening Year No Build AM and PM peak 75-car freight events

The results of the 2040 No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS C or better during the peak hour scenarios, with the following exceptions:

- Cedar Lake Pkwy/ Sunset Blvd in the 2040 No Build PM peak 75-car Freight event
- Cedar Lake Pkwy/ Benton Blvd in the 2040 No Build AM peak 75-car Freight event
- 21st St W/Rail Crossing in the Opening Year No Build AM and PM peak 75-car freight events

The overall intersection results for Opening Year are shown in **Table 4.10** and the overall intersection results for 2040 are shown in **Table 4.11** below.

Movements for which queuing issues were identified in one or more Opening Year No Build scenarios were as follows:

- Cedar Lake Pkwy/ Sunset Blvd – Northbound left-turn/right-turn
- Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd – Eastbound through; Westbound through
- Cedar Lake Pkwy/ Xerxes Ave – Westbound through
- Cedar Lake Pkwy/ Benton Blvd – Westbound through

Movements for which queuing issues were identified in one or more 2040 No Build scenarios were as follows:

- Cedar Lake Pkwy/ Sunset Blvd – Northbound left-turn/right-turn
- Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd – Eastbound through; Westbound through
- Cedar Lake Pkwy/ Xerxes Ave – Westbound through
- Cedar Lake Pkwy/ Benton Blvd – Westbound through

The full table of No Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 4.10. Cedar Lake Pkwy and 21st St Station – Opening Year No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year No Build AM No Freight Event	Opening Year No Build AM 75-Car Freight	Opening Year No Build PM No Freight Event	Opening Year No Build PM 75-Car Freight
Cedar Lake Pkwy/ Sunset Blvd*	1.2 A	15.3 C	2.8 A	44.9 E
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd*	1.6 A	10.7 B	1.7 A	10.0 A
Cedar Lake Pkwy/ Xerxes Ave*	1.3 A	12.0 B	0.7 A	6.2 A
Cedar Lake Pkwy/ Benton Blvd*	0.9 A	33.6 D	0.6 A	18.4 C
21 st St W/ Rail Crossing*	1.5 A	36.2 E	1.5 A	36.4 E

*Side street stop-controlled intersection

Table 4.11. Cedar Lake Pkwy and 21st St Station – 2040 No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	2040 No Build AM No Freight Event	2040 No Build AM 75-Car Freight	2040 No Build PM No Freight Event	2040 No Build PM 75-Car Freight
Cedar Lake Pkwy/ Sunset Blvd*	1.5 A	16.6 C	3.3 A	47.7 E
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd*	2.0 A	10.5 B	2.6 A	10.8 B
Cedar Lake Pkwy/ Xerxes Ave*	1.8 A	12.4 B	1.1 A	6.4 A
Cedar Lake Pkwy/ Benton Blvd*	1.1 A	35.8 E	0.7 A	17.3 C
21 st St W/ Rail Crossing*	1.5 A	36.0 E	2.0 A	39.2 E

*Side street stop-controlled intersection

4.2.7 Penn Station

The results of the Opening Year and 2040 No Build AM and PM peak hour analysis showed that all intersections currently operate at LOS B or better during the peak hour scenarios. The overall intersection results are shown in **Table 4.12** below.

No queuing issues were identified in the Opening Year or 2040 No Build conditions.

The full table of No Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 4.12. Penn Station – Opening Year and No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year No Build AM No Freight Event	2040 No Build AM No Freight Event	Opening Year No Build PM No Freight Event	2040 No Build PM No Freight Event
Penn Ave/ I-394 WB Ramps	13.2 B	14.9 B	12.4 B	12.8 B
Penn Ave/ I-394 EB Ramps	10.4 B	11.5 B	16.1 B	16.9 B

4.2.8 Royalston Station

The results of the Opening Year and 2040 No Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS C or better during the peak hour scenarios. The overall intersection results are shown in **Table 4.13** below.

No queuing issues were identified in the analysis.

The full table of No Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 4.13. Royalston Station – Opening Year and 2040 No Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year No Build AM No Freight Event	2040 No Build AM No Freight Event	Opening Year No Build PM No Freight Event	2040 No Build PM No Freight Event
Glenwood Ave/ E Lyndale Ave	20.3 C	20.6 C	22.2 C	22.5 C
Glenwood Ave/ Royalston Ave/ 12 th St N/ Twins Way	20.9 C	21.9 C	20.5 C	21.2 C
Royalston Ave/ Holden St*	0.9 A	0.9 A	0.8 A	0.7 A
Royalston Ave/ 5 th Ave N*	1.7 A	1.8 A	1.4 A	1.4 A
7 th St N/ 5 th Ave N*	1.1 A	1.2 A	0.6 A	0.6 A

*Side street stop-controlled intersection

4.3 No Build Conditions Summary

All intersections would be expected to operate at LOS D or better in the Opening Year No Build AM and PM peak conditions, with the following exception:

- 21st St W/Rail Crossing in the AM and PM 75-car Freight Event scenarios

The 21st St W/Rail Crossing intersection has very low traffic volumes in the Opening Year AM and PM peaks, with less than 20 vehicles in each direction in the peak hour. Therefore the impact of the freight event on a few vehicles has a very significant influence on the average delay at the intersection. However, the delays do not cause queuing issues through upstream intersections.

All intersections would be expected to operate at LOS D or better in the 2040 No Build AM and PM peak conditions, with the following exception:

- Wooddale Ave/TH 7 EB Ramps in the PM 75-car Freight Event scenario
- Beltline Blvd/CSAH 25 in the PM 75-car Freight Event scenario
- Beltline Blvd/South Frontage Rd in the PM No Freight Event and PM 75-car Freight Event scenarios
- Beltline Blvd/Park Glen Rd in the PM 75-car Freight Event scenario
- Cedar Lake Pkwy/Sunset Blvd in the PM 75-car Freight Event scenario
- Cedar Lake Pkwy/Benton Ave in the AM 75-car Freight Event scenario
- 21st St W/Rail Crossing in the AM and PM 75-car Freight Event scenarios

With the exception of Beltline Blvd/South Frontage Rd, the intersections with LOS E or LOS F operations were all due to a freight event in the peak hour. Since freight events are not expected to occur in the peak hours under typical conditions, the operations are generally considered acceptable.

The poor operations at the Beltline Blvd/South Frontage Rd intersection in the 2040 PM peak are due to congestion and queuing on northbound Beltline Blvd at the CSAH 25 intersection, which spill back through the South Frontage Rd and at times through the freight rail crossing.

On Wooddale Ave, although the TH 7 ramp intersections are expected to operate at LOS D or better in the No Freight Event scenarios, the TH 7 EB ramp approach operated at LOS F and the TH 7 WB ramp approach operated at LOS E in the 2040 No Build PM peak scenario with no freight event. The poor LOS on the ramp approaches and the resulting queues were due to the two-lane section on Wooddale Ave and the side-street stop control at the ramp intersections. In addition, the 95th percentile queues on the TH 7 EB ramp would be expected to extend onto mainline TH 7 in the 2040 No Build PM peak.

5.0 BUILD ANALYSIS

The Build modeling was conducted to identify the expected traffic operations at the Opening Year of the SWLRT project (2020) and for the forecast horizon year (2040), with the LRT operating. The assumptions, methodology, and results of the Build conditions analysis are presented in the following sections.

5.1 Assumptions

Traffic volumes for the Build conditions were based on the same growth forecasts as the No Build conditions. At LRT stations, additional pedestrian volumes were incorporated into the modeling and additional vehicle traffic was added to the roadway network to account for traffic generated by park-and-ride facilities.

The control of each of the LRT crossings was identified based on the proximity to the freight rail alignment and adjacent signalized intersections. **Table 5.1** below displays the existing and proposed control of the LRT crossings along the SWLRT alignment.

Table 5.1. East Segment LRT Crossing Treatments

Crossing Location	- Existing Control	- Build Conditions Control
8 th Ave	- N/A – no crossing	- LRT gated with preemption of Excelsior Blvd (CSAH 3)/ 8 th Ave signal.
5 th Ave	- Freight at-grade crossing with flashers.	- LRT and freight crossings both gated with preemption of Excelsior Blvd (CSAH 3)/ 5 th Ave signal.
TH 169	- Freight grade separated under TH 169.	- LRT and freight grade separated under TH 169
Excelsior Blvd (CSAH 3)	- Freight gated with preemption of Excelsior Blvd (CSAH 3)/ Milwaukee St/Jackson Ave signal.	- LRT grade separated over Excelsior Blvd (CSAH 3). - Freight gated with preemption of Excelsior Blvd (CSAH 3)/ Milwaukee St/Jackson Ave signal.
Blake Rd (CSAH 20)	- Freight gated crossing.	- LRT and freight combined gated crossing with preemption of Blake Rd (CSAH 20)/2 nd St NE signal.
Louisiana Ave	- Freight grade separated over Louisiana Ave.	- LRT and freight grade separated over Louisiana Ave.
Wooddale Ave	- Freight gated crossing with preemption of Wooddale Ave/W 36 th St signal.	- LRT and freight combined gated crossing with preemption of Wooddale Ave/ W 36 th St signal.
TH 100	- Freight grade separated over TH 100.	- LRT and freight grade separated over TH 100.
Beltline Blvd	- Freight gated crossing.	- LRT and freight combined gated crossing, with queue cutter signal.
W Lake St	- Freight grade separated under W Lake St.	- LRT and freight grade separated under W Lake St.
Cedar Lake Pkwy	- Freight at-grade crossing with flashers.	- LRT grade separated under Cedar Lake Pkwy. Freight at-grade crossing with flashers.
21 st St W	- Freight at-grade crossing with stop signs.	- LRT and freight combined gated crossing.
I-394	- Freight grade separated under I-394.	- LRT and freight grade separated under I-394.
Van White Blvd	- Freight grade separated under Van White Blvd.	- LRT and freight grade separated under Van White Blvd.
I-94	- Freight grade separated under I-94.	- LRT and freight grade separated under I-94.

Table 5.1. East Segment LRT Crossing Treatments (continued)

Crossing Location	Existing Control	Build Conditions Control
Glenwood Ave	- Freight grade separated under Glenwood Ave.	- LRT gated crossing. Freight grade separated under Glenwood Ave.
Royalston Ave	N/A – no crossing	- LRT controlled by traffic signal at Royalston Ave/ Holden St.
5 th Ave N	N/A – no crossing	- LRT grade separated over 5 th Ave N.
7 th St N	N/A – no crossing	- LRT grade separated over 7 th St N.

Several improvements were identified as part of the scope of the project in order to provide control of the LRT at intersections and to provide adequate facilities for park-and-ride traffic. These project elements were incorporated into the Build conditions modeling and included:

- Modify southbound 8th Ave lane geometrics at Excelsior Blvd (CSAH 3) to create a shared left-turn/through/ right-turn lane, as requested by the City of Hopkins.
- Modify southbound Penn Ave lane geometrics at I-394 WB Ramps to create a shared through/ right-turn lane, as requested by the City of Minneapolis.
- Install a new traffic signal at Royalston Ave/Holden St to safely control LRT movements through the intersection.
- Install a new traffic signal at 7th St N/5th Ave N to facilitate pedestrian movements to the Royalston Station.

In addition to the improvements identified in the No Build conditions, some improvements were also identified as part of the Build project in order to provide LOS D or better operations at all intersections in the Build conditions and to provide safe and efficient traffic and LRT operations. These project improvements included:

- Install a new traffic signal at Excelsior Blvd (CSAH 3)/ Pierce Ave to accommodate park-and-ride vehicle traffic at the Blake Station.
- Lengthen southbound left-turn lane on Louisiana Ave at Oxford St to accommodate park-and-ride vehicle traffic at the Louisiana Station.
- Restripe Wooddale Ave as a four-lane roadway between TH 7 EB Ramps and W 36th St to accommodate future traffic volumes and queues on Wooddale Ave.
- Install new traffic signals at Wooddale Ave/TH 7 EB Ramps and Wooddale Ave/TH 7 WB ramps to improve operations and better manage ramp queues.
- Convert Wooddale Ave/ South Frontage Rd intersection to right-in/right-out to reduce left-turn conflicts, improve traffic flow on Wooddale Ave, and provide improved access management.
- Improve and expand northbound Beltline Blvd lane geometrics at CSAH 25 to improve left-turn capacity.
- Install a new queue cutter signal on Beltline Blvd at the rail crossing to prevent queues from extending across the tracks.

- Install a new traffic signal at CSAH 25/Lynn Ave to accommodate park-and-ride vehicle traffic at the Beltline Station.

Locally Requested Capital Investments (LRCIs) were also modeled at several locations, based on the improvement projects identified by the local agencies. The projects that were incorporated into the traffic modeling included:

- Grade separated trail crossing of Blake Rd (CSAH 20)
- Grade separated trail crossing of Wooddale Ave
- Grade separated trail crossing of Beltline Blvd
- Intersection capacity improvements on the westbound and southbound approaches of the Beltline Blvd/CSAH 25 intersection
- Backage road parallel to CSAH 25, connecting to Lynn Ave intersection.

Signal phasing was also modified at several locations to provide protected-only turn phasing for turn movements across the tracks and to provide the ability to run track clearance phases where signal preemption was modeled. Signal timing was assumed to be optimized for all traffic signals in the Build conditions.

The Build conditions modeled for each intersection and at-grade crossing, including all intersection control changes, are shown in the intersection layout tables in **Appendix B**.

As previously discussed in Section 2.2, vehicle traffic expected to be generated by the park-and-ride facilities was added to the base No Build volumes to produce the Build conditions peak hour volumes. The location and size of park-and-ride facilities included in the traffic modeling are summarized in **Table 5.2**. The analysis represents the park-and-ride demand as identified in the forecast modeling and as a result, in some cases the modeling included more parking spaces than are proposed to be built as part of the SWLRT project. The analysis assumed a higher number of potential parking spaces in order to capture the full parking capacity of the site and produce a conservative analysis of the park-and-ride traffic impacts.

Table 5.2. Park-and-Ride Facility Summary

Location	Number of Parking Spaces Analyzed
Downtown Hopkins Station	250
Blake Station	240
Beltline Station	545

Additional vehicle and pedestrian volumes generated by the feeder bus network and the pedestrians at each station were also added into the peak hour modeling. The modeled AM and PM peak hour Build turning movement volumes for the Opening Year and 2040 conditions are provided in **Appendix A**.

5.2 Build Traffic Modeling Overview and Results

The same eight modeling areas created for the existing and No Build conditions modeling were used for the Build analysis. The Build operations results are presented by modeling area in the following sections.

5.2.1 Downtown Hopkins Station and Blake Station

The results of the Opening Year Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, including a 75-car freight event.

The results of the 2040 Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, with the following exception:

- Excelsior Blvd (CSAH 3)/ Milwaukee St/ Jackson Ave in the PM peak 75-car Freight Event scenario

A freight event is not expected to occur in the peak hours, therefore mitigations were not identified to address the operations at this intersection.

The overall intersection results for Opening Year are shown in **Table 5.3** and the overall intersection results for 2040 are shown in **Table 5.4** below.

Movements for which queuing issues were identified in one or more Opening Year Build scenarios were as follows:

- Excelsior Blvd (CSAH 3)/ 5th Ave – Northbound left-turn; Southbound left-turn and right-turn
- Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St – Westbound through
- Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20) – Northbound left-turn; Southbound left-turn
- Blake Rd (CSAH 20)/ 2nd St NE – Eastbound left-turn

Movements for which queuing issues were identified in one or more 2040 Build scenarios were as follows:

- Excelsior Blvd (CSAH 3)/ 5th Ave – Northbound left-turn; Southbound left-turn and right-turn
- Excelsior Blvd (CSAH 3)/ TH 169 NB Ramps – Southbound left-turn and through
- Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St – Westbound through
- Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20) – Northbound left-turn; Southbound left-turn
- Blake Rd (CSAH 20)/ 2nd St NE – Eastbound left-turn
- Blake Rd (CSAH 20)/ Cambridge St – Northbound left-turn

The full table of Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 5.3. Downtown Hopkins Station and Blake Station – Opening Year Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year Build AM No Freight Event	Opening Year Build AM 75-Car Freight	Opening Year Build PM No Freight Event	Opening Year Build PM 75-Car Freight
Excelsior Blvd (CSAH 3)/ 8 th Ave	30.2 C	30.2 C	31.3 C	31.2 C
Excelsior Blvd (CSAH 3)/ 5 th Ave	26.5 C	26.5 C	30.1 C	30.2 C
Excelsior Blvd (CSAH 3)/ TH 169 SB Ramps	26.4 C	26.5 C	15.9 B	15.8 B
Excelsior Blvd (CSAH 3)/ TH 169 NB Ramps	39.8 D	44.4 D	32.1 C	38.3 D
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	41.0 D	47.1 D	32.5 C	50.1 D
Excelsior Blvd (CSAH 3)/ Pierce Ave	12.3 B	13.8 B	14.1 B	13.7 B
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	39.6 D	41.3 D	36.2 D	37.3 D
Blake Rd (CSAH 20)/ Rail Crossing	3.9 A	6.3 A	4.1 A	8.3 A
Blake Rd (CSAH 20)/ 2 nd St NE	12.6 B	17.9 B	16.6 B	19.8 B
Blake Rd (CSAH 20)/ Cambridge St	11.4 B	11.5 B	15.7 B	16.1 B

Table 5.4. Downtown Hopkins Station and Blake Station – 2040 Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	2040 Build AM No Freight Event	2040 Build AM 75-Car Freight	2040 Build PM No Freight Event	2040 Build PM 75-Car Freight
Excelsior Blvd (CSAH 3)/ 8 th Ave	29.7 C	29.0 C	33.0 C	32.5 C
Excelsior Blvd (CSAH 3)/ 5 th Ave	26.3 C	26.0 C	33.0 C	32.2 C
Excelsior Blvd (CSAH 3)/ TH 169 SB Ramps	27.7 C	27.8 C	17.2 B	17.3 B
Excelsior Blvd (CSAH 3)/ TH 169 NB Ramps	43.0 D	50.8 D	33.4 C	43.5 D
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	44.2 D	51.5 D	35.4 D	59.1 E
Excelsior Blvd (CSAH 3)/ Pierce Ave	12.5 B	13.8 B	14.3 B	14.3 B
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	41.5 D	43.8 D	39.2 D	39.7 D
Blake Rd (CSAH 20)/ Rail Crossing	4.1 A	6.6 A	4.4 A	8.3 A
Blake Rd (CSAH 20)/ 2 nd St NE	15.3 B	22.2 C	20.6 C	24.5 C
Blake Rd (CSAH 20)/ Cambridge St	12.0 B	12.3 B	21.2 C	24.4 C

5.2.2 Louisiana Station

The results of the Opening Year Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS B or better during the peak hour scenarios.

The results of the 2040 Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS B or better during the peak hour scenarios.

The overall intersection results are shown in **Table 5.5** below.

No queuing issues were identified in the Opening Year or 2040 Build conditions.

The full table of Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 5.5. Louisiana Station –Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year Build AM No Freight Event	2040 Build AM No Freight Event	Opening Year Build PM No Freight Event	2040 Build PM No Freight Event
Louisiana Ave/ Oxford St	11.3 B	11.4 B	11.9 B	13.0 B
Louisiana Ave/ Louisiana Cir	9.4 A	10.4 B	9.4 A	10.1 B

5.2.3 Wooddale Station

The results of the Opening Year Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, including a 75-car freight event.

The results of the 2040 Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, including a 75-car freight event.

The improvement in operations in the 2040 Build conditions at the TH 7 EB Ramp intersection, compared to the 2040 No Build conditions, is due to the improvements on Wooddale Ave included as part of the project.

The overall intersection results for Opening Year are shown in **Table 5.6** and the overall intersection results for 2040 are shown in **Table 5.7** below.

Movements for which queuing issues were identified in one or more Opening Year Build scenarios were as follows:

- Wooddale Ave/ TH 7 WB Ramps – Westbound right-turn
- Wooddale Ave/ TH 7 EB Ramps – Eastbound right-turn
- Wooddale Ave/ Rail Crossing – Northbound through
- Wooddale Ave/ W 36th St – Eastbound left-turn; Southbound left-turn and through; Westbound right-turn

Movements for which queuing issues were identified in one or more 2040 Build scenarios were as follows:

- Wooddale Ave/ TH 7 WB Ramps – Westbound right-turn
- Wooddale Ave/ TH 7 EB Ramps – Eastbound left-turn and right-turn
- Wooddale Ave/ South Frontage Rd – Southbound through
- Wooddale Ave/ Rail Crossing – Northbound through

- Wooddale Ave/ W 36th St – Southbound left-turn and through; Westbound right-turn; Eastbound left-turn

The full table of Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 5.6. Wooddale Station – Opening Year Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year Build AM No Freight Event	Opening Year Build AM 75-Car Freight	Opening Year Build PM No Freight Event	Opening Year Build PM 75-Car Freight
Wooddale Ave/ TH 7 WB Ramps	12.4 B	16.2 B	15.1 B	20.6 C
Wooddale Ave/ TH 7 EB Ramps	9.8 A	13.2 B	12.0 B	18.2 B
Wooddale Ave/ South Frontage Rd*	6.1 A	7.7 A	5.6 A	8.5 A
Wooddale Ave/ Rail Crossing	5.0 A	6.6 A	6.0 A	8.0 A
Wooddale Ave/ W 36 th St	22.6 C	23.2 C	26.3 C	38.7 D

Table 5.7. Wooddale Station – 2040 Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	2040 Build AM No Freight Event	2040 Build AM 75-Car Freight	2040 Build PM No Freight Event	2040 Build PM 75-Car Freight
Wooddale Ave/ TH 7 WB Ramps	12.4 B	16.8 B	18.9 B	29.2 C
Wooddale Ave/ TH 7 EB Ramps	9.8 A	11.5 B	14.9 B	29.0 C
Wooddale Ave/ South Frontage Rd*	6.1 A	9.1 A	9.3 B	16.0 C
Wooddale Ave/ Rail Crossing	5.0 A	6.7 A	8.0 A	10.4 B
Wooddale Ave/ W 36 th St	22.6 C	28.6 C	33.6 C	52.0 D

*Side street stop-controlled intersection

5.2.4 Beltline Station

The results of the Opening Year Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, including a 75-car freight event.

The results of the 2040 Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS D or better during the peak hour scenarios, with the following exceptions:

- Beltline Blvd/ Park Glen Rd in the 2040 Build AM peak 75-car Freight Event scenario

The poor LOS at the Beltline Blvd/ Park Glen Rd intersection in the 2040 AM peak is due to the 75-car freight event, which causes vehicle queues beyond the Park Glen Rd intersection and results in a lack of gaps for traffic turning left from Park Glen Rd onto Beltline Blvd. A freight event is not expected to occur in the peak hours, therefore mitigations were not identified to address the operations at this intersection.

The overall intersection results for Opening Year are shown in **Table 5.8** and the overall intersection results for 2040 are shown in **Table 5.9** below.

Movements for which queuing issues were identified in one or more Opening Year Build scenarios were as follows:

- Beltline Blvd/ CSAH 25 – Northbound left-turn, through, right-turn; Southbound through

Movements for which queuing issues were identified in one or more 2040 Build scenarios were as follows:

- Beltline Blvd/ CSAH 25 – Northbound left-turn, through, right-turn; Southbound through
- Beltline Blvd/ South Frontage Rd – Eastbound right-turn
- Beltline Blvd/ Park Glen Rd – Westbound left-turn, through, right-turn

The queues on northbound Beltline Blvd were also identified as an issue in the No Build modeling. The potential safety impact of the northbound queues in the rail crossing has been addressed using a queue cutter signal, as mentioned in Section 5.1. The queue cutter signal improves the safety and operations of the rail crossing by stopping northbound traffic before the queues from CSAH 25 can extend into the rail crossing.

The full table of Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 5.8. Beltline Station – Opening Year Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year Build AM No Freight Event	Opening Year Build AM 75-Car Freight	Opening Year Build PM No Freight Event	Opening Year Build PM 75-Car Freight
Beltline Blvd/ CSAH 25	25.7 C	25.4 C	35.2 D	35.4 D
Beltline Blvd/ South Frontage Rd*	3.5 A	4.7 A	7.2 A	8.2 A
Beltline Blvd/ Rail Crossing	5.4 A	12.0 B	5.9 A	11.3 B
Beltline Blvd/ Park Glen Rd*	4.5 A	8.8 A	3.5 A	6.4 A
CSAH 25/ Lynn Ave	4.4 A	4.4 A	10.8 B	10.8 B

*Side street stop-controlled intersection

Table 5.9. Beltline Station – 2040 Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	2040 Build AM No Freight Event	2040 Build AM 75-Car Freight	2040 Build PM No Freight Event	2040 Build PM 75-Car Freight
Beltline Blvd/ CSAH 25	29.4 C	28.5 C	40.6 D	42.2 D
Beltline Blvd/ South Frontage Rd*	5.5 A	6.8 A	14.6 B	18.8 C
Beltline Blvd/ Rail Crossing	5.8 A	12.0 B	7.2 A	14.3 B
Beltline Blvd/ Park Glen Rd*	21.5 C	45.8 E	7.2 A	19.4 C
CSAH 25/ Lynn Ave	4.6 A	4.5 A	11.3 B	11.3 B

*Side street stop-controlled intersection

5.2.5 West Lake Station

The results of the Opening Year Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS C or better during the peak hour scenarios.

The results of the 2040 Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS C or better during the peak hour scenarios.

The overall intersection results are shown in **Table 5.10** below.

Movements for which queuing issues were identified in one or more Opening Year Build scenarios were as follows:

- W Lake St/ Market Plaza – Westbound left-turn

Movements for which queuing issues were identified in one or more 2040 Build scenarios were as follows:

- W Lake St/ Market Plaza – Westbound left-turn

The full table of Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 5.10. West Lake Station – Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year Build AM No Freight Event	2040 Build AM No Freight Event	Opening Year Build PM No Freight Event	2040 Build PM No Freight Event
W Lake St/ Drew Ave	2.2 A	2.4 A	3.0 A	3.0 A
W Lake St/ Market Plaza	25.3 C	26.1 C	33.7 C	34.7 C

5.2.6 Cedar Lake Pkwy and 21st St Station

The results of the Opening Year Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS C or better during the peak hour scenarios, with the following exceptions:

- Cedar Lake Pkwy/ Sunset Blvd in the Opening Year Build PM peak 75-car Freight event
- Cedar Lake Pkwy/ Benton Blvd in the Opening Year Build AM peak 75-car Freight event
- 21st St W/Rail Crossing in the Opening Year Build AM and PM peak 75-car freight events

The results of the 2040 Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS C or better during the peak hour scenarios, with the following exceptions:

- Cedar Lake Pkwy/ Sunset Blvd in the 2040 Build PM peak 75-car Freight event
- Cedar Lake Pkwy/ Benton Blvd in the 2040 Build AM peak 75-car Freight event

- 21st St W/Rail Crossing in the Opening Year Build AM and PM peak 75-car freight events

The intersections with poor LOS are all due to freight events in the peak hour and there was no notable change from the No Build conditions. A freight event is not expected to occur in the peak hours, therefore mitigations were not identified to address the operations at these intersections.

The overall intersection results for Opening Year are shown in **Table 5.11** and the overall intersection results for 2040 are shown in **Table 5.12** below.

Movements for which queuing issues were identified in one or more Opening Year Build scenarios were as follows:

- Cedar Lake Pkwy/ Sunset Blvd – Northbound left-turn/right-turn
- Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd – Eastbound through; Westbound through
- Cedar Lake Pkwy/ Xerxes Ave – Westbound through
- Cedar Lake Pkwy/ Benton Blvd – Westbound through

Movements for which queuing issues were identified in one or more 2040 Build scenarios were as follows:

- Cedar Lake Pkwy/ Sunset Blvd – Northbound left-turn/right-turn
- Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd – Eastbound through; Westbound through
- Cedar Lake Pkwy/ Xerxes Ave – Westbound through
- Cedar Lake Pkwy/ Benton Blvd – Westbound through

The full table of Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 5.11. Cedar Lake Pkwy and 21st St Station – Opening Year Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year Build AM No Freight Event	Opening Year Build AM 75-Car Freight	Opening Year Build PM No Freight Event	Opening Year Build PM 75-Car Freight
Cedar Lake Pkwy/ Sunset Blvd*	1.4 A	14.1 B	3.5 A	49.6 E
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd*	2.5 A	11.5 B	3.4 A	11.8 B
Cedar Lake Pkwy/ Xerxes Ave*	1.9 A	13.3 B	1.1 A	6.7 A
Cedar Lake Pkwy/ Benton Blvd*	1.1 A	36.4 E	0.7 A	18.7 C
21 st St W/ Rail Crossing*	6.3 A	42.3 E	6.0 A	44.9 E

*Side street stop-controlled intersection

Table 5.12. Cedar Lake Pkwy and 21st St Station – 2040 Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	2040 Build AM No Freight Event	2040 Build AM 75-Car Freight	2040 Build PM No Freight Event	2040 Build PM 75-Car Freight
Cedar Lake Pkwy/ Sunset Blvd*	1.6 A	18.6 C	3.9 A	46.0 E
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd*	2.7 A	12.3 B	4.0 A	10.9 B
Cedar Lake Pkwy/ Xerxes Ave*	2.0 A	12.7 B	1.2 A	6.6 A
Cedar Lake Pkwy/ Benton Blvd*	1.2 A	37.6 E	0.7 A	18.3 C
21 st St W/ Rail Crossing*	6.4 A	47.4 E	6.6 A	50.2 F

*Side street stop-controlled intersection

5.2.7 Penn Station

The results of the Opening Year and 2040 Build AM and PM peak hour analysis showed that all intersections currently operate at LOS B or better during the peak hour scenarios. The overall intersection results are shown in **Table 5.13** below.

No queuing issues were identified in the Opening Year or 2040 Build conditions.

The full table of Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 5.13. Penn Station – Opening Year and Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year Build AM No Freight Event	2040 Build AM No Freight Event	Opening Year Build PM No Freight Event	2040 Build PM No Freight Event
Penn Ave/ I-394 WB Ramps	15.0 B	18.1 B	13.7 B	14.2 B
Penn Ave/ I-394 EB Ramps	10.4 B	10.9 B	15.2 B	16.3 B

5.2.8 Royalston Station

The results of the Opening Year and 2040 Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS C or better during the peak hour scenarios. The overall intersection results are shown in **Table 5.14** below.

No queuing issues were identified in the analysis.

The full table of Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 5.14. Royalston Station – Opening Year and 2040 Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year Build AM No Freight Event	2040 Build AM No Freight Event	Opening Year Build PM No Freight Event	2040 Build PM No Freight Event
Glenwood Ave/ E Lyndale Ave	19.8 B	20.0 B	22.1 C	22.4 C
Glenwood Ave/ LRT Crossing	6.8 A	6.8 A	6.0 A	6.1 A
Glenwood Ave/ Royalston Ave/ 12 th St N/ Twins Way	20.0 B	19.6 B	21.9 C	22.4 C
Royalston Ave/ Holden St	17.0 B	17.0 B	16.1 B	16.5 B
Royalston Ave/ 5 th Ave N*	1.8 A	2.0 A	1.7 A	1.6 A
7 th St N/ 5 th Ave N	24.7 C	27.8 C	11.8 B	14.1 B

*Side street stop-controlled intersection

5.3 Build Conditions Summary

All intersections would be expected to operate at LOS D or better in the Opening Year Build AM and PM peak conditions, with the following exceptions:

- Cedar Lake Pkwy/ Sunset Blvd in the Opening Year Build PM peak 75-car Freight event
- Cedar Lake Pkwy/ Benton Blvd in the Opening Year Build AM peak 75-car Freight event
- 21st St W/Rail Crossing in the Opening Year Build AM and PM peak 75-car freight events

The 21st St W/Rail Crossing intersection has very low traffic volumes in the Opening Year AM and PM peaks, with less than 20 vehicles in each direction in the peak hour. Therefore the impact of the freight event on a few vehicles has a very significant influence on the average delay at the intersection. However, the delays do not cause queuing issues through upstream intersections.

All intersections would be expected to operate at LOS D or better in the 2040 Build AM and PM peak conditions, with the following exceptions:

- Excelsior Blvd (CSAH 3)/ Milwaukee St/ Jackson Ave in the PM peak 75-car Freight Event scenario
- Beltline Blvd/ Park Glen Rd in the 2040 Build AM peak 75-car Freight Event scenario
- Cedar Lake Pkwy/ Sunset Blvd in the 2040 Build PM peak 75-car Freight event
- Cedar Lake Pkwy/ Benton Blvd in the 2040 Build AM peak 75-car Freight event
- 21st St W/Rail Crossing in the Opening Year Build AM and PM peak 75-car freight events

Overall, there are fewer failing intersections in the Build conditions than in the No Build conditions due to the improvements made as part of the SWLRT project. In addition, all the intersections with LOS E or F were due to a freight event in the peak hour. Since freight events are not expected to occur in the peak hours under typical conditions, no additional mitigations are proposed for the intersections.

5.4 Summary of Improvements

Several improvements were identified in order to provide LOS D or better operations at all intersections in the Build conditions and to provide safe and efficient traffic and LRT operations. These improvements are incorporated into the scope of the project, including:

- Install a new traffic signal at Excelsior Blvd (CSAH 3)/ Pierce Ave to accommodate park-and-ride vehicle traffic at the Blake Station.
- Lengthen southbound left-turn lane on Louisiana Ave at Oxford St to accommodate park-and-ride vehicle traffic at the Louisiana Station.
- Restripe Wooddale Ave as a four-lane roadway between TH 7 EB Ramps and W 36th St to accommodate future traffic volumes and queues on Wooddale Ave.
- Install new traffic signals at Wooddale Ave/TH 7 EB Ramps and Wooddale Ave/TH 7 WB ramps to improve operations and better manage ramp queues.

- Convert Wooddale Ave/ South Frontage Rd intersection to right-in/right-out to reduce left-turn conflicts, improve traffic flow on Wooddale Ave, and provide improved access management.
- Improve and expand northbound Beltline Blvd lane geometrics at CSAH 25 to improve left-turn capacity.
- Install a new queue cutter signal on Beltline Blvd at the rail crossing to prevent queues from extending across the tracks.
- Install a new traffic signal at CSAH 25/Lynn Ave to accommodate park-and-ride vehicle traffic at the Beltline Station.

6.0 SENSITIVITY TESTING

In addition to the Build modeling completed for the project, several additional scenarios were modeled for the purposes of sensitivity testing and to document the operations of alternatives. These additional analyses were conducted for the 2040 Build conditions only. The following sections present the assumptions and analysis results for the modeling of the alternative scenarios.

6.1 Locally Requested Capital Investment (LRCI) Analysis

Several LRCI improvements requested and funded by the local agencies were incorporated into the modeling of the Build scenarios presented in Section 5. The LRCI projects included the following improvements:

- Grade separated trail crossing of Blake Rd (CSAH 20)
- Grade separated trail crossing of Wooddale Ave
- Grade separated trail crossing of Beltline Blvd
- Intersection capacity and pedestrian crossing improvements on the westbound and southbound approaches of the Beltline Blvd/CSAH 25 intersection
- Backage road parallel to CSAH 25, connecting to Lynn Ave intersection.

Additional scenario testing was done to determine the potential impacts on traffic operations if the LRCI improvements were not completed as part of the SWLRT construction. The trail crossing projects are not expected to have a significant impact on traffic operations since the crossings are uncontrolled for vehicle traffic and do not cause significant delay. However, the improvements at the Beltline Blvd/CSAH 25 intersection and the backage road have the potential to change the expected operations in this area therefore additional modeling was completed. The modeling assumed that the other project improvements in this area were completed as identified in Section 5.1, however the LRCI improvements were not completed. All other Build assumptions remained unchanged, including traffic volumes and signal operations.

The analysis showed that all intersections would continue to operate at LOS D or better in the 2040 Build conditions if the LRCI improvements are not constructed.

Table 6.1 shows the results of the Beltline Blvd analysis for the 2040 Build conditions without the LRCI improvements.

Movements for which queuing issues were identified in one or more 2040 Build scenarios without the LRCI improvements were as follows:

- Beltline Blvd/ CSAH 25 – Northbound left-turn, through, right-turn; Southbound through; Westbound left-turn
- Beltline Blvd/ South Frontage Rd – Eastbound right-turn
- Beltline Blvd/ Park Glen Rd – Westbound left-turn, through, right-turn

Table 6.1. Beltline Station – 2040 Build Conditions Results without LRCI Improvements

Intersection	Overall Intersection Delay and LOS	
	2040 Build AM No Freight Event Without LRCI	2040 Build PM No Freight Event Without LRCI
Beltline Blvd/ CSAH 25	30.7 C	52.8 D
Beltline Blvd/ South Frontage Rd*	6.1 A	21.2 C
Beltline Blvd/ Rail Crossing	6.0 A	8.1 A
Beltline Blvd/ Park Glen Rd*	21.4 C	7.7 A
CSAH 25/ Lynn Ave	4.6 A	11.6 B

*Side street stop-controlled intersection

The only notable difference in the intersection operations if the LRCI improvements are not completed at Beltline Blvd would be that the westbound approach on Beltline Blvd at CSAH 25 would be expected to have more delay and queuing. This is due to the elimination of the left-turn lane improvements as part of the LRCI.

6.2 Joint Development Analysis

The SWLRT project includes creating development-ready sites next to the Blake Station and Beltline Station. The project does not include build-out of these sites, but additional traffic analysis was completed to document the expected traffic impacts when the developments open. The 2040 Build scenarios were used for the analysis, since any improvements would be based on the horizon year forecasts and operations.

6.2.1 Blake Station Joint Development

The development scenario assumed for the Blake Station site included the following land uses and sizes:

- 23,700 square feet of retail
- 270 residential units

The trips expected to be generated by this development were calculated by first comparing the land uses to the development already included in this area as part of the background growth in the 2040 forecasts. Then *ITE Trip Generation, 9th Edition* was used to calculate the peak hour trips expected to be generated by the development, using ITE-recommended rates for internal capture and a 15 percent reduction for transit-oriented development next to an LRT station. The additional new trips expected to be generated by the development were as follows:

- 2040 Build AM Peak: 209 trips (80 trips in, 129 trips out)
- 2040 Build PM Peak: 153 trips (88 trips in, 65 trips out)

The development access was assumed to be located on Blake Rd (CSAH 20) at the existing unsignalized access between Excelsior Blvd (CSAH 3) and the Rail Crossing. Traffic was distributed onto the surrounding roadway network based on the current traffic volume patterns in the area.

The 2040 Build modeling of the Blake Joint Development showed that all intersections are expected to continue to operate at LOS D or better. The overall intersection results for 2040 are shown in **Table 6.2** below.

Movements for which queuing issues were identified in one or more 2040 Build Joint Development scenarios were as follows:

- Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20) – Northbound left-turn;
Southbound left-turn
- Blake Rd (CSAH 20)/ 2nd St NE – Eastbound left-turn

No intersection operations or new queuing issues were identified as a result of the joint development. No additional improvements are expected to be necessary as part of the development.

The full table of Build Joint Development conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 6.2. Blake Station – 2040 Build Joint Development Results

Intersection	Overall Intersection Delay and LOS	
	2040 Build Joint Development AM No Freight Event	2040 Build Joint Development PM No Freight Event
Excelsior Blvd (CSAH 3)/ Pierce Ave	12.3 B	11.4 B
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	44.9 D	36.3 D
Blake Rd (CSAH 20)/ Joint Development Access*	1.4 A	2.8 A
Blake Rd (CSAH 20)/ Rail Crossing	4.0 A	5.7 A
Blake Rd (CSAH 20)/ 2 nd St NE	15.4 B	20.2 C

*Side street stop-controlled intersection

6.2.2 Beltline Station Joint Development

The development scenario assumed for the Beltline Station site included the following land uses and sizes:

- 12,200 square feet of retail
- 260 residential units
- 312,000 square feet of office

The trips expected to be generated by this development were calculated by first comparing the land uses to the development already included in this area as part of the background growth in the 2040 forecasts. Then *ITE Trip Generation, 9th Edition* was used to calculate the peak hour trips expected to be generated by the development, using ITE-recommended rates for internal capture and a 15 percent reduction for transit-oriented development next to an LRT station. The additional new trips expected to be generated by the development were as follows:

- 2040 Build AM Peak: 377 trips (332 trips in, 45 trips out)
- 2040 Build PM Peak: 364 trips (62 trips in, 302 trips out)

The primary development access was assumed to be located on CSAH 25 at the new signalized access at Lynn Ave, as well as the right-in access points on Beltline Blvd and CSAH 25. Traffic was distributed onto the surrounding roadway network based on the current traffic volume patterns in the area.

The 2040 Build modeling of the Joint Development scenario at Beltline Blvd showed that all intersections are expected to continue to operate at LOS D or better. The overall intersection results for 2040 are shown in **Table 6.3** below.

Movements for which queuing issues were identified in one or more 2040 Build Joint Development scenarios were as follows:

- Beltline Blvd/ CSAH 25 – Northbound left-turn, through, right-turn; Southbound through

No intersection operations issues were identified as a result of the joint development. However, it was noted that the delay on the westbound approach of Park Glen Rd at Beltline Blvd increased significantly and the 95th percentile queue doubled compared to the 2040 Build conditions. This is primarily due to the increase in traffic on Beltline Blvd, which limits the available gaps for traffic turning left from Park Glen Rd. Therefore, it is recommended that the westbound approach of Park Glen Rd at Beltline Blvd be modified to provide a separate left-turn lane. This is expected to decrease the approach delays and reduce the 95th percentile queues to levels similar or better than the 2040 No Build conditions. No additional improvements are expected to be necessary as part of the development.

The full table of LOS and queuing analysis results for the Build Joint Development scenario can be found in **Appendix C**.

Table 6.3. Beltline Station – 2040 Build Joint Development Results

Intersection	Overall Intersection Delay and LOS			
	2040 Build Joint Development AM No Freight Event	2040 Build Joint Development PM No Freight Event	2040 Build Joint Development AM No Freight Event – With Improvements	2040 Build Joint Development PM No Freight Event – With Improvements
Beltline Blvd/ CSAH 25	31.1 C	42.7 D	32.0 C	42.4 D
Beltline Blvd/ South Frontage Rd*	4.8 A	11.9 B	4.8 A	12.8 B
Beltline Blvd/ Rail Crossing	6.0 A	7.2 A	6.0 A	7.0 A
Beltline Blvd/ Park Glen Rd*	24.6 C	10.2 B	11.2 B	6.2 A
CSAH 25/ Lynn Ave	7.6 A	22.9 C	7.9 A	22.9 C

*Side street stop-controlled intersection

6.2.3 Joint Development Summary

The joint development sites proposed at the Blake Station and Beltline Station are expected to generate additional traffic over what was assumed in the 2040 Build scenario. No improvements are expected to be necessary to accommodate the development traffic at the Blake Station. At the Beltline Station, a westbound left-turn lane on Park Glen Rd at Beltline Blvd is recommended to reduce delays and queuing on that approach. This

improvement is needed due to the increased traffic volume on Beltline Blvd as a result of the development, which limit gaps in traffic for vehicles turning from Park Glen Rd.

7.0 SUMMARY AND CONCLUSION

In the Existing conditions, all intersections operate at LOS D or better in the existing AM and PM peak conditions in the No Freight Event scenario. If a 75-car freight event were to occur in the AM or PM peak, one intersection is expected to operate at LOS E or LOS F. However, freight events do not typically occur in the peak hours in the existing conditions and are not expected to occur in the future year peak hours.

In the Opening Year No Build conditions, all intersections would be expected to operate at LOS D or better in the AM and PM peak No Freight Event scenarios. If a 75-car freight event were to occur in the AM or PM peak, one intersection is expected to operate at LOS E or LOS F.

In the 2040 No Build conditions, all intersections would be expected to operate at LOS D or better in the AM and PM peak No Freight Event scenarios, with the exception of the Beltline Blvd/South Frontage Rd intersection. The poor operations at the Beltline Blvd/South Frontage Rd intersection in the 2040 PM peak are due to congestion and queuing on northbound Beltline Blvd at the CSAH 25 intersection, which spills back through the South Frontage Rd and at times through the freight rail crossing.

On Wooddale Ave, although the TH 7 ramp intersections are expected to operate at LOS D or better in the 2040 No Build No Freight Event scenarios, the TH 7 EB ramp approach operated at LOS F and the TH 7 WB ramp approach operated at LOS E in the PM peak. The poor LOS on the ramp approaches and the resulting queues were due to the two-lane section on Wooddale Ave and the side-street stop control at the ramp intersections. In addition, the 95th percentile queues on the TH 7 EB ramp would be expected to extend onto mainline TH 7 in the 2040 No Build PM peak.

If a 75-car freight event were to occur in the 2040 No Build AM or PM peak, five additional intersections would be expected to operate at LOS E or LOS F.

In the Build modeling, Locally Requested Capital Investments (LRCIs) were incorporated at several locations, based on the improvement projects identified by the local agencies. The projects that were incorporated into the traffic modeling included:

- Grade separated trail crossing of Blake Rd (CSAH 20)
- Grade separated trail crossing of Wooddale Ave
- Grade separated trail crossing of Beltline Blvd
- Intersection capacity improvements on the westbound and southbound approaches of the Beltline Blvd/CSAH 25 intersection
- Backage road parallel to CSAH 25, connecting to Lynn Ave intersection.

Several improvements were also identified in order to provide LOS D or better operations at all intersections in the Build conditions and to provide safe and efficient traffic and LRT operations. These improvements are incorporated into the scope of the project, including:

- Install a new traffic signal at Excelsior Blvd (CSAH 3)/ Pierce Ave to accommodate park-and-ride vehicle traffic at the Blake Station.

- Lengthen southbound left-turn lane on Louisiana Ave at Oxford St to accommodate park-and-ride vehicle traffic at the Louisiana Station.
- Restripe Wooddale Ave as a four-lane roadway between TH 7 EB Ramps and W 36th St to accommodate future traffic volumes and queues on Wooddale Ave.
- Install new traffic signals at Wooddale Ave/TH 7 EB Ramps and Wooddale Ave/TH 7 WB ramps to improve operations and better manage ramp queues.
- Convert Wooddale Ave/ South Frontage Rd intersection to right-in/right-out to reduce left-turn conflicts, improve traffic flow on Wooddale Ave, and provide improved access management.
- Improve and expand northbound Beltline Blvd lane geometrics at CSAH 25 to improve left-turn capacity.
- Install a new queue cutter signal on Beltline Blvd at the rail crossing to prevent queues from extending across the tracks.
- Install a new traffic signal at CSAH 25/Lynn Ave to accommodate park-and-ride vehicle traffic at the Beltline Station.

With these improvements incorporated, in the Opening Year Build conditions all intersections would be expected to operate at LOS D or better in the AM and PM peak No Freight Event scenarios. If a 75-car freight event were to occur in the AM or PM peak, three intersections would be expected to operate at LOS E or LOS F.

In the 2040 Build conditions, all intersections would be expected to operate at LOS D or better in the AM and PM peak No Freight Event scenarios. If a 75-car freight event were to occur in the AM or PM peak, three intersections would be expected to operate at LOS E or LOS F.

Overall, there are fewer failing intersections in the Build conditions than in the No Build conditions due to the improvements made as part of the SWLRT project. In addition, all the intersections with LOS E or F were due to a freight event in the peak hour. Since freight events are not expected to occur in the peak hours under typical conditions, no additional mitigations are proposed for the intersections.

Additional scenario testing showed that the Beltline Blvd/CSAH 25 intersection would be expected to continue to operate at LOS D or better in the 2040 Build AM and PM peak even if the LRCI improvements are not constructed.

Analysis of the joint development sites proposed at the Blake Station and Beltline Station are expected to generate additional traffic over what was assumed in the 2040 Build scenario. No improvements are expected to be necessary to accommodate the development traffic at the Blake Station. At the Beltline Station, a westbound left-turn lane on Park Glen Rd at Beltline Blvd is recommended to reduce delays and queuing on that approach. This improvement is needed due to the increased traffic volume on Beltline Blvd as a result of the development, which limit gaps in traffic for vehicles turning from Park Glen Rd.

Appendix A – Existing and Forecast Traffic Volumes

Table A1. Existing AM Peak Hour Turning Movement Volumes

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ 8th Ave	5	1	4	67	1	31	36	670	18	18	613	66
Excelsior Blvd (CSAH 3)/ 5th Ave	38	22	25	80	23	34	46	653	42	37	625	111
Excelsior Blvd CSAH 3)/ TH 169 SB Ramps	0	0	0	403	0	238	109	649	0	0	535	158
Excelsior Blvd CSAH 3)/ TH 169 NB Ramps	7	2	6	527	4	200	247	786	19	5	486	182
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	30	14	48	10	13	126	520	769	30	33	517	91
Excelsior Blvd (CSAH 3)/ Pierce Ave	49	0	16	6	0	5	20	658	81	40	670	4
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	148	193	50	140	159	124	63	551	66	51	442	47
Blake Rd (CSAH 20)/ 2nd St NE	75	225	1	3	361	217	89	1	59	3	1	2
Blake Rd (CSAH 20)/ Cambridge St	43	263	10	13	494	12	128	9	59	28	8	23
Louisiana Ave/ Oxford St	48	249	7	70	443	194	67	15	33	9	20	32
Louisiana Ave/ Louisiana Cir	16	223	80	194	252	39	7	0	0	0	0	74
Wooddale Ave/ TH 7 WB Ramps	256	473	0	0	398	79	0	0	0	82	0	91
Wooddale Ave/ TH 7 EB Ramps	0	604	85	71	409	0	125	0	264	0	0	0
Wooddale Ave/ South Frontage Rd	21	638	3	12	624	37	7	0	32	19	1	44
Wooddale Ave/ W 36th St	8	56	243	238	364	73	125	58	9	149	57	481
Beltline Blvd/ CSAH 25	235	152	140	4	68	92	54	722	293	86	819	6
Beltline Blvd/ South Frontage Rd	13	503	23	16	379	52	11	1	1	10	1	13
Beltline Blvd/ Park Glen Rd	42	483	20	39	253	98	1	0	6	140	0	55
CSAH 25/ Lynn Ave	4	0	4	0	0	0	0	845	21	7	907	0
W Lake St/ Drew Ave	10	2	25	6	1	8	1	1034	2	1	1312	9
W Lake St/ Market Plaza	156	10	57	17	9	16	39	923	103	34	1150	35
Cedar Lake Pkwy/ Sunset Blvd	6	0	139	0	0	0	0	138	7	181	335	0
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd	0	0	0	5	0	17	33	244	0	0	499	55
Cedar Lake Pkwy/ Xerxes Ave	48	0	10	0	0	0	0	248	0	0	506	0
Cedar Lake Pkwy/ Benton Blvd	0	0	0	20	0	20	20	238	0	0	486	20
21st St W/ Rail Crossing	0	0	0	0	0	0	0	6	0	0	1	0
Penn Ave/ I-394 WB Ramps	37	122	0	0	191	217	0	0	0	280	0	107
Penn Ave/ I-394 EB Ramps	0	93	359	137	322	0	68	50	36	0	0	0
Glenwood Ave/ E Lyndale Ave	136	325	40	0	0	0	65	488	0	0	82	80
Glenwood Ave/ Royalston Ave/ 12th St N/ Twins Way	137	102	22	7	157	11	8	331	189	16	14	2
Royalston Ave/ Holden St	15	97	0	0	144	5	5	0	31	0	0	0
Royalston Ave/ 5th Ave N	0	83	18	33	107	0	0	0	0	42	0	13
7th St N/ 5th Ave N	26	306	0	0	1553	29	32	0	19	0	0	0

Table A2. Existing PM Peak Hour Turning Movement Volumes

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ 8th Ave	38	7	23	168	4	47	75	883	15	8	819	134
Excelsior Blvd (CSAH 3)/ 5th Ave	66	34	23	113	35	53	61	942	71	31	843	188
Excelsior Blvd CSAH 3)/ TH 169 SB Ramps	0	0	0	214	0	332	148	930	0	0	730	359
Excelsior Blvd CSAH 3)/ TH 169 NB Ramps	6	2	5	263	0	168	280	854	10	4	915	223
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	43	24	57	88	15	374	79	1036	7	25	726	1
Excelsior Blvd (CSAH 3)/ Pierce Ave	29	0	24	12	0	33	55	1170	46	12	769	5
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	108	273	39	207	226	185	189	834	183	74	493	227
Blake Rd (CSAH 20)/ 2nd St NE	77	609	3	4	470	148	311	3	144	4	0	4
Blake Rd (CSAH 20)/ Cambridge St	104	755	33	36	485	78	214	22	117	20	14	16
Louisiana Ave/ Oxford St	18	498	6	47	262	82	227	18	24	5	26	59
Louisiana Ave/ Louisiana Cir	0	329	18	30	261	0	19	0	10	87	0	175
Wooddale Ave/ TH 7 WB Ramps	391	565	0	0	455	46	0	0	0	91	0	89
Wooddale Ave/ TH 7 EB Ramps	0	866	60	55	491	0	90	0	365	0	0	0
Wooddale Ave/ South Frontage Rd	31	908	19	39	799	18	6	3	79	5	0	12
Wooddale Ave/ W 36th St	16	85	365	435	332	116	96	86	6	244	76	777
Beltline Blvd/ CSAH 25	261	240	237	8	139	43	108	1053	257	173	633	14
Beltline Blvd/ South Frontage Rd	3	680	32	4	558	7	50	3	17	19	0	8
Beltline Blvd/ Park Glen Rd	11	575	44	98	469	27	39	1	30	44	1	101
CSAH 25/ Lynn Ave	18	0	7	0	0	0	0	1286	12	0	802	0
W Lake St/ Drew Ave	3	3	48	18	2	5	7	1141	1	1	1243	15
W Lake St/ Market Plaza	236	76	84	81	64	88	62	921	224	84	935	124
Cedar Lake Pkwy/ Sunset Blvd	4	0	181	0	0	0	0	396	3	144	170	0
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd	0	0	0	4	0	7	95	482	0	0	307	36
Cedar Lake Pkwy/ Xerxes Ave	22	0	7	0	0	0	0	486	0	0	321	0
Cedar Lake Pkwy/ Benton Blvd	0	0	0	20	0	20	20	473	0	0	301	20
21st St W/ Rail Crossing	0	0	0	0	0	0	0	27	0	0	32	0
Penn Ave/ I-394 WB Ramps	52	259	0	0	256	156	0	0	0	264	2	145
Penn Ave/ I-394 EB Ramps	0	144	427	186	329	0	162	211	22	0	0	0
Glenwood Ave/ E Lyndale Ave	150	443	25	0	0	0	111	304	0	0	383	158
Glenwood Ave/ Royalston Ave/ 12th St N/ Twins Way	340	254	33	7	147	21	7	207	115	107	180	16
Royalston Ave/ Holden St	10	267	0	0	133	5	3	0	42	0	0	0
Royalston Ave/ 5th Ave N	0	236	34	21	118	0	0	0	0	20	0	37
7th St N/ 5th Ave N	28	766	0	0	629	29	39	0	16	0	0	0

Table A3. Opening Year No Build AM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ 8th Ave	5	1	5	70	1	35	35	680	20	20	645	70
Excelsior Blvd (CSAH 3)/ 5th Ave	40	25	25	85	25	35	45	655	55	40	660	130
Excelsior Blvd CSAH 3)/ TH 169 SB Ramps	0	0	0	425	0	250	110	655	0	0	580	175
Excelsior Blvd CSAH 3)/ TH 169 NB Ramps	5	5	5	545	5	210	255	805	20	5	540	210
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	30	15	50	10	15	130	535	790	30	45	595	110
Excelsior Blvd (CSAH 3)/ Pierce Ave	50	0	15	5	0	5	20	745	85	40	695	5
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	150	205	55	155	175	130	75	610	80	55	460	50
Blake Rd (CSAH 20)/ 2nd St NE	85	260	1	5	400	240	95	1	60	5	1	0
Blake Rd (CSAH 20)/ Cambridge St	45	300	10	15	555	15	135	10	60	30	10	25
Louisiana Ave/ Oxford St	50	270	10	75	480	205	70	15	35	10	20	35
Louisiana Ave/ Louisiana Cir	15	245	85	210	275	40	5	0	0	0	0	80
Wooddale Ave/ TH 7 WB Ramps	270	515	0	0	415	85	0	0	0	85	1	95
Wooddale Ave/ TH 7 EB Ramps	0	650	95	75	430	0	130	1	280	0	0	0
Wooddale Ave/ South Frontage Rd	20	670	5	10	655	40	5	1	35	55	1	70
Wooddale Ave/ W 36th St	10	60	255	260	395	90	130	60	10	155	60	505
Beltline Blvd/ CSAH 25	250	165	150	5	75	95	55	735	305	90	850	5
Beltline Blvd/ South Frontage Rd	15	540	25	15	400	55	10	1	1	10	1	15
Beltline Blvd/ Park Glen Rd	45	520	20	40	265	105	1	0	5	150	0	60
CSAH 25/ Lynn Ave	5	0	5	0	0	0	0	870	20	5	940	0
W Lake St/ Drew Ave	10	5	25	5	1	10	1	1060	5	1	1345	10
W Lake St/ Market Plaza	160	10	55	15	10	15	40	945	105	35	1180	35
Cedar Lake Pkwy/ Sunset Blvd	5	0	145	0	0	0	0	140	5	185	345	0
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd	0	0	0	5	0	15	35	250	0	0	515	55
Cedar Lake Pkwy/ Xerxes Ave	50	0	10	0	0	0	0	255	0	0	520	0
Cedar Lake Pkwy/ Benton Blvd	0	0	0	20	0	20	20	245	0	0	500	20
21st St W/ Rail Crossing	0	0	0	0	0	0	0	5	0	0	1	0
Penn Ave/ I-394 WB Ramps	40	125	0	0	195	220	0	0	0	285	0	110
Penn Ave/ I-394 EB Ramps	0	95	370	140	330	0	70	50	35	0	0	0
Glenwood Ave/ E Lyndale Ave	140	335	40	0	0	0	65	505	0	0	85	80
Glenwood Ave/ Royalston Ave/ 12th St N/ Twins Way	140	105	25	10	165	10	10	340	195	15	15	5
Royalston Ave/ Holden St	15	105	0	0	150	5	5	0	35	0	0	0
Royalston Ave/ 5th Ave N	0	90	20	35	110	0	0	0	0	45	0	15
7th St N/ 5th Ave N	30	305	0	0	1590	30	35	0	20	0	0	0

Table A4. Opening Year No Build PM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ 8th Ave	40	5	25	175	5	50	75	945	15	10	860	140
Excelsior Blvd (CSAH 3)/ 5th Ave	70	35	25	120	35	55	65	995	85	30	885	205
Excelsior Blvd CSAH 3)/ TH 169 SB Ramps	0	0	0	225	0	350	150	990	0	0	770	380
Excelsior Blvd CSAH 3)/ TH 169 NB Ramps	5	5	5	285	0	175	285	920	10	5	970	255
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	45	25	70	105	15	375	80	1130	5	30	815	10
Excelsior Blvd (CSAH 3)/ Pierce Ave	30	0	25	10	0	35	60	1190	50	15	790	5
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	110	285	40	230	250	190	195	845	185	80	510	250
Blake Rd (CSAH 20)/ 2nd St NE	85	675	5	5	510	165	325	5	150	5	0	5
Blake Rd (CSAH 20)/ Cambridge St	115	855	35	40	535	85	225	25	125	20	15	15
Louisiana Ave/ Oxford St	20	540	5	50	290	85	240	20	25	5	25	60
Louisiana Ave/ Louisiana Cir	0	360	20	30	290	0	20	0	10	90	0	185
Wooddale Ave/ TH 7 WB Ramps	400	575	0	0	500	50	0	0	0	95	1	95
Wooddale Ave/ TH 7 EB Ramps	0	880	55	60	540	0	95	1	385	0	0	0
Wooddale Ave/ South Frontage Rd	30	915	55	65	840	20	5	5	85	5	1	10
Wooddale Ave/ W 36th St	15	105	385	460	350	120	100	90	5	255	80	795
Beltline Blvd/ CSAH 25	275	255	250	10	150	45	110	1075	270	185	660	15
Beltline Blvd/ South Frontage Rd	5	725	35	5	590	5	55	5	15	20	0	10
Beltline Blvd/ Park Glen Rd	10	610	45	105	495	30	40	1	30	45	1	105
CSAH 25/ Lynn Ave	20	0	10	0	0	0	0	1320	15	0	840	0
W Lake St/ Drew Ave	5	5	50	20	5	5	5	1170	1	1	1275	15
W Lake St/ Market Plaza	240	80	85	85	65	90	65	945	230	85	960	130
Cedar Lake Pkwy/ Sunset Blvd	5	0	185	0	0	0	0	425	5	150	175	0
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd	0	0	0	5	0	5	95	515	0	0	320	35
Cedar Lake Pkwy/ Xerxes Ave	25	0	5	0	0	0	0	500	0	0	330	0
Cedar Lake Pkwy/ Benton Blvd	0	0	0	20	0	20	20	485	0	0	310	20
21st St W/ Rail Crossing	0	0	0	0	0	0	0	30	0	0	35	0
Penn Ave/ I-394 WB Ramps	55	265	0	0	260	160	0	0	0	270	1	150
Penn Ave/ I-394 EB Ramps	0	150	440	190	335	0	165	215	25	0	0	0
Glenwood Ave/ E Lyndale Ave	155	455	25	0	0	0	115	315	0	0	395	160
Glenwood Ave/ Royalston Ave/ 12th St N/ Twins Way	350	265	35	10	155	20	10	210	120	110	185	15
Royalston Ave/ Holden St	10	280	0	0	140	5	5	0	45	0	0	0
Royalston Ave/ 5th Ave N	0	250	35	25	125	0	0	0	0	20	0	40
7th St N/ 5th Ave N	30	785	0	0	645	30	40	0	20	0	0	0

Table A5. 2040 No Build AM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ 8th Ave	5	1	5	80	1	35	40	720	20	20	735	70
Excelsior Blvd (CSAH 3)/ 5th Ave	45	25	30	95	25	40	50	700	55	40	740	130
Excelsior Blvd CSAH 3)/ TH 169 SB Ramps	0	0	0	475	0	280	120	705	0	0	630	200
Excelsior Blvd CSAH 3)/ TH 169 NB Ramps	5	5	5	625	5	235	275	880	25	5	590	230
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	30	15	50	10	15	130	585	890	35	50	670	120
Excelsior Blvd (CSAH 3)/ Pierce Ave	50	0	15	5	0	5	25	830	95	45	785	5
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	150	250	60	195	225	145	85	675	90	70	540	75
Blake Rd (CSAH 20)/ 2nd St NE	105	365	1	5	505	305	115	1	70	5	1	0
Blake Rd (CSAH 20)/ Cambridge St	60	405	15	20	710	15	150	10	70	35	10	25
Louisiana Ave/ Oxford St	65	310	15	85	555	230	80	20	50	20	25	40
Louisiana Ave/ Louisiana Cir	20	285	105	250	325	50	10	0	0	0	0	95
Wooddale Ave/ TH 7 WB Ramps	305	575	0	0	475	95	0	0	0	95	1	110
Wooddale Ave/ TH 7 EB Ramps	0	730	105	85	485	0	150	1	315	0	0	0
Wooddale Ave/ South Frontage Rd	25	755	5	15	740	45	10	5	40	60	1	75
Wooddale Ave/ W 36th St	10	65	290	295	445	100	145	70	10	175	70	570
Beltline Blvd/ CSAH 25	325	215	195	5	105	120	60	805	385	125	1015	5
Beltline Blvd/ South Frontage Rd	20	695	30	20	525	70	15	1	1	15	1	20
Beltline Blvd/ Park Glen Rd	60	670	30	55	350	135	1	0	10	195	0	75
CSAH 25/ Lynn Ave	5	0	5	0	0	0	0	975	25	10	1140	0
W Lake St/ Drew Ave	10	5	30	5	1	10	1	1125	5	1	1430	10
W Lake St/ Market Plaza	170	10	60	15	10	15	45	1005	110	40	1250	40
Cedar Lake Pkwy/ Sunset Blvd	5	0	150	0	0	0	0	150	10	195	370	0
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd	0	0	0	5	0	20	35	265	0	0	545	60
Cedar Lake Pkwy/ Xerxes Ave	50	0	10	0	0	0	0	270	0	0	555	0
Cedar Lake Pkwy/ Benton Blvd	0	0	0	20	0	20	20	260	0	0	535	20
21st St W/ Rail Crossing	0	0	0	0	0	0	0	5	0	0	1	0
Penn Ave/ I-394 WB Ramps	50	170	0	0	255	295	0	0	0	380	0	150
Penn Ave/ I-394 EB Ramps	0	120	490	190	440	0	105	55	45	0	0	0
Glenwood Ave/ E Lyndale Ave	150	355	45	0	0	0	70	530	0	0	90	85
Glenwood Ave/ Royalston Ave/ 12th St N/ Twins Way	150	110	25	10	175	10	10	360	205	15	15	5
Royalston Ave/ Holden St	15	110	0	0	160	5	5	0	35	0	0	0
Royalston Ave/ 5th Ave N	0	95	20	40	115	0	0	0	0	50	0	15
7th St N/ 5th Ave N	30	335	0	0	1690	35	35	0	25	0	0	0

Table A6. 2040 No Build PM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ 8th Ave	45	10	25	200	5	55	80	985	15	10	940	165
Excelsior Blvd (CSAH 3)/ 5th Ave	80	40	25	135	40	65	65	1060	85	35	970	220
Excelsior Blvd CSAH 3)/ TH 169 SB Ramps	0	0	0	255	0	395	160	1060	0	0	830	415
Excelsior Blvd CSAH 3)/ TH 169 NB Ramps	5	5	5	310	0	200	305	1000	10	5	1040	285
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	45	25	70	110	20	375	85	1220	10	30	910	10
Excelsior Blvd (CSAH 3)/ Pierce Ave	30	0	25	10	0	35	65	1275	55	25	885	10
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	110	400	45	290	315	225	210	900	200	105	585	340
Blake Rd (CSAH 20)/ 2nd St NE	110	865	5	5	660	205	405	5	180	5	0	10
Blake Rd (CSAH 20)/ Cambridge St	145	1090	45	50	680	110	260	25	160	30	15	20
Louisiana Ave/ Oxford St	25	640	10	55	355	95	270	20	30	5	30	70
Louisiana Ave/ Louisiana Cir	0	445	26	40	350	0	25	0	10	105	0	205
Wooddale Ave/ TH 7 WB Ramps	425	605	0	0	560	55	0	0	0	105	1	105
Wooddale Ave/ TH 7 EB Ramps	0	925	70	65	595	0	105	1	430	0	0	0
Wooddale Ave/ South Frontage Rd	35	975	55	60	950	20	5	5	95	5	1	15
Wooddale Ave/ W 36th St	20	150	435	515	395	140	115	105	5	290	90	800
Beltline Blvd/ CSAH 25	360	330	325	10	205	55	120	1170	335	245	785	15
Beltline Blvd/ South Frontage Rd	5	940	45	5	770	10	70	5	25	25	0	10
Beltline Blvd/ Park Glen Rd	15	795	60	135	650	35	55	1	40	60	1	140
CSAH 25/ Lynn Ave	20	0	10	0	0	0	0	1495	15	0	1030	0
W Lake St/ Drew Ave	5	5	50	20	5	5	5	1245	1	1	1350	15
W Lake St/ Market Plaza	255	80	90	90	70	95	65	1000	245	90	1015	135
Cedar Lake Pkwy/ Sunset Blvd	5	0	195	0	0	0	0	435	5	155	190	0
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd	0	0	0	5	0	10	105	525	0	0	335	40
Cedar Lake Pkwy/ Xerxes Ave	25	0	10	0	0	0	0	530	0	0	350	0
Cedar Lake Pkwy/ Benton Blvd	0	0	0	20	0	20	20	520	0	0	330	20
21st St W/ Rail Crossing	0	0	0	0	0	0	0	30	0	0	35	0
Penn Ave/ I-394 WB Ramps	55	280	0	0	280	170	0	0	0	285	1	160
Penn Ave/ I-394 EB Ramps	0	155	465	200	360	0	175	260	25	0	0	0
Glenwood Ave/ E Lyndale Ave	165	480	25	0	0	0	120	335	0	0	425	170
Glenwood Ave/ Royalston Ave/ 12th St N/ Twins Way	370	275	35	10	165	25	10	225	125	115	200	15
Royalston Ave/ Holden St	10	290	0	0	155	5	5	0	45	0	0	0
Royalston Ave/ 5th Ave N	0	260	35	25	140	0	0	0	0	20	0	40
7th St N/ 5th Ave N	30	835	0	0	685	30	40	0	20	0	0	0

Table A7. Opening Year Build AM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ 8th Ave	5	1	5	70	1	35	35	680	20	20	645	70
Excelsior Blvd (CSAH 3)/ 5th Ave	40	25	25	85	25	35	45	655	55	40	660	130
Excelsior Blvd CSAH 3)/ TH 169 SB Ramps	0	0	0	435	0	250	110	675	0	0	585	180
Excelsior Blvd CSAH 3)/ TH 169 NB Ramps	5	5	5	590	5	210	255	835	20	5	550	210
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	30	15	55	25	15	130	535	865	30	45	605	115
Excelsior Blvd (CSAH 3)/ Pierce Ave	50	0	15	15	0	20	115	745	85	40	695	15
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	160	205	55	155	175	130	80	610	80	55	460	50
Blake Rd (CSAH 20)/ 2nd St NE	85	265	1	5	455	240	95	1	60	5	1	0
Blake Rd (CSAH 20)/ Cambridge St	45	305	10	15	605	15	135	10	60	30	10	25
Louisiana Ave/ Oxford St	50	270	15	180	480	205	70	15	35	10	20	50
Louisiana Ave/ Louisiana Cir	15	250	85	210	275	40	5	0	0	0	0	80
Wooddale Ave/ TH 7 WB Ramps	330	515	0	0	410	85	0	0	0	85	1	95
Wooddale Ave/ TH 7 EB Ramps	0	710	95	75	480	0	130	1	285	0	0	0
Wooddale Ave/ South Frontage Rd	0	680	5	0	710	55	0	0	40	0	0	125
Wooddale Ave/ W 36th St	10	55	255	270	395	90	130	60	10	155	60	490
Beltline Blvd/ CSAH 25	250	165	175	10	75	95	55	950	285	105	875	5
Beltline Blvd/ South Frontage Rd	15	575	0	0	415	55	10	0	1	0	0	0
Beltline Blvd/ Park Glen Rd	45	565	20	40	260	105	1	0	5	150	0	60
CSAH 25/ Lynn Ave	45	0	10	0	0	0	0	870	270	30	940	0
W Lake St/ Drew Ave	10	5	25	5	1	10	1	1060	5	1	1345	10
W Lake St/ Market Plaza	160	10	55	15	10	15	40	945	105	35	1180	35
Cedar Lake Pkwy/ Sunset Blvd	5	0	145	0	0	0	0	140	5	185	345	0
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd	0	0	0	5	0	15	35	250	0	0	515	55
Cedar Lake Pkwy/ Xerxes Ave	50	0	10	0	0	0	0	255	0	0	520	0
Cedar Lake Pkwy/ Benton Blvd	0	0	0	20	0	20	20	245	0	0	500	20
21st St W/ Rail Crossing	0	0	0	0	0	0	0	5	0	0	1	0
Penn Ave/ I-394 WB Ramps	45	150	0	0	220	220	0	0	0	290	0	110
Penn Ave/ I-394 EB Ramps	0	125	375	140	360	0	70	50	40	0	0	0
Glenwood Ave/ E Lyndale Ave	140	335	40	0	0	0	65	505	0	0	85	80
Glenwood Ave/ Royalston Ave/ 12th St N/ Twins Way	140	105	25	10	165	10	10	340	195	15	15	5
Royalston Ave/ Holden St	15	105	0	0	150	5	5	0	35	0	0	0
Royalston Ave/ 5th Ave N	0	90	20	35	110	0	0	0	0	45	0	15
7th St N/ 5th Ave N	30	305	0	0	1590	30	35	0	20	0	0	0

Table A8. Opening Year Build PM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ 8th Ave	40	5	25	175	5	50	75	945	15	10	860	140
Excelsior Blvd (CSAH 3)/ 5th Ave	70	35	25	120	35	55	65	995	85	30	885	205
Excelsior Blvd CSAH 3)/ TH 169 SB Ramps	0	0	0	230	0	350	150	990	0	0	790	420
Excelsior Blvd CSAH 3)/ TH 169 NB Ramps	5	5	5	290	0	175	285	925	10	5	1030	290
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	45	25	70	105	15	375	80	1140	5	35	910	15
Excelsior Blvd (CSAH 3)/ Pierce Ave	30	0	25	50	0	145	75	1190	50	15	790	5
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	110	285	40	230	255	190	230	845	190	80	510	250
Blake Rd (CSAH 20)/ 2nd St NE	85	705	5	5	515	165	325	5	150	5	0	5
Blake Rd (CSAH 20)/ Cambridge St	115	880	35	40	540	85	225	25	125	20	15	15
Louisiana Ave/ Oxford St	20	540	5	65	290	85	240	20	25	10	25	155
Louisiana Ave/ Louisiana Cir	0	360	20	30	295	0	20	0	10	90	0	185
Wooddale Ave/ TH 7 WB Ramps	405	575	0	0	460	50	0	0	0	95	1	95
Wooddale Ave/ TH 7 EB Ramps	0	880	60	60	505	0	95	1	375	0	0	0
Wooddale Ave/ South Frontage Rd	0	925	35	0	850	30	0	0	90	0	0	15
Wooddale Ave/ W 36th St	15	85	385	470	350	120	100	90	5	255	80	765
Beltline Blvd/ CSAH 25	275	255	280	10	145	45	110	1100	265	235	845	20
Beltline Blvd/ South Frontage Rd	5	755	0	0	640	5	55	0	15	0	0	0
Beltline Blvd/ Park Glen Rd	10	615	45	105	525	30	40	1	30	45	1	105
CSAH 25/ Lynn Ave	260	0	35	0	0	0	0	1315	80	5	840	0
W Lake St/ Drew Ave	5	5	50	20	5	5	5	1170	1	1	1275	15
W Lake St/ Market Plaza	240	80	85	85	65	90	65	945	230	85	960	130
Cedar Lake Pkwy/ Sunset Blvd	5	0	185	0	0	0	0	425	5	150	175	0
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd	0	0	0	5	0	5	95	515	0	0	320	35
Cedar Lake Pkwy/ Xerxes Ave	25	0	5	0	0	0	0	500	0	0	330	0
Cedar Lake Pkwy/ Benton Blvd	0	0	0	20	0	20	20	485	0	0	310	20
21st St W/ Rail Crossing	0	0	0	0	0	0	0	30	0	0	35	0
Penn Ave/ I-394 WB Ramps	60	290	0	0	285	160	0	0	0	275	1	150
Penn Ave/ I-394 EB Ramps	0	180	445	190	365	0	165	215	30	0	0	0
Glenwood Ave/ E Lyndale Ave	155	455	25	0	0	0	115	315	0	0	395	160
Glenwood Ave/ Royalston Ave/ 12th St N/ Twins Way	350	265	35	10	155	20	10	210	120	110	185	15
Royalston Ave/ Holden St	10	280	0	0	140	5	5	0	45	0	0	0
Royalston Ave/ 5th Ave N	0	250	35	25	125	0	0	0	0	20	0	40
7th St N/ 5th Ave N	30	785	0	0	645	30	40	0	20	0	0	0

Table A9. 2040 Build AM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ 8th Ave	5	1	5	80	1	35	40	720	20	20	735	70
Excelsior Blvd (CSAH 3)/ 5th Ave	45	25	30	95	25	40	50	700	55	40	740	130
Excelsior Blvd CSAH 3)/ TH 169 SB Ramps	0	0	0	485	0	280	120	725	0	0	635	205
Excelsior Blvd CSAH 3)/ TH 169 NB Ramps	5	5	5	670	5	235	275	910	25	5	600	230
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	30	15	55	25	15	130	585	965	35	50	680	125
Excelsior Blvd (CSAH 3)/ Pierce Ave	50	0	15	15	0	20	120	830	95	45	785	15
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	160	250	60	195	225	145	90	675	90	70	540	75
Blake Rd (CSAH 20)/ 2nd St NE	105	370	1	5	560	305	115	1	70	5	1	0
Blake Rd (CSAH 20)/ Cambridge St	60	410	15	20	760	15	150	10	70	35	10	25
Louisiana Ave/ Oxford St	65	310	20	190	555	230	80	20	50	20	25	55
Louisiana Ave/ Louisiana Cir	20	290	105	250	325	50	10	0	0	0	0	95
Wooddale Ave/ TH 7 WB Ramps	315	575	0	0	465	95	0	0	0	95	1	110
Wooddale Ave/ TH 7 EB Ramps	0	745	160	85	490	0	150	1	320	0	0	0
Wooddale Ave/ South Frontage Rd	0	770	10	0	750	60	0	0	50	0	0	135
Wooddale Ave/ W 36th St	10	65	290	285	410	100	145	70	10	175	70	555
Beltline Blvd/ CSAH 25	325	215	225	10	110	120	60	1025	365	140	1040	5
Beltline Blvd/ South Frontage Rd	20	745	0	0	545	70	15	0	1	0	0	0
Beltline Blvd/ Park Glen Rd	60	720	30	55	355	135	1	0	10	195	0	75
CSAH 25/ Lynn Ave	50	0	10	0	0	0	0	975	280	35	1135	0
W Lake St/ Drew Ave	10	5	30	5	1	10	1	1125	5	1	1430	10
W Lake St/ Market Plaza	170	10	60	15	10	15	45	1005	110	40	1250	40
Cedar Lake Pkwy/ Sunset Blvd	5	0	150	0	0	0	0	150	10	195	370	0
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd	0	0	0	5	0	20	35	265	0	0	545	60
Cedar Lake Pkwy/ Xerxes Ave	50	0	10	0	0	0	0	270	0	0	555	0
Cedar Lake Pkwy/ Benton Blvd	0	0	0	20	0	20	20	260	0	0	535	20
21st St W/ Rail Crossing	0	0	0	0	0	0	0	5	0	0	1	0
Penn Ave/ I-394 WB Ramps	55	195	0	0	280	295	0	0	0	385	0	150
Penn Ave/ I-394 EB Ramps	0	150	495	190	470	0	105	55	50	0	0	0
Glenwood Ave/ E Lyndale Ave	150	355	45	0	0	0	70	530	0	0	90	85
Glenwood Ave/ Royalston Ave/ 12th St N/ Twins Way	150	110	25	10	175	10	10	360	205	15	15	5
Royalston Ave/ Holden St	15	110	0	0	160	5	5	0	35	0	0	0
Royalston Ave/ 5th Ave N	0	95	20	40	115	0	0	0	0	50	0	15
7th St N/ 5th Ave N	30	335	0	0	1690	35	35	0	25	0	0	0

Table A10. 2040 Build PM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ 8th Ave	45	10	25	200	5	55	80	985	15	10	940	165
Excelsior Blvd (CSAH 3)/ 5th Ave	80	40	25	135	40	65	65	1060	85	35	970	220
Excelsior Blvd CSAH 3)/ TH 169 SB Ramps	0	0	0	260	0	395	160	1060	0	0	850	455
Excelsior Blvd CSAH 3)/ TH 169 NB Ramps	5	5	5	315	0	200	305	1005	10	5	1100	320
Excelsior Blvd (CSAH 3)/ Jackson Ave/ Milwaukee St	45	25	70	110	20	375	85	1230	10	35	1005	15
Excelsior Blvd (CSAH 3)/ Pierce Ave	30	0	25	50	0	145	80	1275	55	25	885	10
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	110	400	45	290	320	225	245	900	205	105	585	340
Blake Rd (CSAH 20)/ 2nd St NE	110	895	5	5	665	205	405	5	180	5	0	10
Blake Rd (CSAH 20)/ Cambridge St	145	1115	45	50	685	110	260	25	160	30	15	20
Louisiana Ave/ Oxford St	25	640	10	70	355	95	270	20	30	10	30	165
Louisiana Ave/ Louisiana Cir	0	445	26	40	355	0	25	0	10	105	0	205
Wooddale Ave/ TH 7 WB Ramps	435	605	0	0	520	55	0	0	0	105	1	105
Wooddale Ave/ TH 7 EB Ramps	0	935	70	65	570	0	105	1	450	0	0	0
Wooddale Ave/ South Frontage Rd	0	985	80	0	965	55	0	0	105	0	0	20
Wooddale Ave/ W 36th St	20	145	435	530	395	140	115	105	5	290	90	795
Beltline Blvd/ CSAH 25	360	330	375	10	205	55	120	1200	330	300	970	20
Beltline Blvd/ South Frontage Rd	5	995	0	0	825	10	75	0	25	0	0	0
Beltline Blvd/ Park Glen Rd	15	810	60	135	680	35	55	1	40	60	1	140
CSAH 25/ Lynn Ave	265	0	35	0	0	0	0	1495	95	5	1030	0
W Lake St/ Drew Ave	5	5	50	20	5	5	5	1245	1	1	1350	15
W Lake St/ Market Plaza	255	80	90	90	70	95	65	1000	245	90	1015	135
Cedar Lake Pkwy/ Sunset Blvd	5	0	195	0	0	0	0	435	5	155	190	0
Cedar Lake Pkwy/ Rail Crossing/ Burnham Rd	0	0	0	5	0	10	105	525	0	0	335	40
Cedar Lake Pkwy/ Xerxes Ave	25	0	10	0	0	0	0	530	0	0	350	0
Cedar Lake Pkwy/ Benton Blvd	0	0	0	20	0	20	20	520	0	0	330	20
21st St W/ Rail Crossing	0	0	0	0	0	0	0	30	0	0	35	0
Penn Ave/ I-394 WB Ramps	60	305	0	0	305	170	0	0	0	290	1	160
Penn Ave/ I-394 EB Ramps	0	185	470	200	390	0	175	260	30	0	0	0
Glenwood Ave/ E Lyndale Ave	165	480	25	0	0	0	120	335	0	0	425	170
Glenwood Ave/ Royalston Ave/ 12th St N/ Twins Way	370	275	35	10	165	25	10	225	125	115	200	15
Royalston Ave/ Holden St	10	290	0	0	155	5	5	0	45	0	0	0
Royalston Ave/ 5th Ave N	0	260	35	25	140	0	0	0	0	20	0	40
7th St N/ 5th Ave N	30	835	0	0	685	30	40	0	20	0	0	0

Table A11. 2040 Build AM Peak Hour Turning Movement Forecasts with Joint Development

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ Pierce Ave	50	0	15	45	0	75	130	840	95	45	800	20
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	160	255	60	205	245	175	125	680	90	70	530	80
Blake Rd (CSAH 20)/ Joint Development Access	45	410	0	0	565	60	30	0	60	0	0	0
Blake Rd (CSAH 20)/ 2nd St NE	110	400	1	5	595	305	115	1	75	5	1	0
Beltline Blvd/ CSAH 25	315	205	215	25	110	120	60	1175	365	150	1060	10
Beltline Blvd/ South Frontage Rd	20	720	0	0	555	70	15	0	1	0	0	0
Beltline Blvd/ Park Glen Rd	60	720	30	55	365	135	1	0	10	195	0	75
CSAH 25/ Lynn Ave	185	0	55	0	0	0	0	915	280	135	1035	0

Table A12. 2040 Build PM Peak Hour Turning Movement Forecasts with Joint Development

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Excelsior Blvd (CSAH 3)/ Pierce Ave	30	0	25	60	0	170	105	1275	55	25	895	20
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	115	405	45	295	330	240	260	895	205	105	595	350
Blake Rd (CSAH 20)/ Joint Development Access	25	945	0	0	825	10	20	0	35	0	0	0
Blake Rd (CSAH 20)/ 2nd St NE	110	910	5	5	695	205	405	5	185	5	0	10
Beltline Blvd/ CSAH 25	350	320	365	15	205	55	120	1230	330	360	1120	35
Beltline Blvd/ South Frontage Rd	5	965	0	0	885	10	75	0	25	0	0	0
Beltline Blvd/ Park Glen Rd	15	810	60	140	735	40	55	1	40	60	1	140
CSAH 25/ Lynn Ave	520	0	125	0	0	0	0	1425	95	50	1000	0

Appendix B – Intersection Layout Tables

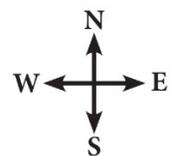
Intersection	Existing	No Build	Build	Notes
Excelsior Blvd & 8 th Ave	 N-S Perm / E-W Prot+Perm	 N-S Perm / E-W Prot+Perm	 N Prot+Perm/S Perm E Prot+Perm / W Prot	
Excelsior Blvd & 5 th Ave	 N-S Perm / E-W Prot	 N-S Perm / E-W Prot	 N-S Prot+Perm / E-W Prot	
Excelsior Blvd & TH 169 SB Ramps	 S Prot / E Prot	 S Prot / E Prot	 S Prot / E Prot	
Excelsior Blvd & TH 169 NB Ramps	 N-S Perm / E-W Prot	 N-S Perm / E-W Prot	 N-S Perm / E-W Prot	
Excelsior Blvd & Milwaukee St/Jackson Ave	 N-S Prot / E-W Prot	 N-S Prot / E-W Prot	 N-S Prot / E-W Prot	LRT 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**
 Perm = Permissive Left-Turn Phase

LRT
 Freight Rail
 Prot = Protected Left-Turn Phase
 Prot+Perm = Protected/Permissive Left-Turn Phase



Intersection	Existing	No Build	Build	Notes
Excelsior Blvd & Pierce Ave				N-S Perm / E-W Perm
Blake Rd & Excelsior Blvd				N-S Prot / E-W Prot
Blake Rd & Rail Crossing				Unsignalized / Rail Crossing
Blake Rd & 2 nd St NE				N-S Prot / E-W Perm
Blake Rd & Cambridge St				N-S Prot / E-W Perm

Legend

Traffic Signal

Stop Control

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S = SB Approach

E = EB Approach

W = WB Approach

Lane Use

Lane Use Change

No Turn on Red **NTOR**

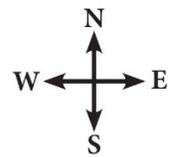
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LRT

Freight Rail

Prot = Protected Left-Turn Phase

Prot+Perm = Protected/Permissive Left-Turn Phase



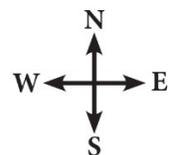
Intersection	Existing	No Build	Build	Notes
Louisiana Ave & Oxford St	 N-S Perm / E-W Perm	 N-S Perm / E-W Perm	 N-S Perm / E-W Perm	LRT grade separated
Louisiana Ave & Louisiana Circle	 N-S Perm / E-W Perm	 N-S Perm / E-W Perm	 N-S Perm / E-W Perm	
Wooddale Ave & TH 7 WB Ramps	 N Prot+Perm / W Perm	 N Prot+Perm / W Perm	 N Prot+Perm / W Perm	
Wooddale Ave & TH 7 EB Ramps	 S Prot+Perm / E Perm	 S Prot+Perm / E Perm	 S Prot+Perm / E Perm	
Wooddale Ave & South Frontage Rd	 S Prot+Perm / E Perm	 S Prot+Perm / E Perm	 S Prot+Perm / E Perm	The Build scenario reflects conversion of the intersection to right in/right out

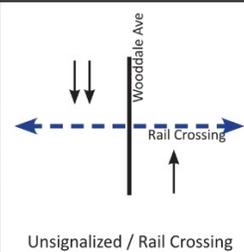
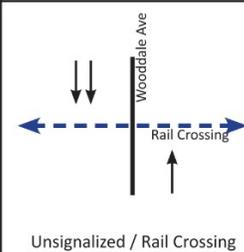
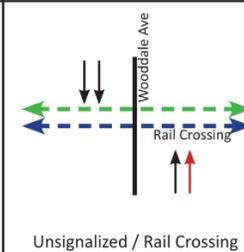
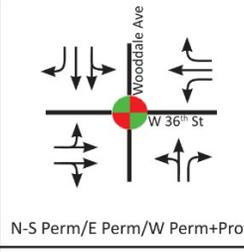
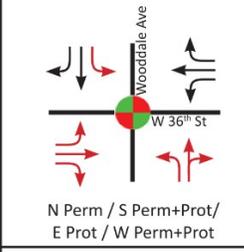
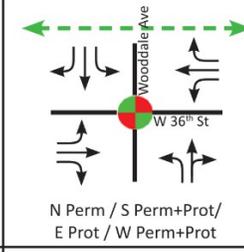
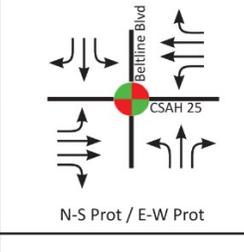
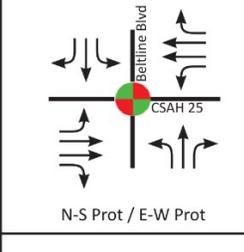
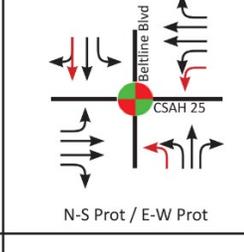
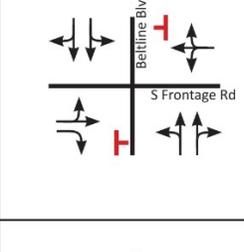
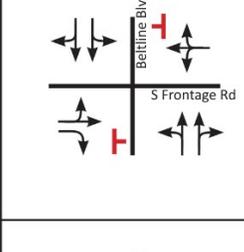
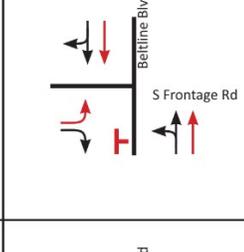
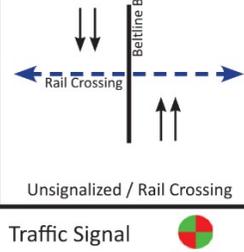
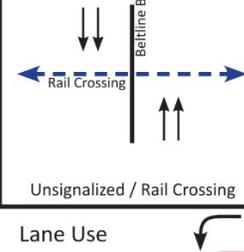
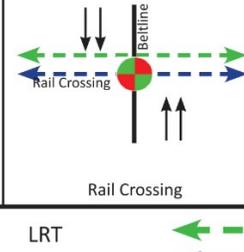
Legend

Traffic Signal
 Stop Control
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 W = WB Approach

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 Lane Use Change
 No Turn on Red **NTOR**
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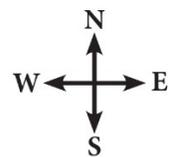
Intersection	Existing	No Build	Build	Notes
Wooddale Ave & Rail Crossing	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	
Wooddale Ave & W 36th St	 N-S Perm/E Perm/W Perm+Prot	 N Perm / S Perm+Prot / E Prot / W Perm+Prot	 N Perm / S Perm+Prot / E Prot / W Perm+Prot	
Beltline Blvd & CSAH 25	 N-S Prot / E-W Prot	 N-S Prot / E-W Prot	 N-S Prot / E-W Prot	
Beltline Blvd & South Frontage Road	 N-S Prot / E-W Prot	 N-S Prot / E-W Prot	 N-S Prot / E-W Prot	
Beltline Blvd & Rail Crossing	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	 Rail Crossing	Signalized for northbound approach (queue signal)

Legend

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



Intersection	Existing	No Build	Build	Notes
Beltline Blvd & Park Glen Rd				
CSAH 25 & Lynn Ave				N Perm / W Prot-Perm
Lake St & Drew Ave				N-S Perm / E-W Perm
Lake St & Market Plaza				N-S Prot+Perm / E-W Prot+Perm
Cedar Lake Pkwy & Sunset Blvd				

Legend

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- Stop Control
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- E = EB Approach
- W = WB Approach
- Lane Use
- Lane Use Change
- No Turn on Red **NTOR**
- LRT
- Freight Rail
- Prot = Protected Left-Turn Phase
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- Prot+Perm = Protected/Permissive Left-Turn Phase

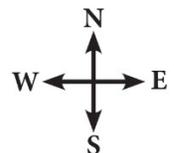
Intersection	Existing	No Build	Build	Notes
Cedar Lake Pkwy & Rail Crossing/ Burnham Rd	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	LRT grade separated
Cedar Lake Pkwy & Xerxes Ave	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	LRT grade separated
Cedar Lake Pkwy & Benton Blvd	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	
W 21 st St & Rail Crossing/ Kenilworth Trail	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	Build scenario adds gates for freight rail crossing
Penn Ave & I-394 WB Ramps	 N Prot+Perm / W Perm	 N Prot+Perm / W Perm	 N Prot+Perm / W Perm	

Legend

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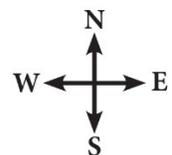
Intersection	Existing	No Build	Build	Notes
Penn Ave & I-394 EB Ramps	 S Prot+Perm / E Perm	 S Prot+Perm / E Perm	 S Prot+Perm / E Perm	
Glenwood Ave & E Lyndale Ave	 N Perm / E Prot+Perm	 N Perm / E Prot+Perm	 N Perm / E Prot+Perm	
Glenwood Ave & LRT Crossing	Does Not Exist	Does Not Exist	 LRT Crossing Rail Crossing	Build scenario adds gates for LRT crossing
Glenwood Ave/ Twins Way & Royalston Ave/12th St N	 N-S Perm / E-W Perm	 N-S Perm / E-W Perm	 N-S Perm / E-W Perm	
Royalston Ave & Holden St	 N Perm / E Perm	 N Perm / E Perm	 N Perm / E Perm	

Legend

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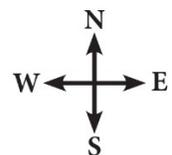
Intersection	Existing	No Build	Build	Notes
Royalston Ave & 5 th Ave N				LRT grade separated
7 th St N & 5 th Ave N				

Legend

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



Appendix C - Traffic Analysis Detailed Results

Queuing Issues

Intersection	Appr	Movement	Peak Period	Scenario(s) with 95th Percentile Queue > Storage										Identified as Issue?	Mitigation Proposed?			
				Existing Conditions No Freight Event	Existing Conditions 75-Car Freight	No Build No Freight Event	No Build 75-Car Freight	Opening Year								2040		
								Build LRT No Freight Event	Build LRT 75-Car Freight	No Build No Freight Event	No Build 75-Car Freight	Build LRT No Freight Event	Build LRT 75-Car Freight				Build LRT Without LRCI No Freight	
Louisiana Ave & Oxford St	NB																	
	EB	Left-Turn	AM												No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Queuing occurs in No Build scenarios and the project does not cause a significant change. Queuing is not expected to impact through traffic or upstream intersections.
			PM					X		X		X						
	SB	Left-Turn	AM					X							No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Queuing is not expected to impact through traffic or upstream intersections. Project includes lengthening turn lane to 140 feet, which will contain the 95th percentile queues.
PM																		
	WB																	
	NB																	
Louisiana Ave & Louisiana Circle	EB	Right-Turn	AM												No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Turn lane is very short (50 feet), and magnitude of queues is very small. Queuing is not expected to impact through traffic or upstream intersections.
			PM					X		X		X						
	SB																	
	WB																	
Wooddale Ave & TH 7 WB Ramps	NB	Left-Turn	AM												No	Average back of queue does not exceed storage length and	No	Queuing occurs mainly during freight scenarios, which are not expected to occur under typical operations.
			PM									X	X					
	SB	Through	AM												No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Queuing only occurs during freight event in 2040 PM Build scenario, which is not expected to occur under typical operations.
			PM										X					
WB	Right-Turn	AM												Yes	Average back of queue does not exceed storage length, but movement operates at LOS E or worse.	No	Queuing occurs in No Build scenarios. Project includes traffic signal installation, which will reduce and better manage queues on ramp. The queue is contained within the ramp.	
		PM						X	X	X	X	X						
Wooddale Ave & TH 7 EB Ramps	NB	Right-Turn	AM					X	X			X	X	No	Average back of queue does not exceed storage and movement operates at LOS D or better.	No	Turn lane is very short (50 feet), so magnitude of queuing is small. Queues are not expected to impact through traffic or upstream intersections.	
			PM					X	X		X	X						
	EB	Left-Turn	AM											Yes	Average back of queue exceeds storage length in some scenarios and movement operates at LOS E or worse in some scenarios.	No	Project includes installation of a traffic signal, which will reduce and better manage queues. In Build conditions, average back of queue is contained within ramp. In Build LRT No Freight scenarios, 95th percentile queue is contained within ramp.	
			PM				X			X	X	X						
	SB	Right-Turn	AM				X				X			Yes	Average back of queue exceeds storage length in some scenarios and movement operates at LOS E or worse in some scenarios.	No	Project includes installation of a traffic signal, which will reduce and better manage queues. In Build conditions, average back of queue is contained within ramp. In Build LRT No Freight scenarios, 95th percentile queue is contained within ramp.	
			PM	X	X	X		X	X	X	X	X						
	WB																	
Wooddale Ave & South Frontage Rd	EB	Left-Turn Through Right-Turn	AM											Yes	No defined storage length, but approach operates at LOS E or worse and 95th percentile queue exceeds 500 feet.	No	Issue occurs only in No Build scenario. Project includes conversion of the intersection to right-in/right-out, eliminating the through and left-turn movements.	
			PM								X							
	SB	Left-Turn	AM	X	X						X			Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but queues do impact through traffic and upstream intersections.	No	Issue occurs only in No Build scenarios. Project includes conversion of the intersection to right-in/right-out and reconfiguration of Wooddale Ave to a 4-lane section.	
			PM	X	X	X				X	X							
	SB	Through	AM											Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but queues do impact through traffic and upstream intersections.	No	Issue occurs only No Build scenarios and 2040 PM Build LRT with freight, which is not expected to occur under typical operations. Project includes conversion of the intersection to right-in/right-out and reconfiguration of Wooddale Ave to a 4-lane section.	
			PM	X	X					X	X							
WB	Right-Turn	AM	X	X		X	X	X	X	X			No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Issue occurs in No Build. Project includes conversion of the intersection to right-in/right-out and reconfiguration of Wooddale Ave to a 4-lane section.		
		PM	X	X	X	X	X	X	X	X	X							
	WB																	
Wooddale Ave & Rail Crossing	NB	Through	AM									X		Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but queues do impact upstream intersections.	No	Issue occurs in No Build scenarios. Project includes reconfiguration of Wooddale Ave to a 4-lane section.	
			PM	X				X	X	X	X	X						
	SB	Through	AM									X		Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but queues do impact upstream intersections.	No	Issue occurs only in No Build scenarios. Project includes reconfiguration of Wooddale Ave to a 4-lane section, which reduces queue lengths.	
			PM	X	X					X								
Wooddale Ave & W 36th St	NB	Right-Turn	AM											No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Queue occurs only during 2030 PM Build Freight scenario which is not expected to occur under typical operations.	
			PM										X					
	EB	Left-Turn	AM					X	X		X	X	X	Yes	Average back of queue exceeds storage length and movement operates at LOS E or worse.	No	Issue occurs on a low volume street that only impacts other local streets, so the magnitude of the issue is limited. Vehicles have other routes to access NB Wooddale Ave.	
			PM					X	X		X	X	X					
	SB	Left-Turn	AM	X	X	X	X	X	X	X	X	X	X	Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but queues do extend to rail crossing.	No	Issue occurs in No Build scenarios and the project does not cause a significant change. Project includes preemption of the signal during LRT and freight events to clear queued vehicles from the rail crossing.	
			PM	X	X	X	X	X	X	X	X	X	X					
WB	Right-Turn	AM				X	X		X	X			Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but right-turn queues do have potential to impact upstream intersections.	No	Project includes reconfiguration of Wooddale Ave to 4-lane section and conversion of South Frontage Road intersection to right-in/right-out to better manage heavy right-turn volume and queues on W 36th St.		
		PM	X	X		X	X	X	X	X	X	X						

Due to the existing close intersection spacing on Wooddale Ave, queues in this area do extend between intersections during peak periods and do have the potential to impact upstream intersections. However, the modeling shows that except during freight events, these queues clear during each signal cycle, do not cause gridlock conditions, and do not result in congestion spreading through the network. In addition, the intersections continue to have acceptable LOS. Therefore, the queues on Wooddale Ave are not considered an operational deficiency in need of mitigation.

Queuing Issues

Intersection	Appr	Movement	Peak Period	Scenario(s) with 95th Percentile Queue > Storage										Identified as Issue?	Mitigation Proposed?					
				Existing Conditions No Freight Event	Existing Conditions 75-Car Freight	No Build No Freight Event	No Build 75-Car Freight	Build LRT No Freight Event	Build LRT 75-Car Freight	No Build No Freight Event	No Build 75-Car Freight	Build LRT No Freight Event	Build LRT 75-Car Freight			2040				
																Build LRT Without LRCI No Freight				
Beltline Blvd & CSAH 25	NB	Left-Turn	AM	X	X	X	X	X	X	X	X	X	X	X	X	Yes	Movement operates at LOS D or better, but average queues exceed storage length during some scenarios and queues do impact upstream intersection.	No	Issue occurs in No Build scenarios. Project includes lane configuration on NB approach of intersection to improve operations and queuing.	
			PM	X	X	X	X	X	X	X	X	X	X	X	X	X				
		Through	AM	X	X	X	X	X	X	X	X	X	X	X	X	X	Yes	Movement operates at LOS D or better, but average queues exceed storage length during some scenarios and queues do impact upstream intersection.	No	Issue occurs in No Build scenarios. Project includes lane configuration on NB approach of intersection to improve operations and queuing.
			PM	X	X	X	X	X	X	X	X	X	X	X	X	X				
		Right-Turn	AM	X	X	X	X	X	X	X	X	X	X	X	X	X	Yes	Movement operates at LOS D or better, but average queues exceed storage length during some scenarios and queues do impact upstream intersection.	No	Issue occurs in No Build scenarios. Project includes lane configuration on NB approach of intersection to improve operations and queuing.
			PM	X	X	X	X	X	X	X	X	X	X	X	X	X				
	EB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	SB	Through	AM	X	X	X	X	X	X	X	X	X	X	X	X	Yes	Average back of queue exceeds storage length in some scenarios and movement operates at LOS E or worse.	No	Issue occurs in No Build scenarios due to close intersection spacing. Project includes intersection improvements that improve operations and queuing for the overall intersection, including this movement.	
			PM	X	X	X	X	X	X	X	X	X	X	X	X					
	WB	Left-Turn	AM													No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Issue occurs in No Build scenarios. Project includes construction of a second left-turn lane, which will limit or eliminate any potential impacts on through traffic.	
PM									X	X				X						
Beltline Blvd & South Frontage Rd	EB	Through	AM												Yes	Average back of queue does not exceed storage length, but movement operates at LOS E or worse in some scenarios and 95th percentile queues exceed 500 feet.	No	Issue occurs only in No Build scenarios. Project includes intersection improvements at CSAH 25 that will improve operations and queuing at this intersection and will close east leg of intersection, eliminating through movement.		
			PM							X	X									
		Right-Turn	AM													Yes	Average back of queue exceeds storage length and movement operates at LOS E or worse in some scenarios.	No	Issue occurs in No Build scenarios. Project includes intersection improvements at CSAH 25 that will improve operations and queuing at this intersection.	
			PM	X	X	X	X			X	X	X	X	X	X					
	SB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	WB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Beltline Blvd & Rail Crossing	NB	Through	AM												Yes	Average back of queue does not exceed storage length, but movement operates at LOS E or worse in some scenarios.	No	Issue occurs only in No Build scenarios. Project includes intersection improvements at CSAH 25 that will improve operations and queuing at this intersection.		
			PM							X	X									
SB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Beltline Blvd & Park Glen Rd	EB	Left-Turn Through Right-Turn	AM												Yes	No defined storage length, but approach operates at LOS E or worse and 95th percentile queues exceed 500 feet.	No	Issue occurs in No Build scenario only.		
			PM								X									
	WB	Left-Turn Through Right-Turn	AM							X	X	X	X	X	Yes	No defined storage length, but approach operates at LOS E or worse and 95th percentile queues exceed 500 feet.	No	Issue occurs in No Build scenarios and the project does not cause a significant change.		
			PM							X	X		X							
CSAH 25 & Lynn Ave	NB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Lake St & Drew Ave	EB	Through	AM												Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but queues do impact upstream intersections.	No	Issue occurs in No Build scenarios and the project does not cause a significant change.		
			PM	X	X	X	X	X	X	X	X	X	X	X						
	WB	Through	AM	X	X	X	X	X	X	X	X	X	X	X	Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but queues do impact upstream intersections.	No	Issue occurs in No Build scenarios and the project does not cause a significant change.		
			PM	X	X	X	X	X	X	X	X	X	X	X						
Lake St & Market Plaza	SB	Right-Turn	AM												No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Queuing occurs in No Build scenarios and the project does not cause a significant change.		
			PM	X	X	X	X	X	X	X	X	X	X	X						
	WB	Left-Turn	AM												Yes	Average back of queue does not exceed storage length, but movement operates at LOS E or worse.	No	Queuing occurs in No Build scenarios and the project does not cause a significant change.		
			PM	X	X	X	X	X	X	X	X	X	X	X						
Cedar Lake Pkwy & Sunset Blvd	NB	Left-Turn Right-Turn	AM												Yes	No defined storage length, but approach operates at LOS E or worse and 95th percentile queues exceed 500 feet.	No	Issue occurs in No Build scenarios and the project does not cause a significant change.		
			PM	X	X	X	X	X	X	X	X	X	X	X						
	WB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Cedar Lake Pkwy & Rail Crossing/ Burnham Rd	EB	Through	AM	X	X	X	X	X	X	X	X	X	X	Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but queues do impact upstream intersections.	No	Issue occurs in No Build scenarios and the project does not cause a significant change.			
			PM	X	X	X	X	X	X	X	X	X	X	X						
	WB	Through	AM	X	X	X	X	X	X	X	X	X	X	Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but queues do impact upstream intersections.	No	Issue occurs in No Build scenarios and the project does not cause a significant change.			
			PM	X	X	X	X	X	X	X	X	X	X	X						
Cedar Lake Pkwy & Xerxes Ave	WB	Through	AM	X	X	X	X	X	X	X	X	X	Yes	Average back of queue does not exceed storage length and movement operates at LOS D or better, but queues do impact upstream intersections.	No	Issue occurs in No Build scenarios and the project does not cause a significant change.				
			PM	X	X	X	X	X	X	X	X	X	X							
	EB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				

Queuing Issues

Intersection	Appr	Movement	Peak Period	Scenario(s) with 95th Percentile Queue > Storage								Identified as Issue?	Mitigation Proposed?		
				Exist	Opening Year	2040									
						Existing Conditions No Freight Event	Existing Conditions 75-Car Freight	No Build No Freight Event	No Build 75-Car Freight	Build LRT No Freight Event	Build LRT 75-Car Freight			No Build No Freight Event	No Build 75-Car Freight
Cedar Lake Pkwy & Benton Blvd	EB														
	SB														
	WB	Through	AM	X	X	X	X	X	X		Yes	Average back of queue does not exceed storage, but movement operates at LOS E or worse in some scenarios and queues do have potential to impact upstream intersections.	No	Issue occurs in No Build scenarios and the project does not cause a significant change.	
			PM	X	X	X	X	X	X						
21st St W & Rail Crossing/	EB														
	WB														
Penn Ave & I-394 WB Ramps	NB														
	SB														
Penn Ave & I-394 EB Ramps	NB														
	SB														
Glenwood Ave & E Lyndale Ave	NB														
	EB														
	WB	Right-Turn	AM									No	Average queues do not exceed storage length and movement operates at LOS D or better.	No	Queuing occurs in No Build scenarios and the project does not cause a significant change.
			PM	X	X	X	X	X	X						
Glenwood Ave & Rail Crossing	EB														
	WB														
Glenwood Ave/ Twins Way & Royalston Ave/ 12th St N	NB														
	EB														
Royalston Ave & Holden St	SB														
	WB														
Royalston Ave & 5th Ave N	NB														
	EB														
7th St N & 5th Ave N	NB														
	SB	Through	AM			X				X	No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Queuing is not expected to impact upstream intersections.	
	PM														

Storage Length for through lanes is measured to the nearest upstream full access public intersection, unless otherwise noted.

N/A indicates link or turn lane was eliminated, or the scenario was not modeled.

1. Storage length measured to rail crossing.

Memorandum

DATE: August 6, 2015
 TO: Jim Alexander
 Director of Design and Engineering, Southwest LRT Project
 FROM: JoNette Kuhnau, PE, PTOE
 Traffic Lead, PEC - East
 SUBJECT: PEC-East Traffic Technical Memorandum – Update 1

1.0 INTRODUCTION

The Metropolitan Council voted to approve a revised scope and budget for the Southwest Light Rail Transit (SWLRT) project on July 8, 2015. The traffic analysis has been updated for areas affected by the revised scope and budget. Only the modeling areas with changes to the project scope are discussed in the following sections, which includes:

- Blake Station
- Louisiana Station
- Beltline Station

The traffic analysis for the other modeling areas with no changes were previously presented in the June 29, 2015 *PEC-East Traffic Technical Memorandum*.

1.1 Assumptions

The change in project scope included several changes to the location and size of park-and-ride facilities, which are summarized in **Table 1.1**.

Table 1.1. Park-and-Ride Facility Summary

Location	Previous Number of Parking Spaces Analyzed	Revised Number of Parking Spaces Proposed
Blake Station	240	89
Louisiana Station	230	350
Beltline Station	545	268

The park-and-ride changes at the Blake Station, Louisiana Station, and Beltline Station are discussed in the following sections.

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This memorandum reflects the changes to the project scope as shown in the SWLRT revised Municipal Consent (MC) plans dated July 23, 2015. No geometric or traffic operations improvements were eliminated as part of the revised project scope. No changes have been made to the Locally Requested Capital Investments (LRCIs) assumed in the analysis.

1.2 Build Traffic Modeling Overview and Results

The revised Build operations results are presented by modeling area in the following sections.

1.2.1 Blake Station

The revised project scope for the Blake Station includes a decrease in park-and-ride spaces from 240 spaces to 89 spaces. The potential joint development was also removed from the project. No other changes in geometrics or operations were made.

The change in park-and-ride spaces would be expected to result in a decrease in traffic of approximately 83 vehicles in the AM peak and 77 vehicles in the PM peak. By comparison, the number of vehicles entering the Excelsior Blvd (CSAH 3)/Blake Rd (CSAH 20) intersection is forecast to be approximately 2,575 vehicles in the 2040 AM peak and 3,770 vehicles in the 2040 PM peak.

The projected change in peak hour volume due to the smaller park-and-ride represents a reduction of approximately two to three percent. Therefore, the expected change in traffic volume due to the park-and-ride size would be expected to be small compared to the overall traffic volumes in the area. The proposed signal at Excelsior Blvd (CSAH 3)/Pierce Ave is proposed to remain in the project in order to improve site access to the station and park-and-ride, and allow for bus routing from CSAH 20 (Blake Rd) through the park-and-ride site and onto eastbound Excelsior Blvd (CSAH 3). Without the signal, buses would be expected to experience delays making the left-turn movement from Pierce Ave onto Excelsior Blvd (CSAH 3).

No changes in geometrics or operations have been made as a result of the revised project scope. The intersection geometrics for the Blake Station area are provided as a reference in **Appendix B**.

The previous modeling, as documented in the June 29, 2015 *PEC-East Traffic Technical Memorandum*, showed that no significant impact on intersection LOS, delay, or queuing would be expected as a result of the project. For all intersections in the Blake Station area, the previous modeling showed no more than 11 additional seconds of overall intersection delay as a result of the Build project. In addition, all intersections operated at LOS D or better in the Build conditions and most operated at LOS B or better.

As a reference, tables comparing the LOS for each intersection across the Existing, Opening Year, and 2040 scenarios are shown for reference in **Table 1.2** and **Table 1.3**. It should be noted that these are the same results previously reported in the June 29, 2015 *PEC-East Traffic Technical Memorandum* and do not reflect any new analysis. Only the intersections closest to Blake Station have been included in the **Table 1.2** and **Table 1.3** since these are the intersections most impacted by the park-and-ride facility.

Table 1.2. Blake Station –AM Peak Results (No Freight Event)

Intersection	Overall Intersection Delay and LOS				
	Existing AM No Freight Event	Opening Year No Build AM No Freight Event	Opening Year Build AM No Freight Event	2040 No Build AM No Freight Event	2040 Build AM No Freight Event
Excelsior Blvd (CSAH 3)/ Pierce Ave* (side street stop-controlled in Existing and No Build conditions)	2.1 A	1.9 A	12.3 B	2.1 A	12.5 B
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	37.4 D	38.3 D	39.6 D	39.7 D	41.5 D
Blake Rd (CSAH 20)/ Rail Crossing	0.3 A	0.3 A	3.9 A	0.4 A	4.1 A
Blake Rd (CSAH 20)/ 2 nd St NE	10.3 B	10.2 B	12.6 B	11.5 B	15.3 B
Blake Rd (CSAH 20)/ Cambridge St	11.7 B	11.0 B	11.4 B	11.7 B	12.0 B

* Side street stop-controlled intersection

Table 1.3. Blake Station – PM Peak Results (No Freight Event)

Intersection	Overall Intersection Delay and LOS				
	Existing PM No Freight Event	Opening Year No Build PM No Freight Event	Opening Year Build PM No Freight Event	2040 No Build PM No Freight Event	2040 Build PM No Freight Event
Excelsior Blvd (CSAH 3)/ Pierce Ave* (side street stop-controlled in Existing and No Build conditions)	4.5 A	4.0 A	14.1 B	5.2 A	14.3 B
Excelsior Blvd (CSAH 3)/ Blake Rd (CSAH 20)	36.0 D	36.7 D	36.2 D	39.4 D	39.2 D
Blake Rd (CSAH 20)/ Rail Crossing	0.2 A	0.3 A	4.1 A	0.5 A	4.4 A
Blake Rd (CSAH 20)/ 2 nd St NE	14.4 B	14.6 B	16.6 B	18.4 B	20.6 C
Blake Rd (CSAH 20)/ Cambridge St	14.4 B	14.5 B	15.7 B	19.0 B	21.2 C

*Side street stop-controlled intersection

The reduction in park-and-ride spaces at Blake Station would result in a two to three percent reduction in peak hour volumes at the study intersections. Based on the results of the previous modeling that demonstrate the intersections have similar delays and overall operations under multiple Build scenarios, the reduction in park-and-ride spaces would be expected to result in a nominal change in intersection delays and no changes in overall intersection LOS or queuing in the Build conditions. Therefore, the project impacts previously documented would not change significantly. For these reasons, the Blake Station area is considered to have acceptable operations and the modeling was not revised to reflect the reduction in park-and-ride capacity at this station.

1.2.2 Louisiana Station

The revised analysis for the Louisiana Station included an increase in park-and-ride spaces from 230 spaces to 350 spaces. The AM and PM peak hour Build turning movement volumes for the Opening Year and 2040 conditions at Louisiana Station with the larger park-and-ride facility are provided in **Appendix A**.

No changes in geometrics or operations have been made as a result of the revised project scope. The intersection geometrics for the Louisiana Station analysis area are provided as a reference in **Appendix B**.

The analysis in this section replaces the Louisiana Station results previously presented in Section 5.2.2 in the June 29, 2015 *PEC-East Traffic Technical Memorandum*.

The results of the revised Opening Year Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS B or better during the peak hour scenarios.

The results of the 2040 Build AM and PM peak hour analysis showed that all intersections would be expected to operate at LOS B or better during the peak hour scenarios.

The overall intersection results are shown in **Table 1.4** below.

No queuing issues were identified in the Opening Year or 2040 Build conditions.

The full table of Build conditions LOS and queuing analysis results can be found in **Appendix C**.

Table 1.4. Louisiana Station – Revised Build Conditions Results

Intersection	Overall Intersection Delay and LOS			
	Opening Year Build AM No Freight Event	2040 Build AM No Freight Event	Opening Year Build PM No Freight Event	2040 Build PM No Freight Event
Louisiana Ave/ Oxford St	11.4 B	12.0 B	12.2 B	13.4 B
Louisiana Ave/ Louisiana Cir	9.3 A	10.3 B	8.8 A	10.0 B

The results of the updated analysis show no change in intersection LOS with the larger park-and-ride facility at Louisiana Station. The adjacent intersections would still be expected to have acceptable operations, no queuing issues have been identified, and no additional improvements are needed to accommodate the additional traffic.

1.2.3 Beltline Station

The revised project scope for the Beltline Station includes a decrease in park-and-ride size, from 545 spaces to 268 spaces. The change in park-and-ride spaces would be expected to result in a decrease in traffic of approximately 152 vehicles in the AM peak and approximately 141 vehicles in the PM peak. By comparison, the number of vehicles entering the Beltline Blvd/CSAH 25 intersection is forecast to be approximately 3,640 vehicles in the 2040 AM peak and 4,280 vehicles in the 2040 PM peak.

The projected change in peak hour volume due to the smaller park-and-ride represents a reduction of approximately three to four percent. Therefore, the expected change in traffic volume due to the change in park-and-ride size would be expected to be small compared to the overall traffic volumes in the area. No changes in geometrics or operations have been made as a result of the revised project scope. The proposed signal at CSAH 25/Lynn Ave would still be needed as part of the SWLRT project because Lynn Ave provides the only exit from the park-and-ride site to the roadway network. Based on the projected volume of park-and-ride traffic, even with the smaller park-and-ride site, a signal would be needed to provide for the left-turn movements from Lynn Ave onto CSAH 25. The intersection geometrics for the Beltline Station analysis area are provided as a reference in **Appendix B**.

The previous modeling, as documented in the June 29, 2015 *PEC-East Traffic Technical Memorandum*, showed that no significant impact on intersection LOS, delay, or queuing would be expected as a result of the project. For all intersections in the Beltline Station analysis area, the previous modeling showed no more than 11 additional seconds of overall intersection delay as a result of the Build project, and several intersections were shown to have improved operations in the Build conditions due to the improvements included as part of the SWLRT project. In addition, all intersections operated at LOS D or better in the Build conditions and most operated at LOS C or better. The previous modeling also showed that queuing issues in the Beltline Station area were similar or less

in the Build conditions compared with the No Build conditions, due to the intersection and turn lane improvements on Beltline Blvd and CSAH 25.

As a reference, tables comparing the LOS for each intersection across all the Existing, Opening Year, and 2040 scenarios are shown for reference in **Table 1.5** and **Table 1.6**. It should be noted that these are the same results previously reported in the June 29, 2015 *PEC-East Traffic Technical Memorandum* and do not reflect any new analysis.

Table 1.5. Beltline Station – AM Peak Results (No Freight Event)

Intersection	Overall Intersection Delay and LOS					
	Existing AM No Freight Event	Opening Year No Build AM No Freight Event	Opening Year Build AM No Freight Event	2040 No Build AM No Freight Event	2040 Build AM No Freight Event	2040 Build Without LRCI AM No Freight Event
Beltline Blvd/ CSAH 25	29.4 C	29.9 C	25.7 C	34.6 C	29.4 C	30.7 C
Beltline Blvd/ South Frontage Rd*	12.3 B	14.3 B	3.5 A	19.2 B	5.5 A	6.1 A
Beltline Blvd/ Rail Crossing	1.0 A	1.7 A	5.4 A	5.2 A	5.8 A	6.0 A
Beltline Blvd/ Park Glen Rd*	3.5 A	3.8 A	4.5 A	13.2 B	21.5 C	21.4 C
CSAH 25/ Lynn Ave * (side street stop-controlled in Existing and No Build conditions)	0.4 A	0.4 A	4.4 A	0.6 A	4.6 A	4.6 A

*Side street stop-controlled intersection

Table 1.6. Beltline Station – PM Peak Results (No Freight Event)

Intersection	Overall Intersection Delay and LOS					
	Existing PM No Freight Event	Opening Year No Build PM No Freight Event	Opening Year Build PM No Freight Event	2040 No Build PM No Freight Event	2040 Build PM No Freight Event	2040 Build Without LRCI PM No Freight Event
Beltline Blvd/ CSAH 25	38.2 D	39.1 D	35.2 D	52.5 D	40.6 D	52.8 D
Beltline Blvd/ South Frontage Rd*	18.4 C	20.3 C	7.2 A	52.3 F	14.6 B	21.2 C
Beltline Blvd/ Rail Crossing	2.1 A	3.0 A	5.9 A	27.5 D	7.2 A	8.1 A
Beltline Blvd/ Park Glen Rd*	2.5 A	2.7 A	3.5 A	34.3 D	7.2 A	7.7 A
CSAH 25/ Lynn Ave * (side street stop-controlled in Existing and No Build conditions)	0.6 A	0.6 A	10.8 B	0.7 A	11.3 B	11.6 B

*Side street stop-controlled intersection

Based on the level of geometric and operational improvements being made in the Beltline Station area as part of the SWLRT project and the results of the previous modeling that demonstrate the intersections have similar delays and overall operations under multiple Build scenarios, a reduction in peak hour volume of three to four percent would be expected to result in a nominal change in intersection delays and no changes in overall intersection LOS or queuing in the Build conditions. Therefore, the project impacts previously documented would not change significantly. For these reasons, the Beltline Station area is considered to have acceptable operations and the modeling was not revised to reflect the reduction in park-and-ride capacity at this station.

1.2.4 Beltline Station Joint Development

The joint development scenario assumed for the Beltline Station site has not changed as a result of the revised project scope. The following land uses and sizes still represent the maximum build-out of the joint development:

- 12,200 square feet of retail
- 260 residential units
- 312,000 square feet of office

The trips expected to be generated by this development, as documented in the June 29, 2015 *PEC-East Traffic Technical Memorandum*, were as follows:

- 2040 Build AM Peak: 377 trips (332 trips in, 45 trips out)
- 2040 Build PM Peak: 364 trips (62 trips in, 302 trips out)

Compared to the Build volumes, the additional vehicle traffic expected to be generated by the joint development represents an eight to 10 percent increase in peak hour traffic at the Beltline Blvd/CSAH 25 intersection in 2040. The decrease in the number of park-and-ride spaces would result in the overall traffic volumes in the Build Joint Development scenario decreasing by the same amount as previously described for the Build conditions (three to four percent reduction).

The previous analysis as documented in the June 29, 2015 *PEC-East Traffic Technical Memorandum* showed all intersections operated at LOS D or better in the Joint Development scenarios, and no significant changes in intersection LOS, delay, or queuing occurred as a result of the joint development traffic. The 2040 Build and 2040 Build Joint Development operations, as previously reported in the June 29, 2015 *PEC-East Traffic Technical Memorandum*, are shown for reference in **Table 1.7**.

Table 1.7. Beltline Station – 2040 Build Joint Development Results (No Freight Event)

Intersection	Overall Intersection Delay and LOS			
	2040 Build AM No Freight Event	2040 Build PM No Freight Event	2040 Build Joint Development AM No Freight Event	2040 Build Joint Development PM No Freight Event
Beltline Blvd/ CSAH 25	29.4 C	40.6 D	31.1 C	42.7 D
Beltline Blvd/ South Frontage Rd*	5.5 A	14.6 B	4.8 A	11.9 B
Beltline Blvd/ Rail Crossing	5.8 A	7.2 A	6.0 A	7.2 A
Beltline Blvd/ Park Glen Rd*	21.5 C	7.2 A	24.6 C	10.2 B
CSAH 25/ Lynn Ave	4.6 A	11.3 B	7.6 A	22.9 C

*Side street stop-controlled intersection

As shown in the table, a volume increase of more than 350 trips in each of the AM and PM peak hours resulted in less than five additional seconds of delay at all intersections except the main site access (CSAH 25/Lynn Ave). In addition, all intersections continued to operate at LOS D or better in the 2040 Build Joint Development scenarios. A reduction in peak hour volume of one to five percent would be expected to result in nominal changes in intersection delays and no changes in overall intersection LOS or queuing at any of the intersections in the Build Joint Development scenario.

In addition, no increase in size or density of the Joint Development land uses are planned as a result of the reduced park-and-ride size. Therefore, the incremental changes in traffic operations between the Build and Build Joint Development scenarios would be expected to be the same as previously documented because

both scenarios would have the same peak hour volume reductions (152 vehicles in AM peak and 141 vehicles in PM peak).

Based on the analysis previously presented and the supporting information above, a reduction in peak hour volume of five percent or less would be expected to result in a nominal change in intersection delays and no changes in overall intersection LOS or queuing in the Build Joint Development conditions. Therefore, the project impacts previously documented would not change significantly. For these reasons, the Beltline Station area is considered to have acceptable operations and the modeling was not revised to reflect the reduction in park-and-ride capacity at this station.

2.0 SUMMARY AND CONCLUSION

The changes to the proposed SWLRT project scope and improvements presented in this memorandum included:

- Reduction in park-and-ride spaces from 240 spaces to 89 spaces at Blake Station.
- Elimination of the proposed joint development at Blake Station.
- Increase in park-and-ride spaces from 230 spaces to 350 spaces at Louisiana Station.
- Reduction in park-and-ride spaces from 545 spaces to 268 spaces at Beltline Station.

At Blake Station, the reduction in park-and-ride spaces would result in a two to three percent reduction in peak hour volumes at the study intersections. This would be expected to result in nominal changes in intersection delays and no changes in overall intersection LOS or queuing in the Build conditions. Therefore, the project impacts previously documented would not change significantly. For these reasons, the Blake Station area is considered to have acceptable operations and the modeling was not revised to reflect the reduction in park-and-ride capacity at this station.

At Louisiana Station, the revised modeling with increased park-and-ride spaces showed no changes in intersections LOS compared to the traffic operations previously documented in the June 29, 2015 *PEC-East Traffic Technical Memorandum*. The revised modeling with increased park-and-ride spaces showed that:

- In the revised Opening Year Build conditions all intersections would be expected to operate at LOS B or better in the AM and PM peak.
- In the revised 2040 Build conditions, all intersections would be expected to operate at LOS B or better in the AM and PM peak.

At Beltline Station, the proposed reduction in park-and-ride spaces would result in less than a five percent reduction in peak hour volumes at the study intersections. This would be expected to result in nominal changes in intersection delays and no changes in overall intersection LOS or queuing in the Build and Build Joint Development conditions. Therefore, the project impacts previously documented would not change significantly. For these reasons, the Beltline Station area is considered to have acceptable operations and the modeling was not revised to reflect the reduction in park-and-ride capacity at this station.

Appendix A – Build Forecast Traffic Volumes

Table A1. Opening Year Build AM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Louisiana Ave/ Oxford St	50	270	20	230	480	205	70	15	35	20	20	55
Louisiana Ave/ Louisiana Cir	15	255	85	210	280	40	5	0	0	0	0	80

Table A2. Opening Year Build PM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Louisiana Ave/ Oxford St	20	540	10	70	290	85	240	20	25	15	25	205
Louisiana Ave/ Louisiana Cir	0	365	20	30	300	0	20	0	10	90	0	185

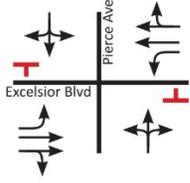
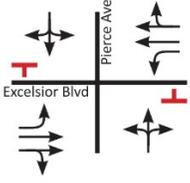
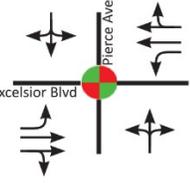
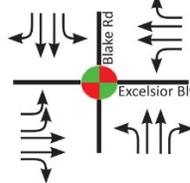
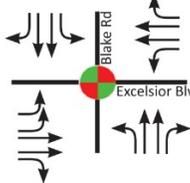
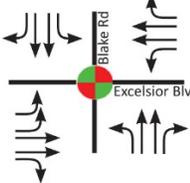
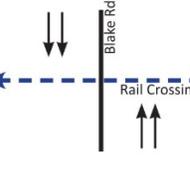
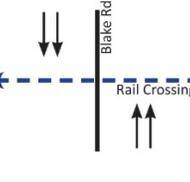
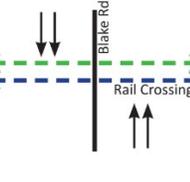
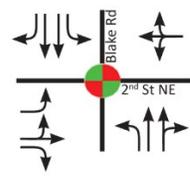
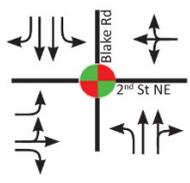
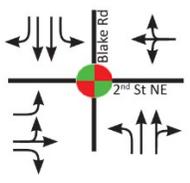
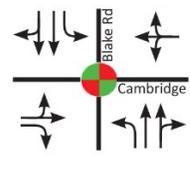
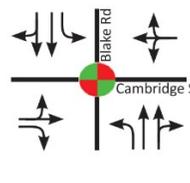
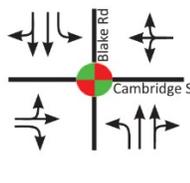
Table A3. 2040 Build AM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Louisiana Ave/ Oxford St	65	310	25	240	555	230	80	20	50	25	25	65
Louisiana Ave/ Louisiana Cir	20	295	105	250	330	50	10	0	0	0	0	95

Table A4. 2040 Build PM Peak Hour Turning Movement Forecasts

Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Louisiana Ave/ Oxford St	25	640	15	75	355	95	270	20	30	15	30	215
Louisiana Ave/ Louisiana Cir	0	450	25	40	360	0	25	0	10	105	0	205

Appendix B – Intersection Layout Tables

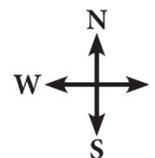
Intersection	Existing	No Build	Build	Notes
Excelsior Blvd & Pierce Ave			 N-S Perm / E-W Perm	
Blake Rd & Excelsior Blvd			 N-S Prot / E-W Prot	
Blake Rd & Rail Crossing			 Unsignalized / Rail Crossing	
Blake Rd & 2nd St NE			 N-S Prot / E-W Perm	
Blake Rd & Cambridge St			 N-S Prot / E-W Perm	

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 **NTOR**
 Perm = Permissive Left-Turn Phase

LRT 
 Freight Rail 
 Prot = Protected Left-Turn Phase
 Phase
 Prot+Perm = Protected/Permissive Left-Turn Phase



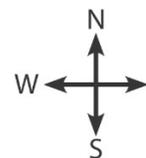
Intersection	Existing	No Build	Build	Notes
Louisiana Ave & Oxford St	 N-S Perm / E-W Perm	 N-S Perm / E-W Perm	 N-S Perm / E-W Perm	LRT grade separated
Louisiana Ave & Louisiana Circle	 N-S Perm / E-W Perm	 N-S Perm / E-W Perm	 N-S Perm / E-W Perm	
Beltline Blvd & CSAH 25	 N-S Prot / E-W Prot	 N-S Prot / E-W Prot	 N-S Prot / E-W Prot	
Beltline Blvd & South Frontage Road	 S Frontage Rd	 S Frontage Rd	 S Frontage Rd	
Beltline Blvd & Rail Crossing	 Unsignalized / Rail Crossing	 Unsignalized / Rail Crossing	 Rail Crossing	Signalized for northbound approach (queue signal)

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**
 Perm = Permissive Left-Turn Phase

LRT
 Freight Rail
 Prot = Protected Left-Turn Phase
 Phase
 Prot+Perm = Protected/Permissive Left-Turn Phase



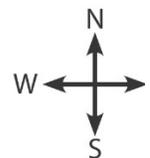
Intersection	Existing	No Build	Build	Notes
Beltline Blvd & Park Glen Rd				
CSAH 25 & Lynn Ave				

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**
 Perm = Permissive Left-Turn Phase

LRT
 Freight Rail
 Prot = Protected Left-Turn Phase
 Prot+Perm = Protected/Permissive Left-Turn Phase



Appendix C - Traffic Analysis Detailed Results

AM Peak Hour Level of Service by Approach and Intersection Delay and Level of Service

		Opening Year						2040					
		Build LRT No Freight Event			Build LRT + 75-Car Freight			Build LRT No Freight Event			Build LRT + 75-Car Freight		
		LOS		Delay									
Intersection	Appr	Appr	Inter	Inter									
Louisiana Ave & Oxford St ^{1,2}	NB	B			-			B			-		
	EB	B	B	11.4	-			B	B	12.0	-		
	SB	B			-			B			-		
	WB	A			-			B			-		
Louisiana Ave & Louisiana Circle ^{1,2}	NB	A			-			A			-		
	EB	A	A	9.3	-			B	B	10.3	-		
	SB	B			-			B			-		
	WB	A			-			A			-		

All intersections modeled in VISSIM unless otherwise noted.

- Freight is grade separated at this location and does not interact with roadway traffic, therefore freight events were not modeled for this intersection.
- Intersection modeled in Synchro/SimTraffic.

PM Peak Hour Level of Service by Approach and Intersection Delay and Level of Service

		Opening Year						2040					
		Build LRT No Freight Event			Build LRT + 75-Car Freight			Build LRT No Freight Event			Build LRT + 75-Car Freight		
		LOS		Delay	LOS		Delay	LOS		Delay	LOS		Delay
Intersection	Appr	Appr	Inter	Inter	Appr	Inter	Inter	Appr	Inter	Inter	Appr	Inter	Inter
		Louisiana Ave & Oxford St ^{1,2}	NB	B			-			B			-
EB	B		B	12.2	-	-	-	B	B	13.4	-	-	-
SB	B				-	-	-	B	B		-	-	-
WB	A				-			A			-		
Louisiana Ave & Louisiana Circle ^{1,2}	NB	B			-			B			-		
	EB	A	A	8.8	-	-	-	A	A	10.0	-	-	-
	SB	B			-			B			-		
	WB	A			-			A			-		

All intersections modeled in VISSIM unless otherwise noted.

- Freight is grade separated at this location and does not interact with roadway traffic, therefore freight events were not modeled for this intersection.
- Intersection modeled in Synchro/SimTraffic.

Storage Length

		2018			2040		
		Build			Build		
Intersection	Appr	Effective Storage Distance (feet)			Effective Storage Distance (feet)		
		LT	Th	RT	LT	Th	RT
Louisiana Ave & Oxford St	NB	150	490 ¹	-	150	490 ¹	-
	EB	130	2500	-	130	2500	-
	SB	120	1250	-	120	1250	-
	WB	130	1000 ¹	-	130	1000 ¹	-
Louisiana Ave & Louisiana Circle	NB	200	1450	200	200	1450	200
	EB	-	220	45	-	220	45
	SB	215	360 ¹	-	215	360 ¹	-
	WB	-	550	95	-	550	95

Storage Length for through lanes is measured to the nearest upstream full access public intersection, unless otherwise noted.

1. Storage length measured to rail crossing.

Queuing Issues

Intersection	Appr	Movement	Peak Period	Scenario(s) with 95th Percentile Queue > Storage				Identified as Issue?	Mitigation Proposed?		
				Opening Year		2040					
				Build LRT No Freight Event	Build LRT 75-Car Freight	Build LRT No Freight Event	Build LRT 75-Car Freight				
Louisiana Ave & Oxford St	NB	-	-					-	-		
	EB	Left-Turn	AM					No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Queuing occurs in No Build scenarios and the project does not cause a significant change. Queuing is not expected to impact through traffic or upstream intersections.
			PM	X		X					
	SB	Left-Turn	AM	X		X		No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Queuing is not expected to impact through traffic or upstream intersections. Project includes lengthening turn lane to 140 feet, which will contain the 95th percentile queues within the turn lane taper.
			PM								
WB	-	-						-	-		
Louisiana Ave & Louisiana Circle	NB	-	-					-	-		
	EB	Right-Turn	AM					No	Average back of queue does not exceed storage length and movement operates at LOS D or better.	No	Turn lane is very short (50 feet), and magnitude of queues is very small. Queuing is not expected to impact through traffic or upstream intersections.
			PM	X		X					
	SB	-	-					-	-		
	WB	-	-					-	-		

Storage Length for through lanes is measured to the nearest upstream full access public intersection, unless otherwise noted.