ATTACHMENT Y: L200 TRAFFIC ENGINEERING REPORT

Lynnwood Link Extension | Northgate Station to Lynnwood Transit Center
Contract No. RTA/AE 0010-15

Contract L200
Traffic Engineering Report
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ACRONYMS AND ABBREVIATIONS

FEIS	Final Environmental Impact Statement
FTA	Federal Transit Administration
HCM	Highway Capacity Manual
H-J	HNTB Jacobs Trusted Design Partners
HOV	High-Occupancy Vehicles
LOS	Level of Service
LRT	Light Rail Transit
MOT	Maintenance of Traffic
MUTCD	Manual on Uniform Traffic Control Devices
ROD	Record of Decision
SEPA	State Environmental Policy Act
SDOT	Seattle Department of Transportation
vpd	vehicles per day
vph	vehicles per hour
WSDOT	Washington State Department of Transportation

1.0 INTRODUCTION

1.1 Background

The Lynnwood Link Extension project is an 8.5-mile extension to Sound Transit's current light rail transit system. It will begin at Northgate Station in the northern part of the City of Seattle just north of the Northgate Transit Center and terminate at the Lynnwood Transit Center in the City of Lynnwood. It will essentially follow the route of I-5 and be primarily within the I-5 transportation corridor. In areas where there is not sufficient public right-of-way within the I-5 corridor, private right-of-way will be acquired. The extension will follow the east side of I-5 for approximately 5.8 miles from Northgate to the Mountlake Terrace Transit Center. It will then cross I-5 to the west side and continue north along the west side of I-5 for the remaining 2.7 miles into the Lynnwood Transit Center. Figure 1 shows the project vicinity. The project is split into two civil design contract packages, L200 from Northgate Station to the King/Snohomish County line and L300 from the King/Snohomish County line to Lynnwood Transit Center. Contract L200 is the subject of this report.

The project will be on exclusive right-of-way without at-grade crossings with approximately 4 miles on elevated structure guideway and approximately 4.5 miles of at-grade, retained cut or fill guideway. There will be four passenger stations. Two will be located in the City of Shoreline—an elevated station at NE 145th Street and a retained cut station at NE 185th Street. One elevated station will be located in the City of Mountlake Terrace at the site of the current Mountlake Terrace Transit Center. One elevated station will be located in the City of Lynnwood at the current Lynnwood Transit Center. New structured park-and-ride facilities for approximately 500 cars will be provided at the NE 145th Street station and the NE 185th Street station. No new parking will be constructed at the Mountlake Terrace Transit Center. The existing Lynnwood Transit Center park-and-ride facility will be expanded by approximately 500 cars to a capacity of approximately 1,900 cars by constructing a new parking structure for approximately 1,600 cars. Bicycle parking facilities will also be provided at each passenger station.

In addition to the infrastructure required for the light rail system, several I-5 ramps and various arterial and residential streets will need to be modified to support vehicular and non-motorized traffic in the station areas and in locations where the guideway alignment would interfere with local streets. Various existing utilities will also need to be relocated, including several that cross I-5. New stormwater management facilities will be provided to serve the transit facility and new roadways. Existing trees and vegetation along the I-5 corridor displaced by the transit facilities will be replaced and/or mitigated. And existing noise walls along I-5 will be replaced or new walls will be built to mitigate light rail and/or highway noise.

Figure 1: Lynnwood Link Extension Project Vicinity

1.2 Organization of this Report

The Traffic Engineering Report for Contract L200 addresses corridor design at the 60-percent level of development for two areas of design development:

1.2.1 Corridor Design Refinement

Design of permanent intersection configurations and new traffic signals adjacent to the LRT alignment and station areas are discussed, along with ROD mitigation commitments. Traffic signal warrants are covered in this section. Synchro analysis of design refinements not addressed in the FEIS and PE are included in this section. Sight distance calculations where the elevated guideway impacts sight distance to traffic signals are included in this section.

1.2.2 Maintenance of Traffic During Construction

Design of temporary features to support construction of the project, including traffic signal modifications, detour routes and impacts, lane closure schedules, and traffic operations in work zones are discussed. The objective is to minimize potential disruption to the movement of traffic near construction sites and to serve local access to businesses and residences during construction. Synchro analysis of intersections impacted by lane or street closures and detour routes is covered in this section. Construction impacts to existing park-and-ride lots and transit service, along with associated mitigation strategies are also included in this section.

2.0 METHODOLOGY AND ASSUMPTIONS

This chapter documents the methods and assumptions used for the traffic technical analysis for both the permanent and temporary features of the Lynnwood Link Extension project.

2.1 Analysis Locations

Locations subject to analysis in Contract L200 include those associated with the corridor design refinement and those related to maintenance of traffic during construction.

2.1.1 Corridor Design Refinement

The NE 145th Street LRT station will be developed along the west side of 5th Avenue NE north of NE 145th Street. The following locations require analysis for the completed project:

- 5th Avenue NE / NE 145th Street
- 5th Avenue NE / I-5 Northbound On-Ramp
- 5th Avenue NE / NE 148th Street (Transit Center / Park-and-Ride Access)
- 5th Avenue NE / NE 155th Street

The NE 185th Street LRT station will be developed along the east side of I-5 immediately north of NE 185th Street. An associated parking garage will be located on the west side of I-5 along 5th Avenue NE. The following locations require analysis for the completed project:

- NE 185th Street / 5th Avenue NE (west of I-5)
- NE 185th Street / 5th Avenue NE / Transit Center Access (east of I-5)
- NE 185th Street / 8th Avenue NE
- 5th Avenue NE / Park-and-Ride Garage Access (north of NE 185th Street)
- N 185th Street / Meridian Avenue N
- NE 185th Street / 2nd Avenue NE

2.1.2 Maintenance of Traffic During Construction

Traffic analysis locations for maintenance of traffic during construction consists primarily of long-term and short-term lane closures and associated detour routes. Potential detour routes will be identified as needed and are not included in the list below.

Anticipated long-term single-lane or roadway closure locations include:

- 1st Avenue NE (NE 112th Street to NE 116th Street)
- NE 115th Street, west of 3rd Avenue NE
- NE 116th Street, west of 3rd Avenue NE
- 3rd Avenue NE, north of NE 117th Street
- NE 120th Street, west of 5th Avenue NE
- NE 123rd Street, west of 5th Avenue NE
- 5th Avenue NE (NE 125th Street to NE 145th Street)
- 5th Avenue NE (NE 145th Street to NE 148th Street)
- NE 155th Street (east of I-5)
- 1st Avenue NE (NE 159th Street to NE 161st Street)
- I-5 northbound on- and off-ramps (transit-only) at the King County Metro Base
- NE 165th Street at 1st Avenue NE
- 1st Avenue NE (NE 170th Street to NE 174th Street)
- I-5 northbound off-ramp at NE 175th Street (single-lane closure)
- NE 180th Street, west of 5th Avenue NE

- 5th Avenue NE (NE 180th Street to NE 185th Street)
- NE 185th Street (5th Avenue NE west of I-5 to 5th Avenue NE east of I-5)
- 8th Avenue NE, north of NE 185th Street
- 5th Avenue NE, north of NE 185th Street

Anticipated short-term (overnight or weekend) single-lane or full closure locations include:

- 1st Avenue NE, south of NE Northgate Way
- I-5 northbound on and off-ramps, south of NE Northgate Way
- NE Northgate Way, west of 1st Avenue NE
- I-5 northbound on-ramp at NE Northgate Way
- I-5 northbound off-ramp at NE 130th Street
- NE 130th Street, west of 5th Avenue NE
- I-5 northbound off-ramp at NE 145th Street
- NE 145th Street, west of 5th Avenue NE
- I-5 northbound transit-only off-ramp at NE 145th Street
- I-5 northbound on-ramp at NE 145th Street
- NE 175th Street (east of I-5)

2.2 Traffic Data

Traffic data was obtained from the FEIS *Transportation Technical Report*, from the WSDOT CDR system for freeway ramps and mainline, the King County Metro Long Range Plan, the City of Shoreline and from a count program conducted in November 2016. Sources of traffic counts for Contract L200 are described briefly below.

2.2.1 Motorized Vehicle Volume Data

Motorized vehicle volume data sources include existing peak hour turning movement counts from the FEIS *Transportation Technical Report*. These counts were conducted in 2012. Additional peak hour turning movement counts and 24-hour counts were collected in November 2016 for intersections on potential detour routes for the proposed closure of 5th Avenue NE.

Daily traffic volumes for roadways in the vicinity of Contract L200 from the FEIS *Transportation Technical Report* are included in Appendix A.

WSDOT CDR data was obtained for ramps at the NE 130th Street and NE 145th Street interchanges for maintenance of traffic during construction analysis.

Design year motorized vehicle volume data was obtained from the FEIS *Transportation Technical Report.*

2.2.2 Non-motorized Volume Data

Non-motorized vehicle volume data sources include existing peak hour pedestrian and bicycle counts at intersections from the FEIS *Transportation Technical Report*. These counts were conducted in 2012. Additional peak hour counts were collected in November 2016 for intersections on potential detour routes for the proposed closure of 5th Avenue NE.

Design year pedestrian forecasts at the LRT station areas were obtained from the FEIS *Transportation Technical Report.*

2.2.3 Transit Integration Data

Transit integration data, for restructuring bus-transit access to LRT stations, was obtained from the FEIS and the King County Metro long-range plan *Metro Connects*.

2.2.4 Traffic Signal Timing Data

Traffic signal timing plans used in the FEIS traffic analysis (Synchro and VISSIM) will also be used by H-J during final design. Signal timing plans were obtained from the City of Shoreline to verify timing values at intersections along 155th Street. Timing plans will be requested from the appropriate agencies (Seattle, Shoreline and WSDOT) as needed throughout final design.

2.3 Traffic Volume Forecasts

Traffic volume forecasts were obtained from the FEIS *Transportation Technical Report.*

2.3.1 Corridor Design Refinement

A design year of 2035 was used for the project. Design year no-build and build traffic volume forecasts were obtained from the FEIS. Synchro models incorporating these volume forecasts were transferred from the PE team to H-J, and were used as a basis for the corridor design refinement.

2.3.2 Maintenance of Traffic During Construction

A construction year of 2020 was used for the project. Construction year traffic volume forecasts were estimated by H-J based on traffic growth rates obtained from the FEIS *Transportation Technical Report.* AM and PM peak hour annual growth rates in the Contract L200 vicinity were estimated to be 0.8-percent (FEIS *Transportation Technical Report* Section 5.4.1). This value will be used to estimate construction year peak hour and 24-hour volumes.

2.4 Analysis Tools

A range of traffic analysis tools will be used on this project as each are needed. Within the limits of Contract L200, the Synchro software (version 9 or later) will be used to analyze conventional signalized and unsignalized intersections for corridor design refinement and maintenance of traffic during construction for AM and PM peak hours.

Synchro will also be used for preliminary screening of roundabouts for corridor design refinement. If a roundabout is selected as the preferred intersection control type, Sidra Intersection 7 software (or later) will be used as the analysis tool for roundabouts.

If construction activities require long-term closure of freeway ramp or mainline lanes (e.g. closures longer than a weekend) AM and PM peak hour VISSIM modeling of the affected area will be completed. VISSIM modeling will be based on models developed for the project FEIS. Existing conditions (2012) and design year (2035) VISSIM models were developed for the FEIS. Existing conditions VISSIM models will be used as the basis for modeling MOT scenarios. FEIS models were created in VISSIM 5.4; these models will be converted to be compatible with VISSIM 8 or later.

Where construction activities require short-term closure of surface streets and freeway ramp or mainline lanes, spreadsheet tools will be used to estimate closure durations based on the available capacity of detour routes or the remaining open lanes on a facility.

2.5 Level of Service Criteria

Level of service categories for signalized and unsignalized intersections were determined in accordance with the 2010 *Highway Capacity Manual.* For two-way stop controlled intersections, delay and LOS are reported for the poorest movement. For all-way stop controlled intersections, delay is averaged for all movements. The vehicle delay associated with level-of-service is shown in Table 1.

Table 1: Intersection Level-of-Service Criteria

	Control Delay* (seconds per vehicle)	
Level of Service	**Signalized**	**Unsignalized**
A	≤10	0 to 10
B	>10 to 20	>10 to 15
C	>20 to 35	>15 to 25
D	>35 to 55	>25 to 35
E	>55 to 80	>35 to 50
F	>80	>50

Source: Transportation Research Board. Highway Capacity Manual 2010. Exhibit 18-4 and Exhibit 19-1.

* Control delay is time spent slowing, stopping, moving up in a queue, and accelerating back to desired speed.

Level of service categories for freeway segments (basic, weaving and merge/diverge) were determined in accordance with the 2010 *Highway Capacity Manual*. Vehicle density (passenger cars – per mile – per lane) is the measurement used to determine freeway LOS. The vehicle density associated with level-of-service is shown in Table 2.

Table 2: Freeway Level-of-Service Criteria

	Vehicle Density (passenger cars / mile / lane)		
Level of Service	**Basic Segment**	**Weave Segment**	**Merge/Diverge Segment**
A	≤11	≤10	≤10
B	> 11 to 18	> 10 to 20	> 10 to 20
C	>18 to 26	>20 to 28	>20 to 28
D	>26 to 35	>28 to 35	>28 to 35
E	>35 to 45	>35	>35
F	>45	Demand exceeds capacity	Demand exceeds capacity

Source: Transportation Research Board. Highway Capacity Manual 2010. Exhibit 11-5, Exhibit 12-10 and Exhibit 13-2.

Level of Service analysis for pedestrian facilities was performed by the PE team, and presented in the FEIS *Transportation Technical Report*. Any necessary updates to the pedestrian facility analysis will utilize the HCM 2000 methodology. Two measures of pedestrian level of service are available, space (ft^2) per pedestrian and flow rate per unit width. The parameters associated with pedestrian level-of-service are shown in Table 3.

Table 3: Pedestrian Level-of-Service Criteria

Level of Service	Space (ft^2/p)	Flow Rate (p/min/ft)
A	>530	≤0.5
B	>530 to 90	>0.5 to 3
C	>40 to 90	>3 to 6
D	>23 to 40	>6 to 11
E	>11 to 23	>11 to 18
F	≤11	>18

Note: These LOS criteria apply to sidewalks and walkways and are platoon-adjusted. Source: Transportation Research Board. Highway Capacity Manual 2000. Exhibit 18-4.

2.6 Roadway Segment Capacity Estimates

For short-term lane and roadway closures and detours (overnight or weekend), a generalized lane capacity of 1,500 vph per lane was used for freeway mainline lanes, 750 vph per lane was used for arterial facilities and 600 vph per lane for local streets.

These figures approximate the Level of Service (LOS) E capacity of facilities affected by temporary construction activity. Delays of several signal cycles might be encountered under these conditions.

3.0 CORRIDOR DESIGN REFINEMENT

Contract L200 includes the design of permanent traffic features in the vicinity of the light rail stations at NE 145th Street and NE 185th Street. Synchro output reports for design refinement analysis are included in Appendix D.

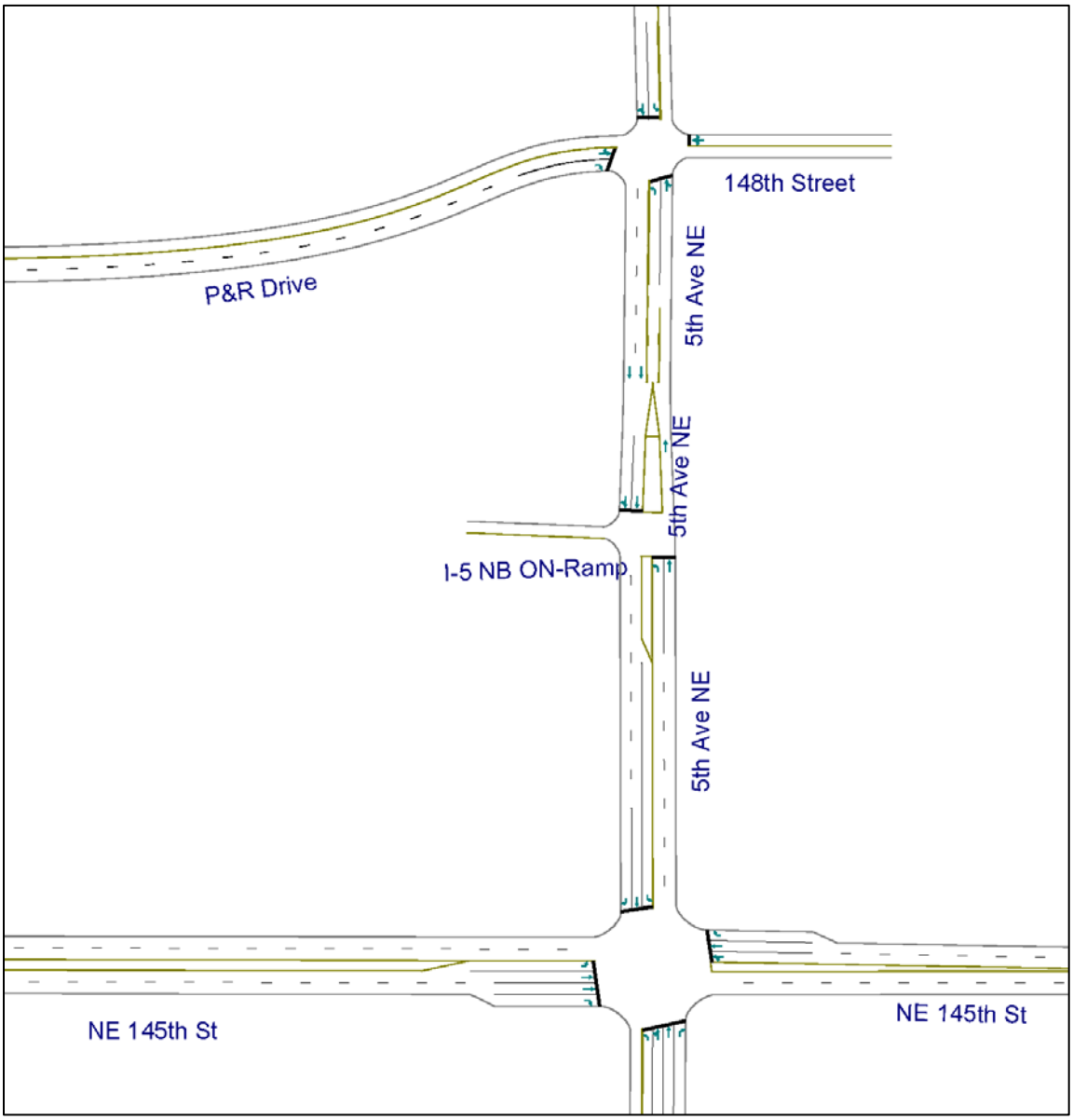
3.1 NE 145th Street Station Design Refinement

Contract L200 will construct a light rail station and bus transit center with a 500-stall parking garage on the east side of I-5, north of NE 145th Street, with a driveway at NE 148th Street, see Figure 2.

Figure 2: NE 145th Street Station Layout

5th Avenue NE will be modified to accommodate transit, pedestrian, bicycle, and general purpose traffic access to the station area and the garage. See Figure 3 for the proposed channelization of 5th Avenue NE; the shared-use path on the west side of 5th Avenue NE is not shown in this figure.

Figure 3: Proposed 5th Avenue NE Configuration



The configuration of the intersections along 5th Avenue NE includes a single station access connection to 5th Avenue NE at NE 148th Street. The west leg of NE 148th Street will be realigned to the north in order to create a four-leg intersection with the east leg of NE 148th Street, eliminating the existing offset-T intersection. This intersection will be signalized.

The on-ramp to northbound I-5 from 5th Avenue NE will be signalized and will not need to be relocated with the final design light rail station configuration, as it was in the preliminary engineering (PE) design configuration and evaluated in the project FEIS.

Intersection delay and LOS values for the 2035 AM and PM peak hours are shown in Table 4. The three intersections included in this analysis are: NE 145th Street / 5th Avenue NE, I-5 northbound on-ramp / 5th Avenue NE, and NE 148th Street / 5th Avenue NE.

Table 4: NE 145th Street Station Intersection Analysis

Intersection	2035 AM Peak Hour Intersection Delay (sec/veh) / Level of Service (LOS)	2035 PM Peak Hour Intersection Delay (sec/veh) / Level of Service (LOS)
NE 145th Street / 5th Avenue NE	56 / E	69 / E
NB I-5 On-Ramp / 5th Avenue NE	9 / A	10 / A
NE 148th Street / 5th Avenue NE	21 / C	28 / C

The configuration of the NE 145th Street / 5th Avenue NE intersection is the same as was analyzed in the PE design; this intersection retains its existing channelization with the addition of a westbound right-turn lane. This intersection would operate at LOS E in the AM and PM peak hours.

The northbound I-5 on-ramp intersection on 5th Avenue NE would operate at LOS A in the AM and PM peak hours. This intersection would operate as a through-T with traffic signal, with northbound through traffic only stopping for the east-west pedestrian crossing.

Traffic operations along 5th Avenue NE at the northbound I-5 on-ramp intersection would benefit from signalization. With the existing unsignalized traffic control, queues of northbound left-turning vehicles would extend up to 800 feet and would spill back through the NE 145th Street intersection. With traffic signal control, northbound queue lengths of 210 feet or less would not interfere with traffic operation on NE 145th Street, as documented for 2035 Baseline and Build Option 2 conditions in the project's SR 523 (NE 145th Street) Interchange Justification Report.

The west leg of the NE 148th Street / 5th Avenue NE intersection becomes the station driveway in the final design configuration and a traffic signal is added at this intersection. This intersection would operate at LOS C in the final design configuration.

3.1.1 NE 145th Street Station Area Traffic Signal Warrant Analysis

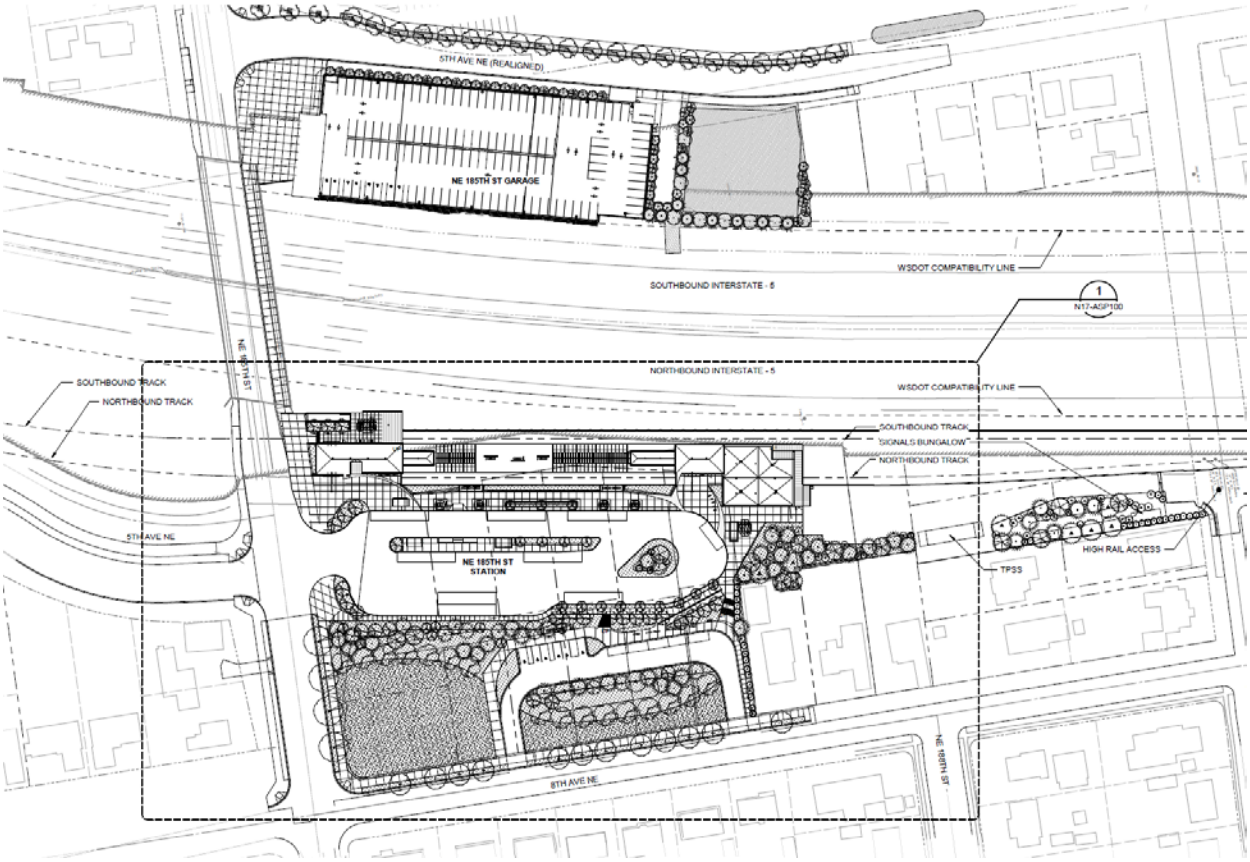
Traffic signal warrant analysis for the northbound I-5 on-ramp intersection was completed as Appendix E in the project WSDOT Design Approval (April 2016). Warrant 1, the 8-hour vehicle volume warrant is met for this location.

Signal warrant analysis for the intersection of NE 148th Street and 5th Avenue NE is included in Appendix B of this report. Warrant 3, the peak hour vehicle warrant is met for this location.

3.2 NE 185th Street Station Design Refinement

Contract L200 will construct a light rail and bus transit center at NE 185th Street on the east side of I-5, and a 500-stall parking garage on the west side of I-5. NE 185th Street will be modified to enhance transit, pedestrian, bicycle, and general purpose traffic access to the station area and the garage.

Figure 4: NE 185th Street Station Layout



3.2.1 NE 185th Street Cross-Section

The existing bridge structure carrying NE 185th Street over I-5 provides the following cross-section:

- Two 6-foot-wide sidewalks (one each side)
- 46-foot-wide roadway (currently allocated for one bike and one traffic lane in each direction and a parking area on the south side for eastbound motorists)
- 58 feet total width

The recommended cross-section for NE 185th Street at the I-5 crossing retains the existing bridge structure and provides a 12-foot-wide walkway with one buffer-protected bike and one traffic lane in each direction and a median separating the two directions of traffic. The proposed cross-section would consist of the following elements:

- A 12-foot-wide walkway on the north side of the bridge, created by removing the existing 6-foot-wide sidewalk and bridge rail, and relocating the bridge rail on the south side of the resulting walkway.
- The existing 6-foot-wide walkway would remain in place on the south side of the bridge.
- One 5-foot-wide bike lane in each direction with a 2-foot-wide painted buffer.
- One 11-foot-wide traffic lane in each direction.

East of the bridge, the roadway would widen from 40 feet on the bridge to 43 feet at the intersection, to provide a minimum 11-foot-wide eastbound left turn lane for buses entering the transit center. The eastbound left turn lane should be at least 60-feet in length to provide space for one bus.

3.2.2 NE 185th Street Pedestrian Walkway Recommended Cross-Section

Pedestrian level of service analysis in the station area was prepared during preliminary engineering. A design year (2035) PM peak hour forecast of 290 pedestrians would use the walkway on the north side of NE 185th Street between the light rail station and the park-and-ride garage.

This volume of pedestrians produces LOS C with a 12-foot-wide walkway and LOS D with a 10-foot or 8-foot-wide walkway.

Given the directional split in the PM peak hour pedestrian volume forecast (1/3 traveling towards the station and 2/3 traveling towards the park-and-ride garage), LOS C would be desirable to provide room for people to comfortably pass by one another.

A 12-foot-wide walkway is recommended to be provided on the north side of the existing NE 185th Street bridge.

The existing 6-foot-wide walkway is recommended to be provided on the south side of the bridge.

The pedestrian analysis performed during preliminary engineering did not consider the walkway on the south side of the NE 185th Street bridge. Pedestrian activity was shown to concentrate on the north side of NE 185th Street between the park-and-ride garage and the station. The analysis showed 12 pedestrians approaching the station on NE 185th Street, west of 5th Avenue NE, and 36 pedestrians leaving the station traveling west of 5th Avenue NE along NE 185th Street for a total of 48 pedestrians in the PM peak hour, resulting in LOS A on the 5-foot-wide walkway west of 5th Avenue NE.

All of the pedestrians traveling to and from the station on NE 185th Street west of 5th Avenue NE could be accommodated on the 6-foot-wide walkway on the south side of the bridge, though most or all are likely to use the walkway on the north side as shown in the preliminary engineering analysis.

3.2.3 NE 185th Street / 5th Avenue NE (West of I-5) Intersection Control

The 5th Avenue NE intersection adjacent to the proposed park-and-ride garage was shown in the PE design as unsignalized (same as existing condition), and would benefit from signalization. Use of the center two-way turn lane by southbound left-turning vehicles accounts for the difference between LOS D and LOS F.

A traffic signal at this location would eliminate the need for a continuous two-way left turn lane on the 185th Street bridge. The primary use of this lane is to allow southbound to eastbound left turns to complete a two-step turn with stop control. A signal would also facilitate provisions for transit priority treatment for buses utilizing 5th Avenue NE, and would provide signalized protection for the pedestrian cross walks. Table 5 shows that with signal control this intersection would operate at LOS B in the 2035 PM peak hour.

Table 5: NE 185th Street / 5th Avenue NE (West of I-5) Intersection Analysis

Intersection	2035 PM Peak Hour Intersection Delay (sec/veh) / Level of Service (LOS)
NE 185th Street / 5th Avenue NE	13 / B

Note: Signalized intersection control

3.2.4 NE 185th Street / 5th Avenue NE (East of I-5) Intersection Control

A traffic signal will be constructed at this intersection. Table 6 shows that this intersection would operate at LOS D in the 2035 PM peak hour with signal control. Signal phasing analyzed at this intersection include east/west protected-permissive left-turns and north/south split-phase to minimize conflicts between pedestrians and transit vehicles.

Table 6: NE 185th Street / 5th Avenue NE (East of I-5) Intersection Analysis

Intersection	2035 PM Peak Hour Intersection Delay (sec/veh) / Level of Service (LOS)
NE 185th Street / 5th Avenue NE	38 / D

Note: Signalized intersection control

The north and south legs of this intersection would desirably be aligned. Transit center site space constraints and transit bus program requirements combined with bus maneuvering characteristics preclude aligning the two intersection approaches while also providing for a shared-use path on the west side of 5th Avenue south of I-5. As a result, split phasing of the traffic signal will be required. The width of the transit center driveway throat on the north leg should be minimized to the extent feasible to reduce the crosswalk length while accommodating bus maneuvers in and out of the transit center area.

A bike box could be provided to facilitate bicycle access into the 185th Street Station plaza from the eastbound bike lane on NE 185th Street at the intersection with 5th Avenue NE east of I-5. This would encourage cyclists to stay in the bike lanes, reducing the potential for conflicts between faster-moving cyclists and pedestrians on the walkways across I-5.

A roundabout at the NE 185th Street / 5th Avenue NE intersection east of I-5 was studied and would operate at a similar level of service as a signalized intersection. A roundabout would not require provisions for left-turn pockets on NE 185th Street. It would, however, require all transit buses entering or leaving the transit center to negotiate the roundabout, and buses exiting the transit center would have to wait for a gap in westbound and northbound to westbound traffic to exit.

A roundabout would have a larger footprint than a signalized intersection and would likely reduce the space available for the bus loop at the transit center.

A residential property driveway on the east leg of the intersection would fall within the roundabout exit lane, complicating the design of pedestrian and bicycle provisions on the east leg of the roundabout.

For these reasons, a roundabout configuration is not recommended at the intersection of NE 185th Street and 5th Avenue NE east of I-5.

3.2.5 NE 185th Street / 8th Avenue NE Intersection Control

8th Avenue NE will provide access to the station pick-up/drop-off area and ADA parking spaces. The NE 185th Street / 8th Avenue NE intersection is currently unsignalized with two-way stop control. This intersection control will be retained by the Lynnwood Link Extension project. The three-lane cross section on NE 185th Street should extend through 8th Avenue NE, with stop control on the north and south legs of 8th Avenue NE. Table 7 shows that this intersection would operate at LOS C in the 2035 PM peak hour.

Table 7: NE 185th Street / 8th Avenue NE Intersection Analysis

Intersection	2035 PM Peak Hour Intersection Delay (sec/veh) / Level of Service (LOS)
NE 185th Street / 8th Avenue NE	24 / C

Note: Unsignalized intersection control – 185th does not stop

3.2.6 NE 185th Street Station Area Traffic Signal Warrant Analysis

Traffic signal warrant analysis for the NE 185th Street / 5th Avenue NE west of I-5 intersection is included in Appendix B of this report. Warrant 3, the peak hour vehicle volume warrant is met for this location.

Signal warrant analysis for the intersection of NE 185th Street and 5th Avenue NE east of I-5 is included in Appendix B of this report. Warrant 3, the peak hour vehicle warrant is met for this location.

3.3 Sight Distance Calculations

Vertical sight distance calculations have been prepared for locations where the LRT guideway crosses over streets in the vicinity of traffic control signals.

Exhibits showing sight lines to traffic signal heads are included in Appendix C.

There are no vertical sight distance issues at the following intersections:

- 1st Avenue NE / I-5 northbound ramps (Exhibits SD-14 and SD-15)
- 1st Avenue NE / NE Northgate Way (26-ft vertical clearance is provided to the bottom of the guideway, which is equivalent to the maximum allowable traffic signal height)
- 5th Avenue NE / NE 130th Street
- 5th Avenue NE / NE 145th Street

The LRT guideway alignment proximity to existing traffic signals results in vertical sight distance issues at the following intersections:

- NE 155th Street / Fire Station signal. Exhibit SD-19 shows limited vertical clearance in the eastbound direction. An existing supplemental signal head addresses a similar sight distance limitation under the I-5 bridge. This supplemental signal head will also address sight distance limitations produced by the LRT guideway.
- NE 175th Street / I-5 northbound ramps. Exhibits SD-18 and SD-21 show the westbound and eastbound vertical sight distances, respectively. The LRT guideway would provide 16.5-feet of vertical clearance at this intersection. Supplemental signal heads will be incorporated into the L200 design to meet traffic signal sight distance requirements in the westbound and eastbound directions.

3.4 ROD Mitigation

Two mitigation items in Contract L200 were included in the project ROD issued by the Federal Transit Administration in July 2015.

N 185th Street / Meridian Avenue N – add protected/permissive phasing to the northbound and southbound left-turns. See Tables 9-1 and 9-2 in the Transportation Technical Report.

NE 185th Street / 2nd Avenue NE – add a two-way left-turn lane or refuge area on NE 185th Street. See Table 9-1 in the Transportation Technical Report.

The ROD Mitigation Plan states that Sound Transit will provide these improvements or other improvements as agreed to by the local jurisdiction. Sound Transit could also contribute to a local jurisdiction's project to improve intersection performance, as agreed to with local jurisdictions.

These ROD mitigation items are being evaluated along with other City of Shoreline projects in the *City of Shoreline Station Area Access Assessment Report*. Sound Transit cost responsibility for these improvements is limited to a proportional share of those resulting directly from implementation of the light rail project.

The number of project trips using the N 185th Street / Meridian Avenue N intersection is 155 vehicles in the AM and PM peak hours, which is 7-8 percent of the total entering volume. The number of project trips using the NE 185th Street / 2nd Avenue NE intersection is 215 vehicles in the PM peak hour, which is 19-percent of the total entering volume.

Sound Transit and the City of Shoreline will agree upon Sound Transit's contribution to these two City projects.

4.0 MAINTENANCE OF TRAFFIC DURING CONSTRUCTION

Traffic analysis for maintenance of traffic during construction consists primarily of short-term and long-term lane closures on the affected routes. Detour routes will be provided to maintain circulation and local access related to full-closures of streets. The lane and street closures described in this report would be available to the L200 contractor with permit approval by the cities of Seattle and Shoreline and WSDOT.

Street closures will be publicized in the print and electronic media to notify motorists, cyclists, and pedestrians of the closure hours and alternate routes. These measures will be augmented with changeable message signing along routes affected by the closures. Local access to businesses and residences will be preserved during the street closures.

Short-term lane closures would affect individual lanes on roadways adjacent to the LRT alignment during off-peak hours. They could occur during the midday or overnight hours, or over a weekend or other period when traffic volumes may be suppressed. Local access to businesses and residences would be maintained. Impacts to pedestrian and transit travel would also be minimized through the determination of closure hours and the use of signed detours. The contractor will also provide pedestrian detours or clearly delineated facilities within construction areas, such as protected walkways, and will notify the public as appropriate.

Long-term lane and street closures would affect facilities for durations longer than a weekend. Local access to businesses and residences would be maintained. Potential impacts to pedestrian and transit travel will be identified in this report along with potential strategies to mitigate those impacts.

This section of the report covers long-term and short-term closures separately. Closure locations are organized geographically from south to north. A brief description of work activities is included along with the extent of lane/street closures and traffic analysis of closure hours and/or detour routes.

Synchro output reports for Maintenance of Traffic analysis are included in Appendix E.

4.1 Potential Long-Term Street Closures

Potential long-term single-lane or street closure locations are listed geographically from south to north.

4.1.1 1st Avenue NE (NE 112th Street to NE 116th Street)

This closure would be necessary for the reconstruction of 1st Avenue NE, guideway construction adjacent to 1st Avenue NE and reconstruction of the shared-use path. Separate short-term closures would be needed when guideway construction passes above 1st Avenue NE, north of NE 112th Street.

Construction activities may require a single lane closure of 1st Avenue NE, or a full closure. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.1.2 NE 115th Street, west of 3rd Avenue NE

This closure would be necessary to construct a cul-de-sac on NE 115th Street, west of 3rd Avenue NE adjacent to the LRT guideway. Local access would be maintained during construction. This local street currently does not extend west to 1st Avenue NE, so no travel patterns would be changed during construction.

Continuity of the non-motorized vehicle path between 1st Avenue NE and 3rd Avenue NE would be maintained during construction.

The extent of the closure will be defined in advance of the 90-percent submittal.

4.1.3 NE 116th Street, west of 3rd Avenue NE

This closure would be necessary to construct a cul-de-sac on NE 116th Street, west of 3rd Avenue NE adjacent to the LRT guideway. Local access would be maintained during construction. This local street currently does not extend west to 1st Avenue NE, so no travel patterns would be changed during construction.

Continuity of the non-motorized vehicle path between 1st Avenue NE and 3rd Avenue NE would be maintained during construction.

The extent of the closure will be defined in advance of the 90-percent submittal.

4.1.4 3rd Avenue NE, north of NE 117th Street

This closure would be necessary to reconstruct 3rd Avenue NE, north of NE 117th Street, where 3rd Avenue NE terminates at the Latvian Community Center driveway. Local access would be maintained during construction. This local street currently does not extend north to NE 120th Street, so no travel patterns would be changed during construction.

The extent of the closure will be defined in advance of the 90-percent submittal.

4.1.5 NE 120th Street, west of 5th Avenue NE

This closure would be necessary to construct a cul-de-sac on NE 120th Street, west of 5th Avenue NE adjacent to the LRT guideway. Local access would be maintained during construction. This local street currently does not extend west of 5th Avenue NE, so no travel patterns would be changed during construction.

The extent of the closure will be defined in advance of the 90-percent submittal.

4.1.6 NE 123rd Street, west of 5th Avenue NE

This closure would be necessary to construct a cul-de-sac on NE 123rd Street, west of 5th Avenue NE adjacent to the LRT guideway. Local access would be maintained during construction. This local street currently does not extend west of 5th Avenue NE, so no travel patterns would be changed during construction.

The extent of the closure will be defined in advance of the 90-percent submittal.

4.1.7 5th Avenue NE (NE 125th Street to NE 145th Street)

This full closure of 5th Avenue NE would be necessary for construction of the elevated guideway between I-5 and 5th Avenue NE. The difference in elevation and steep grades between I-5 and 5th Avenue NE do not easily allow for construction activities to be conducted from the I-5 right-of-way.

Local access would be maintained on 5th Avenue NE between NE 125th Street and NE 133rd Street. The northbound I-5 off-ramps at NE 130th Street and NE 145th Street would also remain open during construction. Short-term closures of these ramps will be necessary, and will be coordinated to minimize travel disruptions.

The South Jackson Park Park-and-Ride would also be closed during construction. 5th Avenue NE does not provide access to any adjacent properties between the park-and-ride lot at approximately NE 135th Street and NE 145th Street.

The Jackson Park Trail along the east side of 5th Avenue NE could remain open during construction to minimize pedestrian and bicycle detours.

Peak hour and 24-hour traffic counts were collected on 5th Avenue NE and potential detour routes (15th Avenue NE, 1st Avenue NE, Roosevelt Way NE and NE 145th Street) in November 2016 to determine the feasibility of this long-term full closure of 5th Avenue NE.

The highest weekday volumes on 5th Avenue NE between 130th Street NE and 145th Street NE are 500 vph in the northbound direction (PM peak) and 300 vph in the southbound direction (AM peak).

Weekend volumes do not exceed 350 vph in either direction.

15th Avenue NE and 1st Avenue NE would be able to accommodate motorists detouring from 5th Avenue.

Figure 5 through Figure 7 show average midweek (Tuesday through Thursday) hourly volume forecasts for the 2020 construction year on 15th Avenue NE, NE 145th Street and Roosevelt Way NE, respectively. Hourly volume forecasts for 5th Avenue NE are added to the volume of each street to determine if these streets can provide a detour route during the proposed closure of 5th Avenue NE.

Figure 8 through Figure 10 show weekend (Friday evening through Monday morning) hourly volume forecasts for the 2020 construction year on 15th Avenue NE, NE 145th Street and Roosevelt Way NE, respectively.

A 1,500 vph threshold line is also shown on these figures to represent the available vehicle capacity on these arterial streets where two travel lanes are available in each direction.

Figure 5 and Figure 8 show that 15th Avenue NE can accommodate detour traffic from 5th Avenue NE.

Figure 6 and Figure 9 indicate that NE 145th Street operates near capacity in the midweek and weekend peak periods, due to the volume plateaus at 1,000 vph and 1,200 vph in the westbound and eastbound directions. The congested signalized intersections on NE 145th Street at 5th Avenue NE and 15th Avenue NE limit the capacity of NE 145th Street. NE 145th Street between 5th Avenue NE and 15th Avenue NE would not likely function as a detour route for all 5th Avenue NE motorized traffic during peak periods.

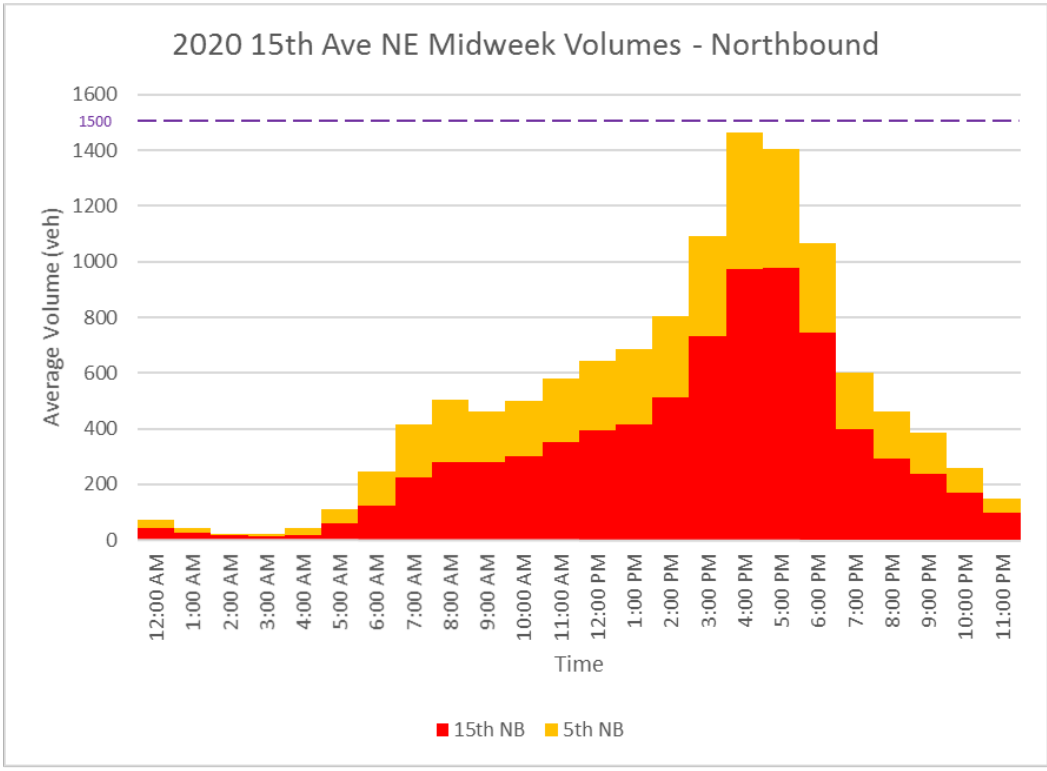
Figure 7 and Figure 10 indicate that Roosevelt Way NE operates near capacity in the midweek and weekend peak periods, due to the volume plateaus at 800 vph in the westbound and eastbound directions. This lower capacity value is due to the single-lane segment of Roosevelt Way NE between 10th Avenue NE and 15th Avenue NE. Roosevelt Way NE would not likely function as a detour route for all 5th Avenue NE motorized traffic during peak periods.

NE 145th Street and Roosevelt Way NE / NE 125th Street currently operate near capacity, and would not be likely to accommodate all of the motorists detouring from 5th Avenue. A public information campaign would be needed to alert motorists to the closure of 5th Avenue and help motorists shift their travel route to 15th Avenue NE or 1st Avenue NE.

Travel patterns suggest that the majority of trips on 5th Avenue connect residences in Shoreline to Northgate or areas further south, so motorists would likely use east-west streets near their origin/destination to access 15th Avenue NE or 1st Avenue NE instead of traveling east-west on NE 145th Street and Roosevelt Way NE / NE 125th Street.

Synchro analysis of a wide-area shift in travel patterns from 5th Avenue NE to 15th Avenue NE is shown in Table 8.

Figure 5: 15th Avenue NE Midweek Volumes



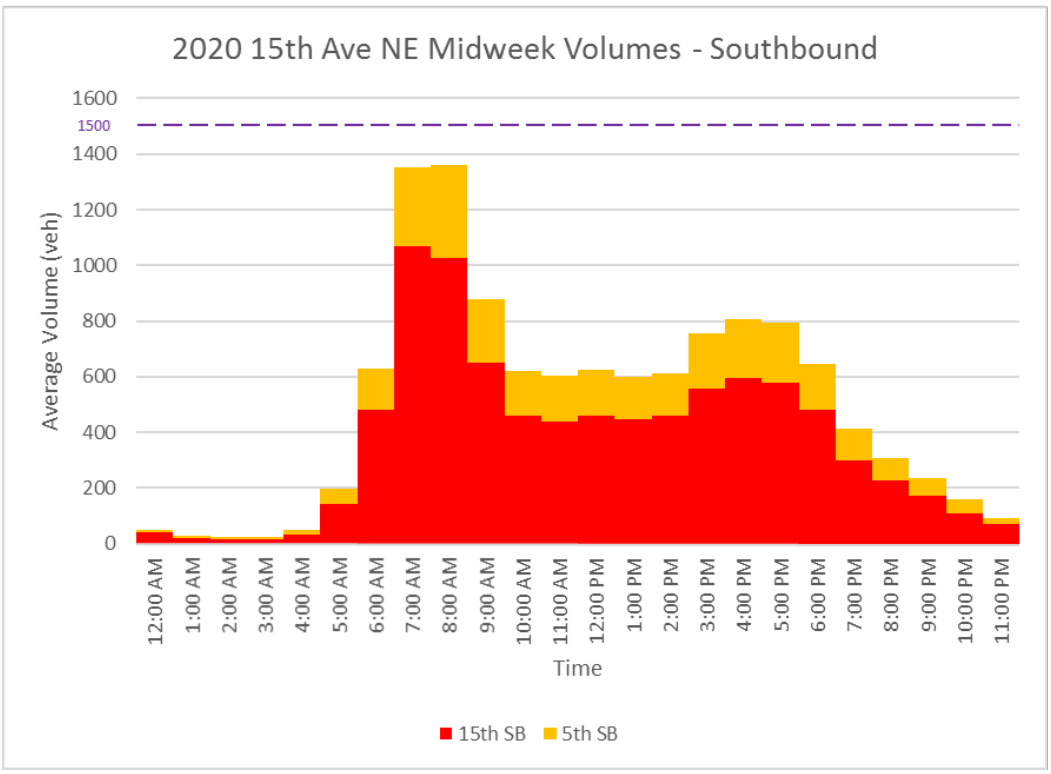
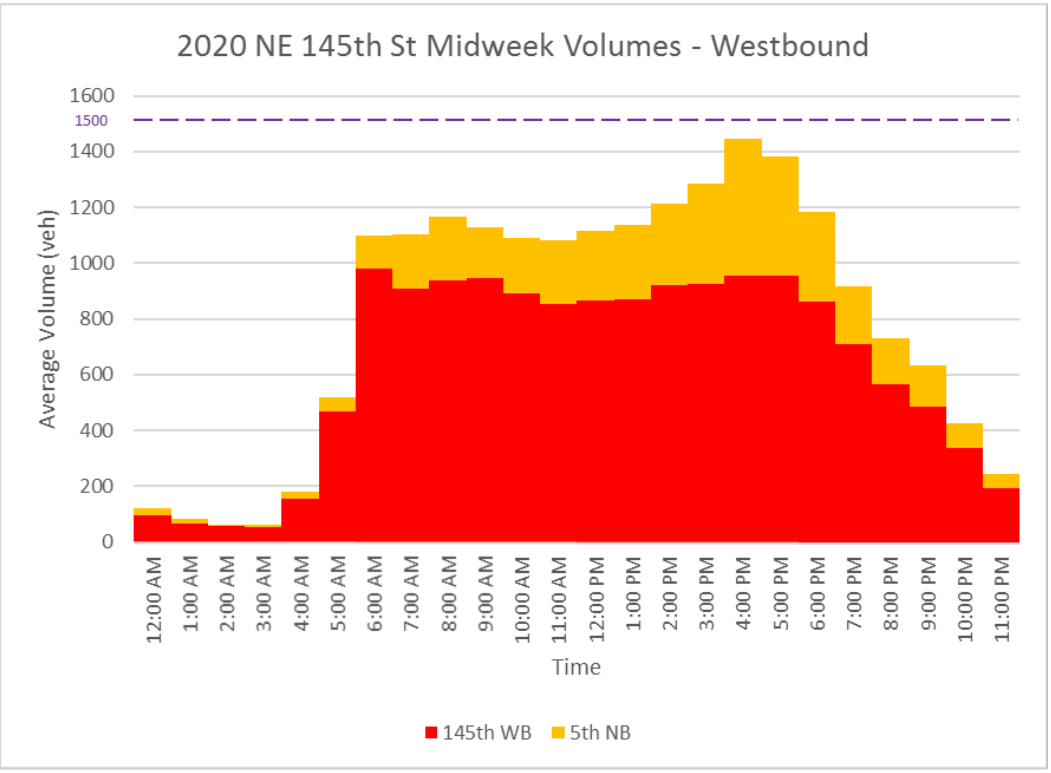


Figure 6: NE 145th Street Midweek Volumes



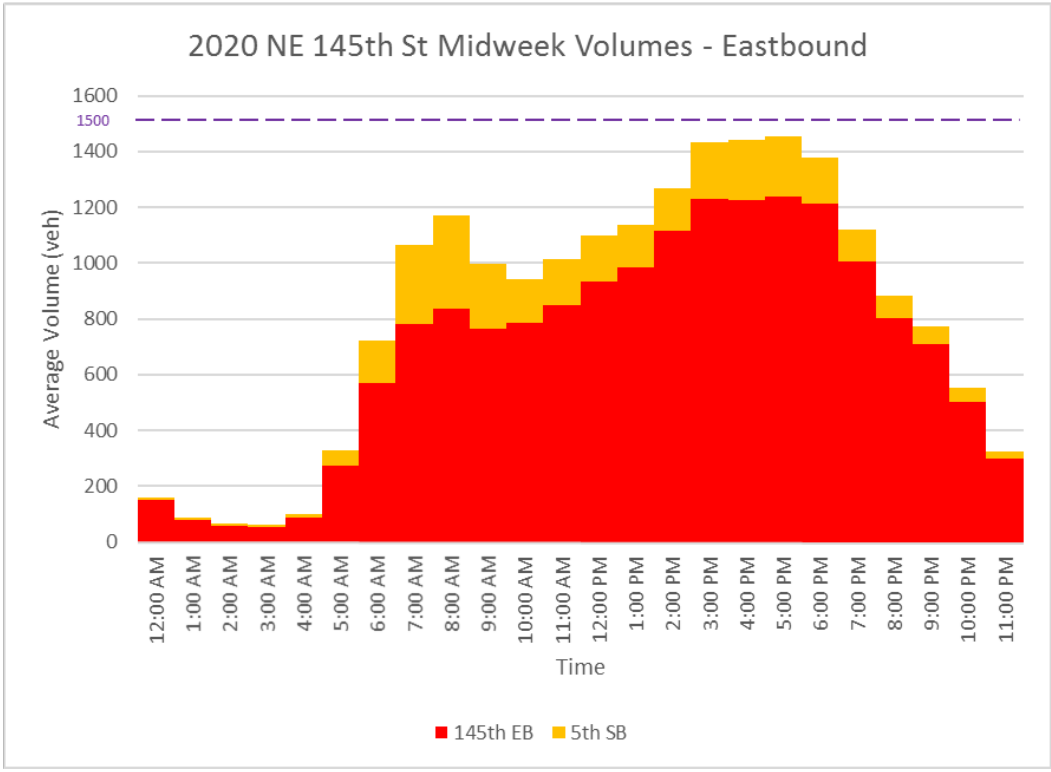
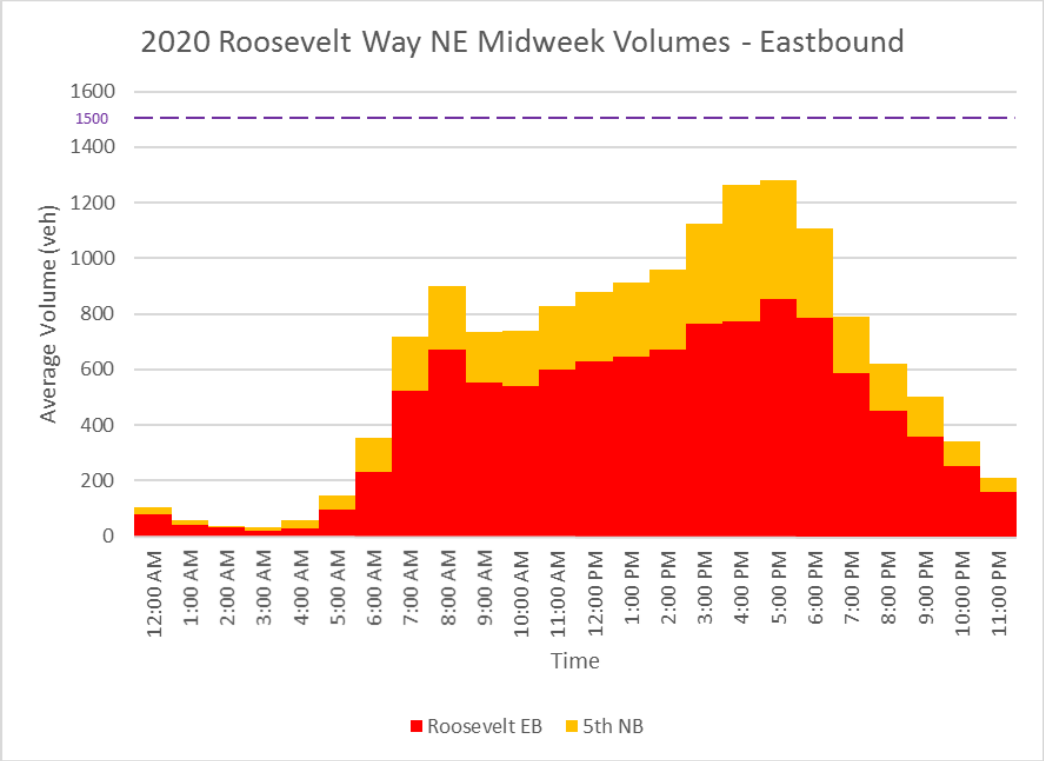


Figure 7: Roosevelt Way NE Midweek Volumes



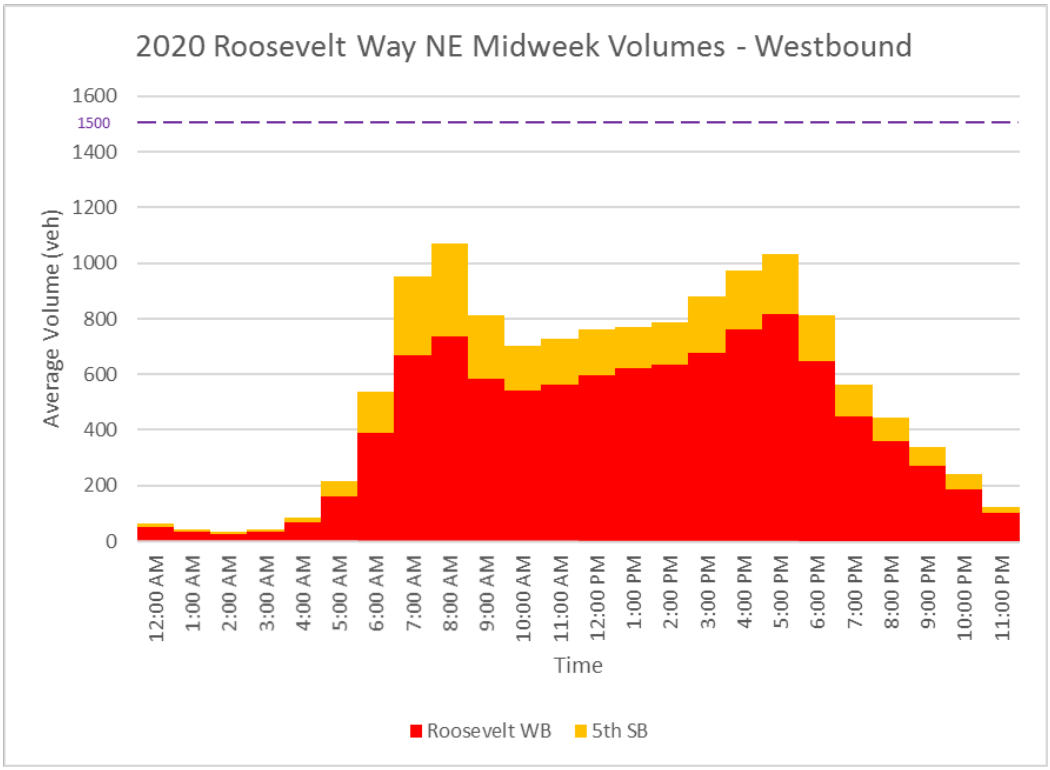
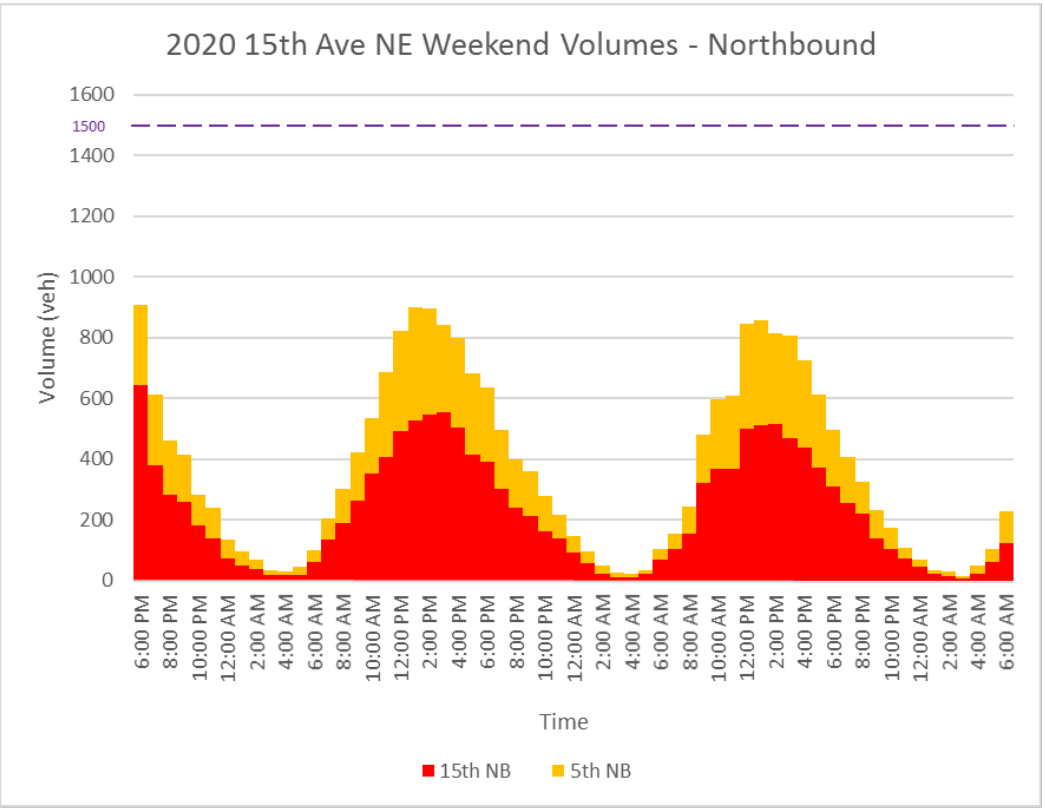


Figure 8: 15th Avenue NE Weekend Volumes



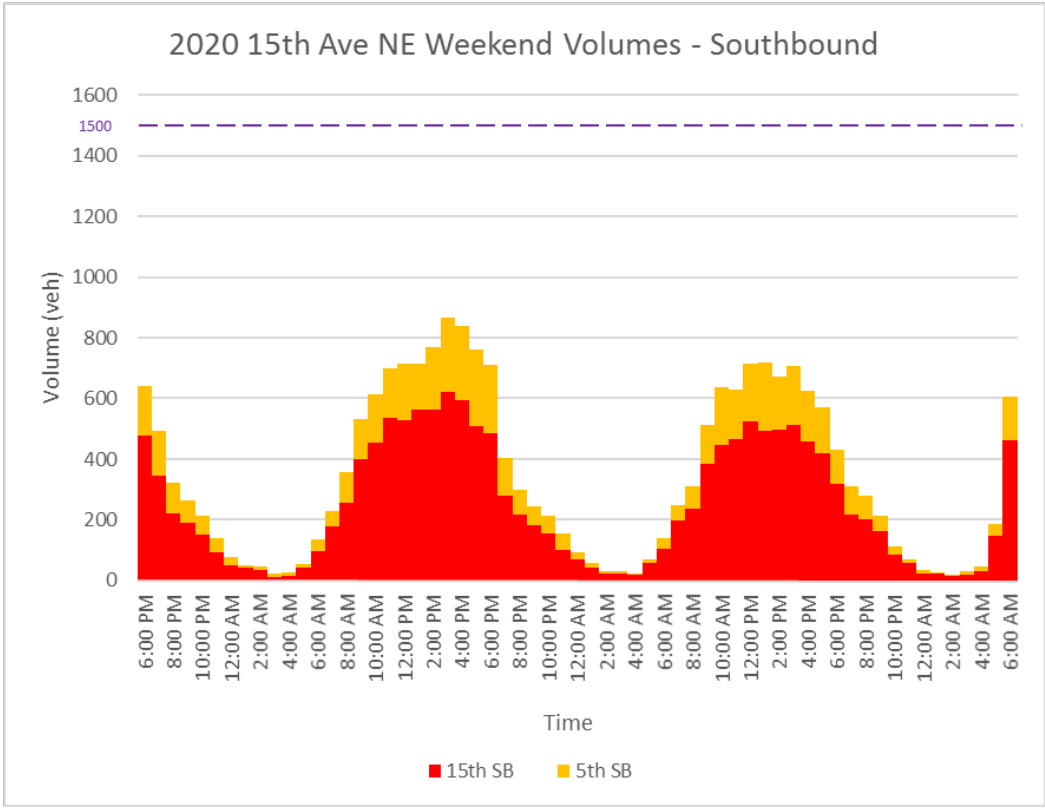
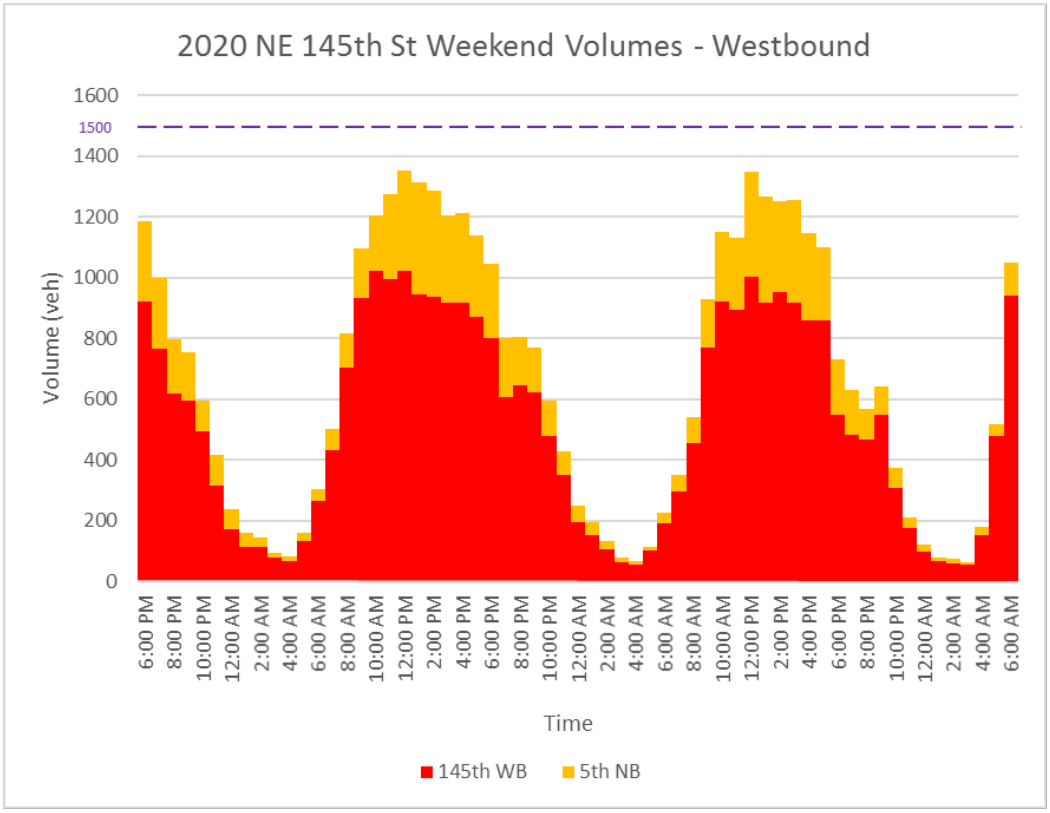


Figure 9: NE 145th Street Weekend Volumes



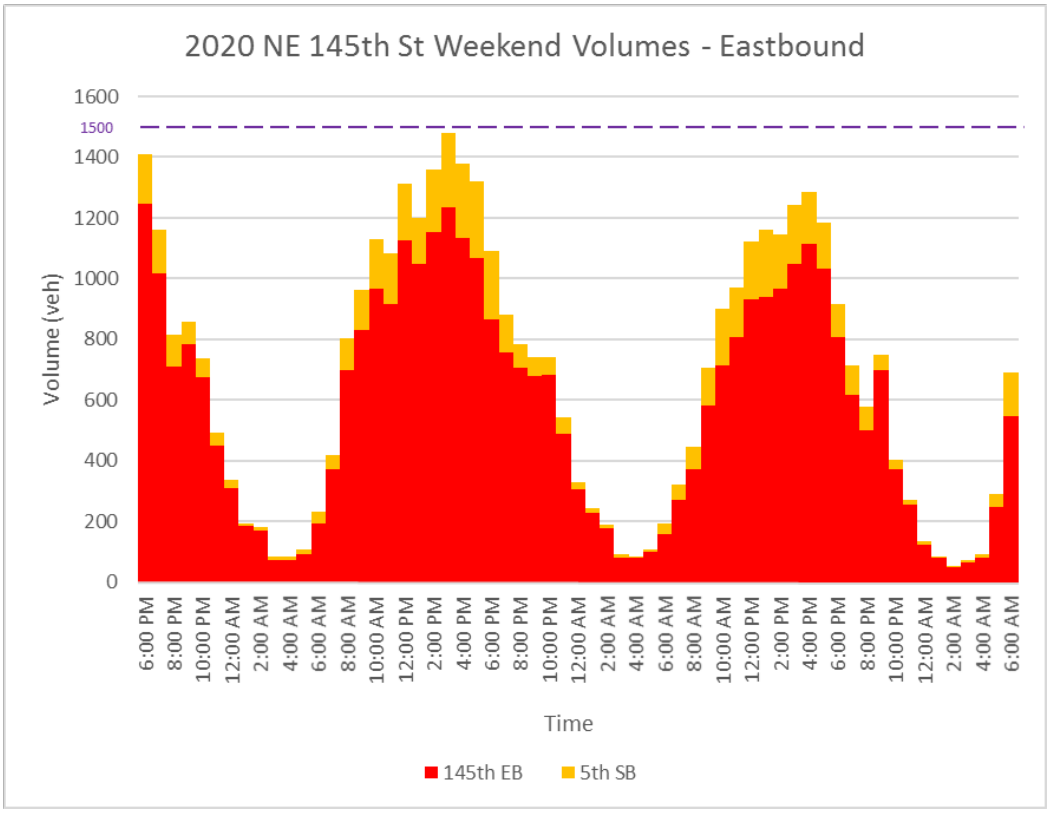
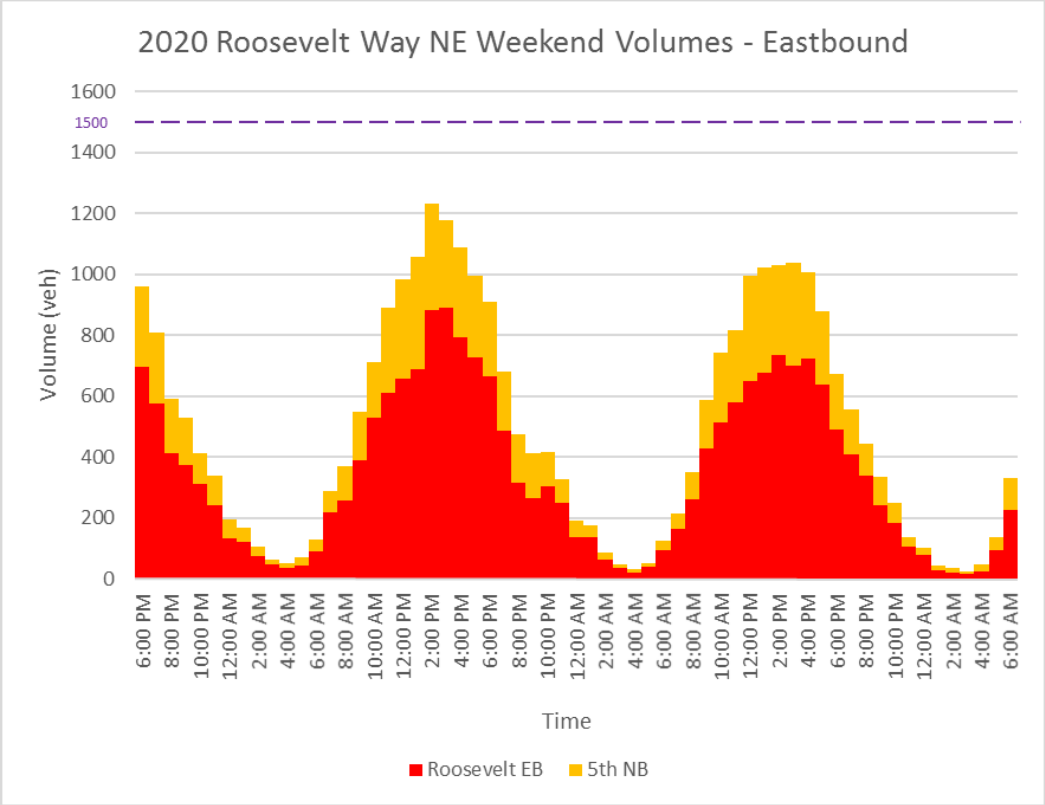
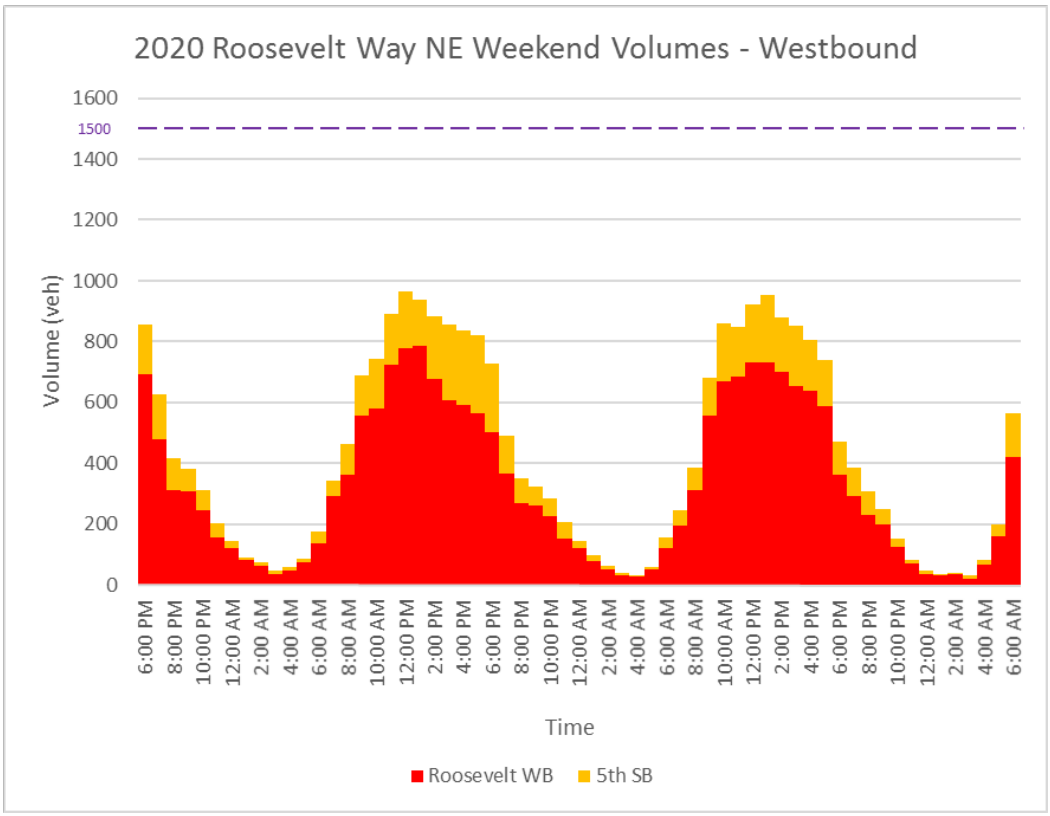


Figure 10: Roosevelt Way NE Weekend Volumes





Intersection operations would be characterized as LOS E or better during construction in the area bounded by 1st Avenue NE, 15th Avenue NE, NE 145th Street and NE 125th Street. Baseline conditions would be characterized as LOS D or better.

Traffic signal timing optimization would likely mitigate the higher traffic volumes on 15th Avenue NE and 1st Avenue NE during the closure of 5th Avenue NE.

Table 8: 5th Avenue NE Closure Traffic Operations during Construction

Intersection	AM Peak Hour Delay / LOS		PM Peak Hour Delay / LOS	
	Baseline	MOT	Baseline	MOT
5th Avenue NE / NE 130th Street	31 / C	28 / C	40 / D	28 / C
5th Avenue NE / NE 145th Street	50 / D	40 / D	48 / D	48 / D
1st Avenue NE / NE 130th Street	30 / C	36 / D	39 / D	47 / D
1st Avenue NE / NE 145th Street	29 / C	33 / C	33 / C	43 / D
15th Avenue NE / NE 125th Street	45 / D	44 / D	48 / D	51 / D
15th Avenue NE / NE 145th Street	40 / D	64 / E	49 / D	69 / E

The intersection of 15th Avenue NE / NE 145th Street would see the most change in operations during the closure of 5th Avenue NE. This intersection would operate at LOS E in the AM and PM peak hours, compared to LOS D with 5th Avenue NE open to vehicle traffic. LOS E would be acceptable during the peak hours.

Traffic signal timing should be optimized for the temporary condition when 5th Avenue NE is closed, and traffic patterns should be monitored during the closure to identify other intersections in need to signal optimization.

4.1.8 5th Avenue NE (NE 145th Street to NE 148th Street)

A series of single-lane or two-lane closures would be necessary for the reconstruction of 5th Avenue NE adjacent to the future NE 145th Street Station and construction of the shared-use path on the west side of 5th Avenue NE. At least one travel lane in each direction would remain open throughout construction.

The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

Pedestrian and bicycle detours will be minimized.

4.1.9 NE 155th Street (east of I-5)

Single-lane closures may be necessary for the construction of guideway abutment walls. Separate short-term closures would be needed when guideway construction passes above NE 155th Street, east of I-5.

The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.1.10 1st Avenue NE (NE 159th Street to NE 161st Street)

This closure would be necessary for the reconstruction of 1st Avenue NE, guideway construction adjacent to 1st Avenue NE and reconstruction of the Ridgecrest Park parking lot.

The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.1.11 I-5 northbound on- and off-ramps at the King County Metro North Base

This closure would be necessary for the reconstruction of the wall on the east side of these ramps. Only one ramp would be closed at a time to maintain transit operations. Transit buses would utilize adjacent interchanges at NE 145th Street and NE 175th Street as detour routes when the ramps are closed.

The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.1.12 NE 165th Street at 1st Avenue NE

This closure would be necessary to construct a hammer-head on NE 165th Street, west of 3rd Avenue NE adjacent to the LRT guideway. Local access would be maintained during construction. This local street currently does not extend west of 3rd Avenue NE, so no travel patterns would be changed during construction.

The extent of the closure will be defined in advance of the 90-percent submittal.

4.1.13 1st Avenue NE (NE 170th Street to NE 174th Street)

This closure would be necessary for the realignment of 1st Avenue NE, and guideway construction adjacent to 1st Avenue NE.

Construction activities may require a single lane closure of 1st Avenue NE, or a full closure. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.1.14 I-5 northbound off-ramp at NE 175th Street

A single-lane closure on this ramp may be necessary to create a work zone for the construction of two drilled shaft guideway columns south of NE 175th Street.

The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent design submittal.

4.1.15 NE 180th Street, west of 5th Avenue NE

This closure would be necessary to construct a hammer-head on NE 180th Street, west of 5th Avenue NE adjacent to the LRT guideway. Local access would be maintained during construction. This local street currently does not extend west of 5th Avenue NE, so no travel patterns would be changed during construction.

The extent of the closure will be defined in advance of the 90-percent submittal.

4.1.16 5th Avenue NE (NE 180th Street to NE 185th Street)

This full-closure would be necessary for the realignment of 5th Avenue NE, and guideway construction between 5th Avenue NE and I-5. Local access would be maintained during construction.

The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.1.17 NE 185th Street (5th Avenue NE west of I-5 to 5th Avenue NE east of I-5)

A series of single-lane or two-lane closures would be necessary for construction of the pedestrian walkway on the bridge over I-5, for construction of the guideway beneath NE 185th Street, and for construction of the Station driveway. At least one travel lane in each direction would remain open throughout construction.

The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

Pedestrian and bicycle detours will be minimized and closures coordinated with work affecting the pedestrian bridge over I-5 at NE 195th Street.

4.1.18 8th Avenue NE, north of NE 185th Street

A series of single-lane closures may be necessary for construction of the Station pick-up/drop-off area west of 8th Avenue NE, north of NE 185th Street. Local access would be maintained during construction.

The extent of closures will be defined in advance of the 90-percent submittal.

4.1.19 5th Avenue NE, north of NE 185th Street

A full-closure or a series of single-lane closures may be necessary for realignment of 5th Avenue NE adjacent to the park-and-ride garage. Local access would be maintained during construction.

The extent of closures will be defined in advance of the 90-percent submittal.

4.2 Potential Short-Term Street Closures

Potential short-term single-lane or street closure locations are listed geographically from south to north.

4.2.1 1st Avenue NE, south of NE Northgate Way

A series of short-term closures may be necessary for construction of the elevated guideway across 1st Avenue NE. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.2.2 I-5 northbound on- and off-ramps, south of NE Northgate Way

A series of short-term closures may be necessary for construction of the elevated guideway across the I-5 northbound on- and off-ramps, south of NE Northgate Way. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.2.3 NE Northgate Way, west of 1st Avenue NE

A series of short-term closures may be necessary for construction of the elevated guideway across NE Northgate Way, west of 1st Avenue NE. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.2.4 I-5 northbound on-ramp at NE Northgate Way

A series of short-term closures may be necessary for construction of the elevated guideway across the I-5 northbound on-ramp at NE Northgate Way. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.2.5 I-5 northbound off-ramp at NE 130th Street

A series of short-term closures may be necessary for construction of the elevated guideway across the I-5 northbound off-ramp at NE 130th Street. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.2.6 NE 130th Street, west of 5th Avenue NE

A series of short-term closures may be necessary for construction of the elevated guideway across NE 130th Street, west of 5th Avenue NE. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.2.7 I-5 northbound off-ramp at NE 145th Street

A series of short-term closures may be necessary for construction of the elevated guideway across the I-5 northbound off-ramp at NE 145th Street. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.2.8 NE 145th Street, west of 5th Avenue NE

A series of short-term closures may be necessary for construction of the elevated guideway across NE 145th Street, west of 5th Avenue NE. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.2.9 I-5 northbound transit-only off-ramp at NE 145th Street

This transit-only ramp and the associated flyer stop will closely permanently early in the construction of the Lynnwood Link Extension project. Prior to the permanent closure, a series of short-term closures may be necessary during early stages of construction of the elevated guideway across the I-5 northbound transit-only off-ramp at NE 145th Street. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.2.10 I-5 northbound on-ramp at NE 145th Street

A series of short-term closures may be necessary for construction of the elevated guideway across the I-5 northbound on-ramp at NE 145th Street. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.2.11 NE 175th Street, east of I-5

A series of short-term closures may be necessary for construction of the elevated guideway across NE 175th Street. The extent of the closure will be defined and appropriate traffic analysis will be completed in advance of the 90-percent submittal.

4.3 Transit Facility Impacts

Two park-and-ride lots will be closed during Contract L200 construction:

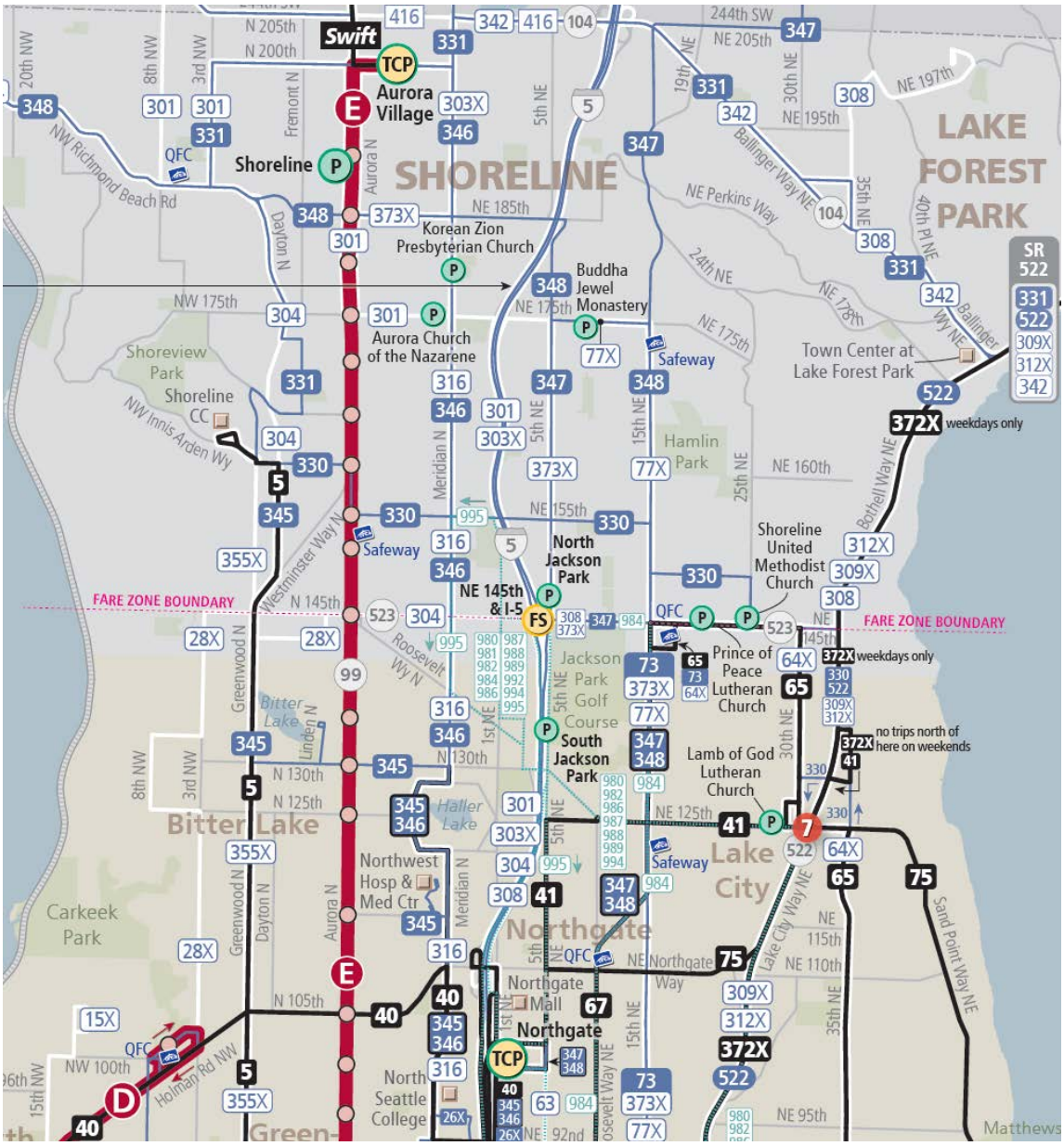
- South Jackson Park Park-and-Ride
- North Jackson Park Park-and-Ride

South Jackson Park Park-and-Ride is a 46-stall facility on the west side of 5th Avenue NE at NE 133rd Street. No transit routes serve this facility, it is used for carpool and vanpool parking. Replacement parking in the South Jackson Park area will be identified in advance of the 90-percent design submittal.

North Jackson Park Park-and-Ride is a 68-stall facility and is served by several King County Metro and Sound Transit bus routes. This park-and-ride lot is located on 5th Avenue NE at NE 147th Street. This facility will be closed to construct the future LRT station at NE 145th Street. Replacement parking in the North Jackson Park area will be identified in advance of the 90-percent design submittal. Lane closures on 5th Avenue NE will be scheduled to minimize impacts to existing bus routes.

Figure 11 shows the existing bus transit routes and park-and-ride facilities in the Contract L200 vicinity. Sound Transit and King County Metro will coordinate to minimize impacts to existing bus transit routes during Contract L200 construction.

Figure 11: Contract L200 Vicinity Transit Routes and Facilities



King County Metro Route 348 would be impacted by closures of 5th Avenue NE and NE 185th Street adjacent to the future LRT station at NE 185th Street.

King County Metro Routes 304 and 308, which are weekday peak direction commute routes connecting Richmond Beach and Lake Forest Park to downtown Seattle would be impacted by the closure of the northbound transit-only loop ramp at 5th Avenue NE, north of NE 145th Street.

Short-term closures of the I-5 northbound off-ramp to 1st Avenue NE in the Northgate area will be scheduled to minimize impacts to transit routes like the King County Metro Route 41 that use this ramp during off-peak hours.

4.4 Haul Routes and Construction Access

The delivery of materials and removal of construction debris will require approved and permitted truck haul routes. For Contract L200, trucks accessing the work sites are anticipated to use I-5 and adjacent arterial routes. Construction access will be primarily from 1st Avenue NE and 5th Avenue NE adjacent to the guideway alignment.

The contractor will be required to submit a Work Sequence Plan, a Contract Interface Plan, and a Truck Haul Route Operation Plan for review and approval prior to the start of construction.

Hours of operation for hauling activities and material deliveries will be included in the Contract L200 Special Conditions.

Construction access points and associated haul routes will be identified in advance of the 90-percent design submittal.

APPENDIX A: EXISTING WEEKDAY TRAFFIC VOLUMES

Existing daily traffic volumes for roadways in the vicinity of Contract L200 are shown below in Table 4-19 from the FEIS *Transportation Technical Report* Section 4.4.1.

Table 4-19. Segment A Existing Roadway Facilities

Roadway	Arterial Classification	Number of Lanes	Speed Limit (mph)	Daily Traffic Volume[a] (vehicles)
I-5	Interstate	6–8	60	171,000–211,000
SR 99	Principal Arterial	4–7	30–50	28,000–34,000
SR 522/Lake City Way NE	Principal Arterial	2–5	30–35	32,000–46,000
SR 523/North 145th Street	Principal Arterial	4	35	21,000–28,000
NE Northgate Way	Principal Arterial	4	30	17,500–31,700
NE 115th Street	Collector Arterial	2	20	1,200
NE 125th Street	Principal Arterial	2–3	30	18,000
North/NE 130th Street	Principal Arterial	4	30	19,900
North/NE 155th Street	Minor Arterial	2	35	7,200–11,800
North/NE 165th Street	Local Primary Street or Collector Arterial	2	25	600–1,900
North/NE 175th Street	Principal Arterial	4	35	18,000–30,800
North/NE 185th Street	Minor Arterial	2–4	35	7,200–17,300
Ashworth Avenue North	Local Primary Street or Collector Arterial	2	25	400–1,800
Meridian Avenue North	Collector Arterial	2	35	3,900–12,100
1st Avenue NE	Principal/Collector Arterial	2–5	25–30	3,000–5,300
5th Avenue NE	Minor Arterial	2–4	30	3,400–19,300
Roosevelt Way North/NE	Principal/Collector Arterial	4	30	18,400
10th Avenue NE	Collector Arterial or Local Primary Street	2	30	1,300–5,000
15th Avenue NE	Principal/Minor Arterial	4	35	14,100–15,700

[a] Year 2011 to 2012 daily traffic volumes are based on the latest available daily traffic count information available, including average annual daily traffic (AADT) volumes from the WSDOT Annual Traffic Report (2011), average annual weekday traffic (AAWT) volumes from 2010 Seattle Traffic Flow Map (2011), average daily traffic (ADT) counts from the Seattle Department of Transportation traffic count database (2011-2012), and average weekday daily traffic (AWDT) volumes from the Shoreline Master Plan (2011).

APPENDIX B: TRAFFIC SIGNAL WARRANT ANALYSIS

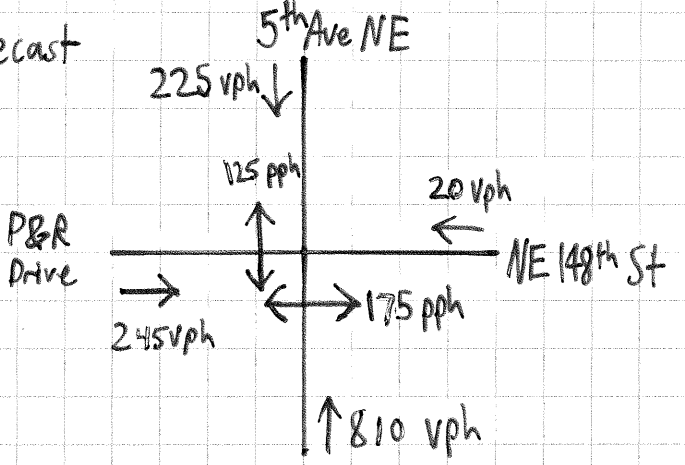
FOR: 5th/148th Signal Warrant	JOB NO: 60512	SHEET NO: 1 of 5
MADE BY: LLJ	CHECKED BY: WJS	BACKCHECKED BY: CJG
DATE: 8/9/2016	DATE: 2/6/2017	DATE: 2/7/2017

HNTB

5th Ave NE / NE 148th St – Peak Hour and Pedestrian Signal Warrants

2035 PM Peak Hour Traffic Forecast

(note: left turn volumes are removed from N/S legs to treat them as 1-lane approaches)

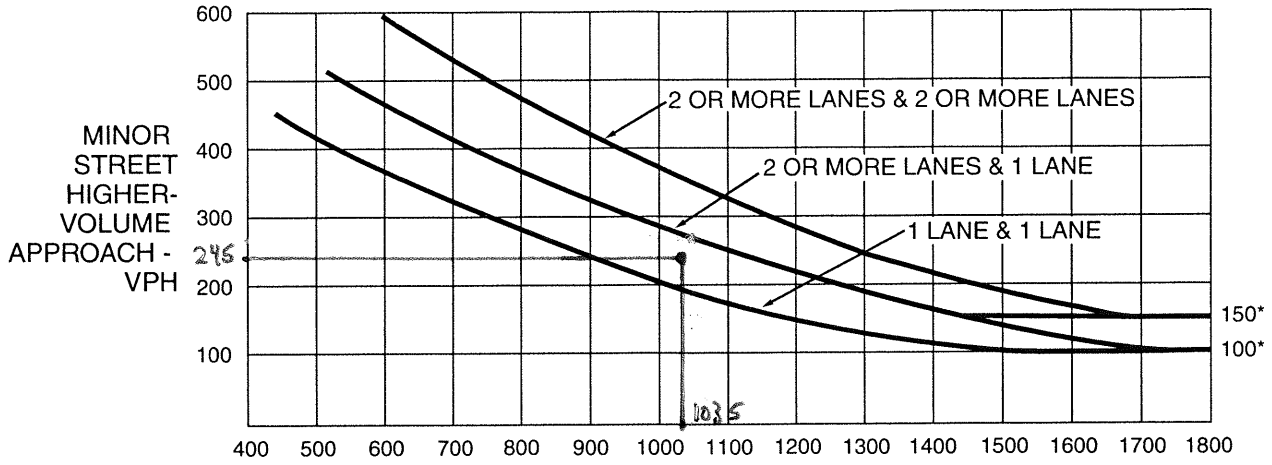


- total approach volume on the minor street leg with the higher volume (W leg) = 245 vph
- total approach volume on the major street, both legs (N/S legs) = 225 + 810 = 1035 vph
- total peds crossing the major street (N/S legs) = 175 pph

Warrant 3 – Condition B: met; the volumes (1035, 245) meet the threshold for roadways with 1-lane approaches on the major and minor streets (MUTCD Fig. 4C-3; note that left turn volumes were removed on the major street to treat N/S legs as 1-lane approaches)

Warrant 4 – Condition B: not met; the total major street volume and pedestrian volume crossing the major street (1035, 175) do not meet the threshold for the peak hour (MUTCD Fig. 4C-7)

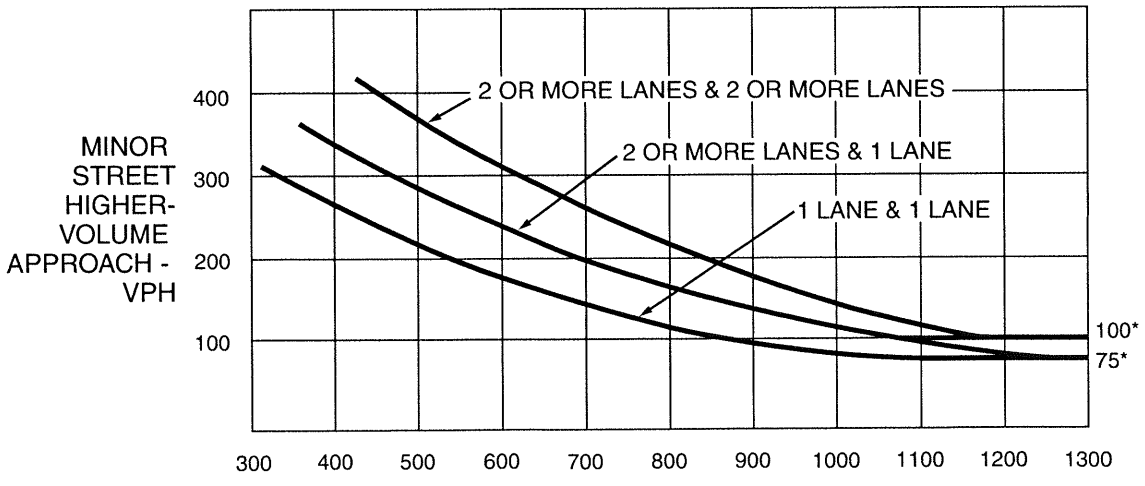
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Option:

08 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

Section 4C.03 Warrant 2, Four-Hour Vehicular Volume

Support:

01 The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.**

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-2 may be used in place of Figure 4C-1.

Section 4C.04 Warrant 3, Peak Hour

Support:

01 The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

Standard:

02 **This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.**

03 **The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:**

A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:

1. **The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach; and**
2. **The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and**
3. **The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.**

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

Option:

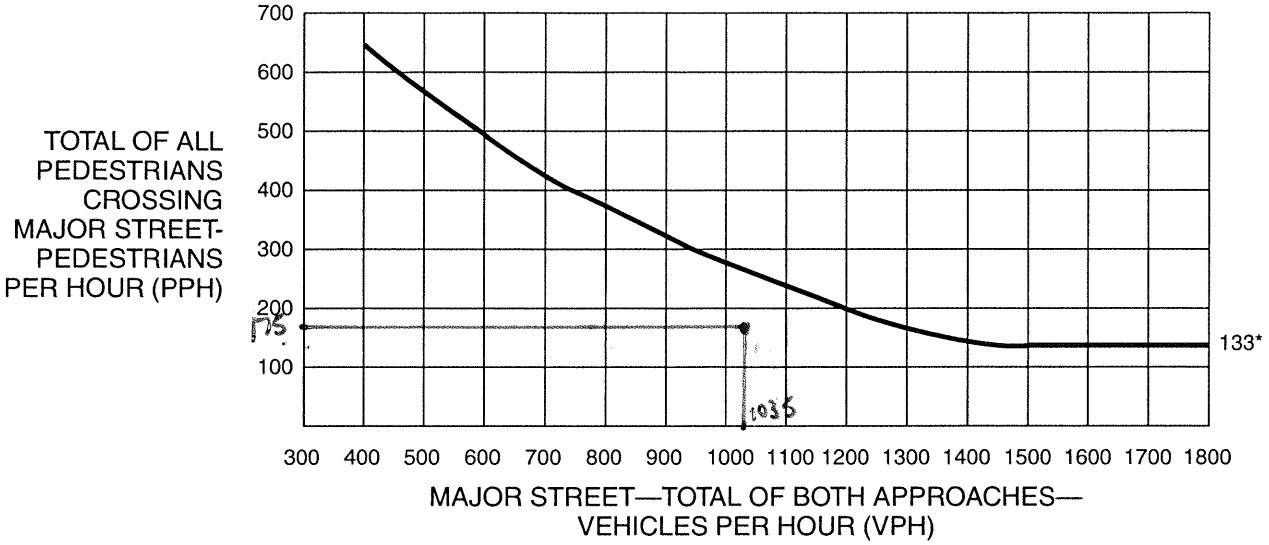
04 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-4 may be used in place of Figure 4C-3 to evaluate the criteria in the second category of the Standard.

05 If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal may be operated in the flashing mode during the hours that the volume criteria of this warrant are not met.

Guidance:

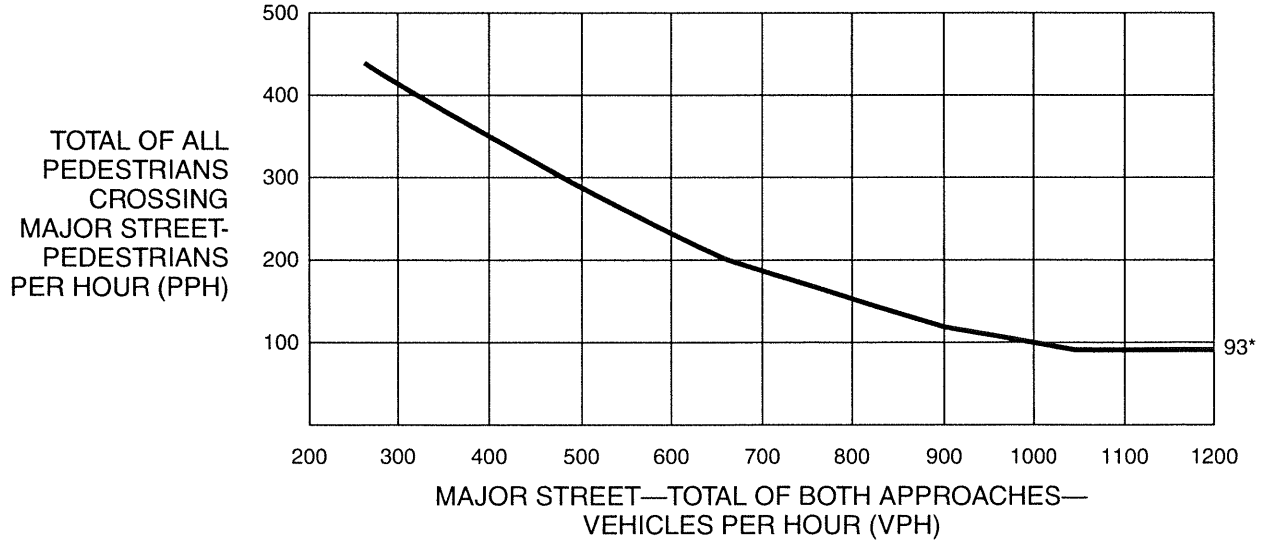
06 *If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal should be traffic-actuated.*

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Section 4C.05 Warrant 4, Pedestrian Volume

Support:

01 The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

Standard:

02 **The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that one of the following criteria is met:**

A. For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or

B. For 1 hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-7.

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 35 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-6 may be used in place of Figure 4C-5 to evaluate Criterion A in Paragraph 2, and Figure 4C-8 may be used in place of Figure 4C-7 to evaluate Criterion B in Paragraph 2.

Standard:

04 **The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal or STOP sign controlling the street that pedestrians desire to cross is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

05 **If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E.**

Guidance:

06 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

A. If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.

B. If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.

C. Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.

Option:

07 The criterion for the pedestrian volume crossing the major street may be reduced as much as 50 percent if the 15th-percentile crossing speed of pedestrians is less than 3.5 feet per second.

08 A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street.

Section 4C.06 Warrant 5, School Crossing

Support:

01 The School Crossing signal warrant is intended for application where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word "schoolchildren" includes elementary through high school students.

Standard:

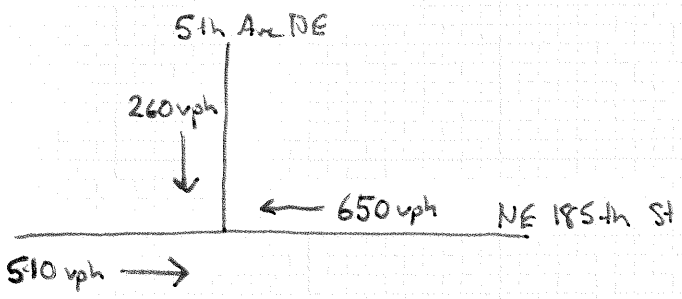
02 **The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period (see Section 7A.03) and there are a minimum of 20 schoolchildren during the highest crossing hour.**

Calculations For 185th / 5th Signal Warrant	Job No. 60512	Sheet No. 1 of 3
Made by CJG	Date 7/15/2016	
Checked by WIJ	Date 2/6/2017	
Backchecked by CJG	Date 2/7/2017	

HNTB

NE 185th Street / 5th Ave NE – Peak Hour Signal Warrant

2035 PM Peak Hour traffic forecast



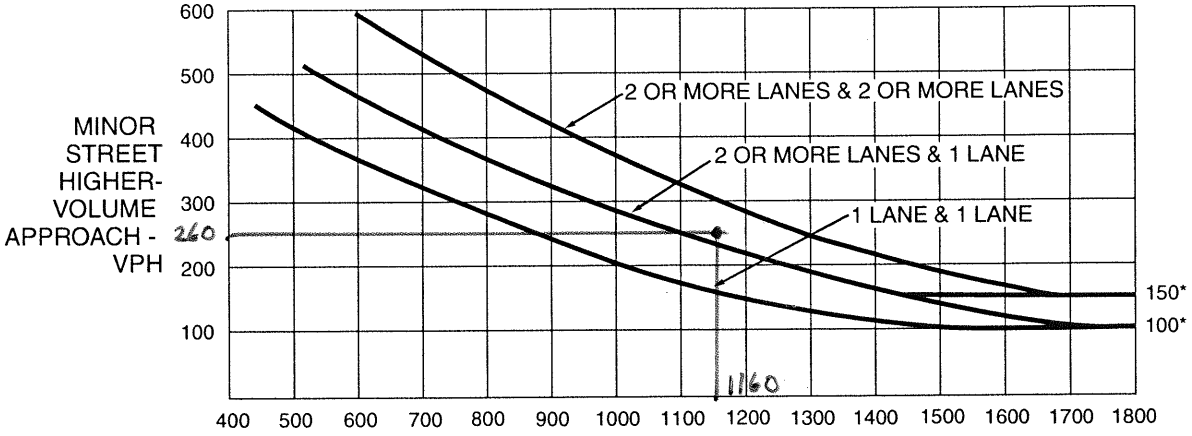
total approach volume on the minor street (5th Ave NE) = 260 vph

total approach volume on the major street (185th St) = 1160 vph

These volumes exceed the threshold for roadways with 1-lane approaches on the major and minor streets.

Criteria B of the peak hour warrant is met.

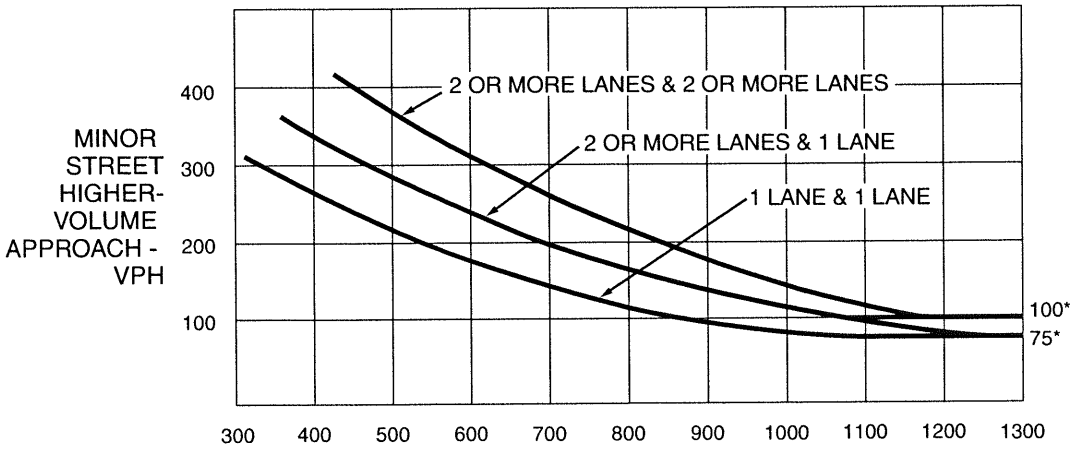
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Option:

08 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

Section 4C.03 Warrant 2, Four-Hour Vehicular Volume

Support:

01 The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.**

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-2 may be used in place of Figure 4C-1.

Section 4C.04 Warrant 3, Peak Hour

Support:

01 The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

Standard:

02 **This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.**

03 **The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:**

A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:

1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach; and

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and

3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

Option:

04 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-4 may be used in place of Figure 4C-3 to evaluate the criteria in the second category of the Standard.

05 If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal may be operated in the flashing mode during the hours that the volume criteria of this warrant are not met.

Guidance:

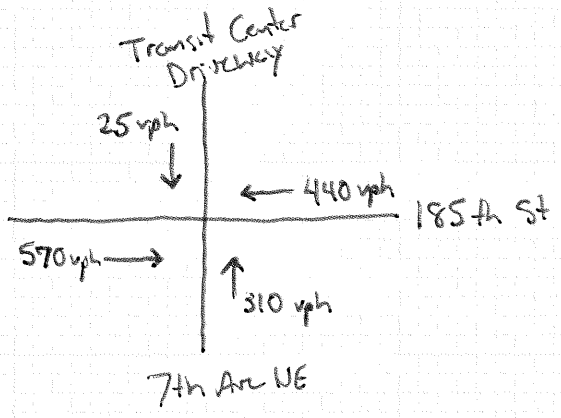
06 *If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal should be traffic-actuated.*

Calculations For 185th / 7th Signal Warrant	Job No. 60512	Sheet No. 1 of 3
Made by CJG	Date 7/15/2016	
Checked by WJS	Date 2/6/2017	
Backchecked by CJG	Date 2/7/2017	

HNTB

NE 185th Street / 7th Ave NE – Peak Hour Signal Warrant

2035 PM Peak Hour traffic forecast



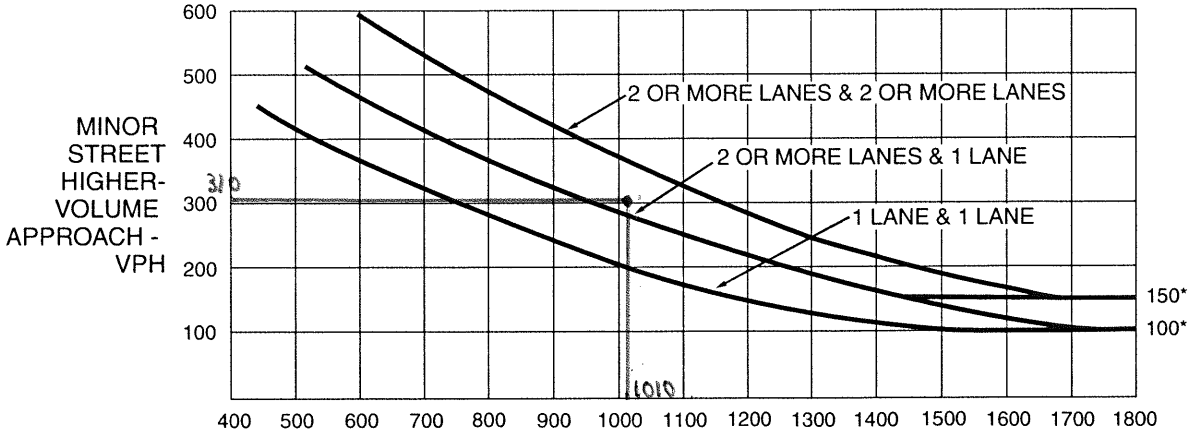
total approach volume on the minor street leg with the higher volume (7th Ave) = 310 vph

total approach volume on the major street, both legs (185th St) = 1,010 vph

These volumes exceed the threshold for roadways with 1-lane approaches on the major and minor streets.

Criteria B of the peak hour warrant is met.

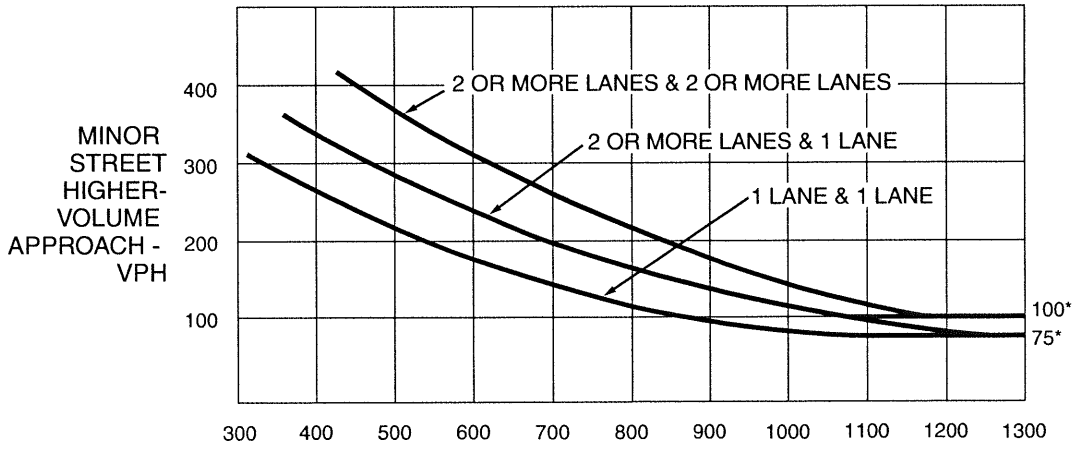
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Option:

08 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

Section 4C.03 Warrant 2, Four-Hour Vehicular Volume

Support:

01 The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.**

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-2 may be used in place of Figure 4C-1.

Section 4C.04 Warrant 3, Peak Hour

Support:

01 The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

Standard:

02 **This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.**

03 **The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:**

- **A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:**
  1. **The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach; and**
  2. **The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and**
  3. **The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.**
- **B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.**

Option:

04 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-4 may be used in place of Figure 4C-3 to evaluate the criteria in the second category of the Standard.

05 If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal may be operated in the flashing mode during the hours that the volume criteria of this warrant are not met.

Guidance:

06 *If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal should be traffic-actuated.*

APPENDIX C: SIGHT DISTANCE CALCULATIONS

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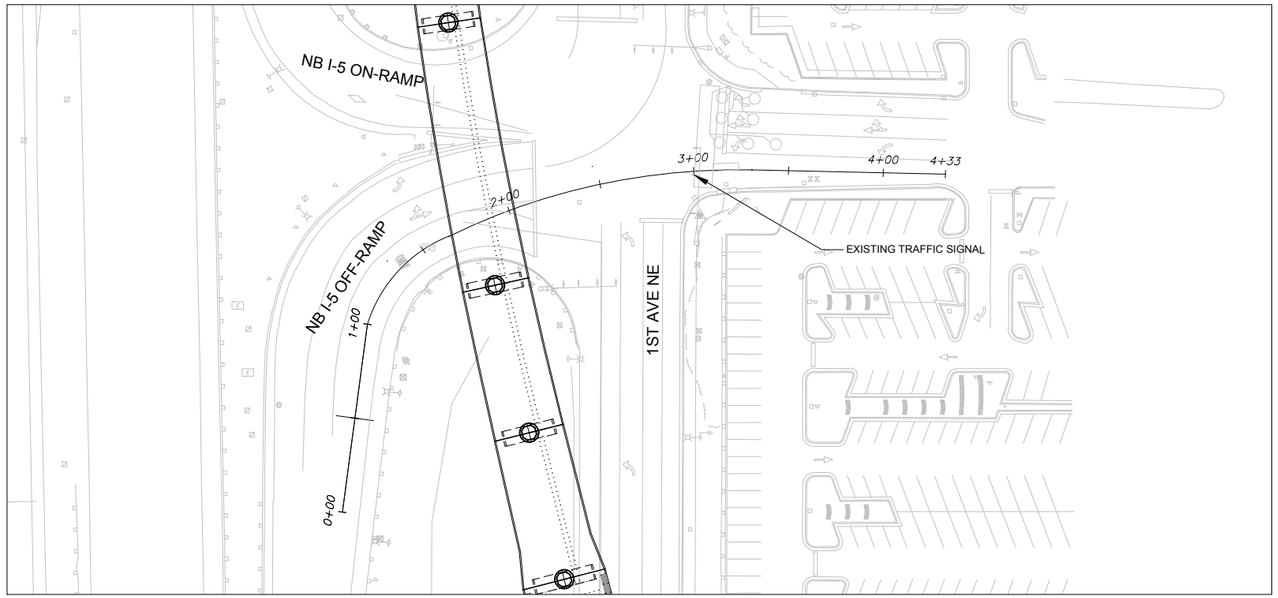
Xrefs:
xLLE-SEAT-VBP
xL200-L85-SEP100
xL200-GB-TB22x34

LYNNWOOD LINK - COLUMN SIGHT DISTANCE EVALUATION

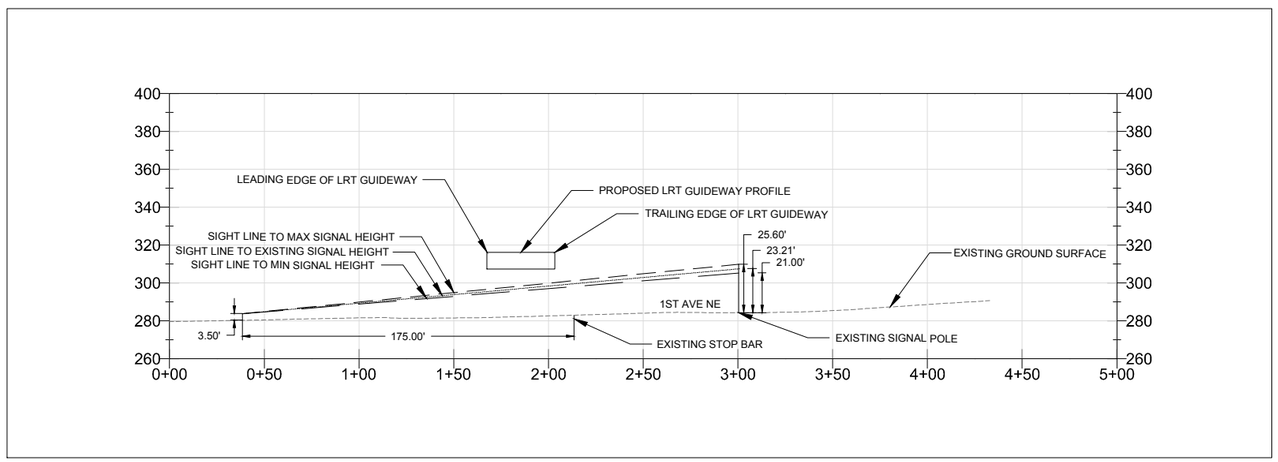
REFERENCE: WSDOT 2014 DM EX. 1250-5
MUTCD 2009 TABLE 4D-2

ASSUMPTIONS: DESIGN SPEED OF 20 MPH BASED ON WSDOT 2014 DM EX. 1250-5, CURVE RADIUS OF 78' AND SUPERELEVATION RATE OF 3%. CITY OF SEATTLE ARTERIAL SPEED LIMIT IS 30 MPH.
REQUIRED SIGHT DISTANCE FOR SIGNAL VISIBILITY PER MUTCD 2009 TABLE 4D-2 IS 175'.
DRIVER EYE HEIGHT ASSUMED 3.5' (WSDOT 2014 DM 1260.03).
MINIMUM HEIGHT FROM ROAD SURFACE TO BOTTOM OF SIGNAL HEAD IS 15' PER MUTCD 2009 PG. 465; MAXIMUM TOP OF SIGNAL HEIGHT IS 25.6'. ASSUMED MIN. TOP OF SIGNAL HEIGHT IS 21' (16.5' FOR TRUCK CLEARANCE PLUS 4.5' FOR 3-DISPLAY SIGNAL HEAD).
ASSUMED LRT GUIDEWAY VERTICAL CLEARANCE IS 24.66' MIN. FROM DESIGN.



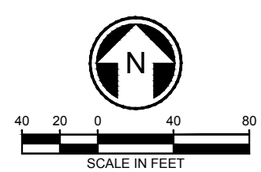
SIGHT LINE CLEARANCES
(BETWEEN BOTTOM OF LRT GUIDEWAY AND SIGHT LINES TO EXISTING SIGNAL POLE)
(NEGATIVE VALUES INDICATE SIGHT LINE OBSTRUCTED BY GUIDEWAY)

- SIGHT LINE TO MAX SIGNAL HEIGHT
  - LEADING EDGE: 10.73'
  - TRAILING EDGE: 7.16'
- SIGHT LINE TO EXISTING SIGNAL HEIGHT
  - LEADING EDGE: 11.91'
  - TRAILING EDGE: 8.67'
- SIGHT LINE TO MIN SIGNAL HEIGHT
  - LEADING EDGE: 13.00'
  - TRAILING EDGE: 10.06'



CRITERIA PER MUTCD 2009 TABLE 4D-2

- MINIMUM SIGHT DISTANCE FOR SIGNAL VISIBILITY
  - 20 MPH - 175 FT
  - 25 MPH - 215 FT
  - 30 MPH - 270 FT
  - 35 MPH - 325 FT
  - 40 MPH - 390 FT
  - 45 MPH - 460 FT



No.	DATE	DSN	CHK	APP	REVISION

DESIGNED BY: L. JAMES
DRAWN BY: L. JAMES
CHECKED BY: P. CHU
APPROVED BY: P. CHU
SUBMITTED BY:
DATE:
REVIEWED BY:
DATE:
DATE:
LINE IS 1" AT FULL SCALE
SCALE: 1" = 40'
FILENAME: L100SEA_LJWORKING
CONTRACT No.:

HNTB Jacobs trusted design partners
SOUNDTRANSIT

LYNNWOOD LINK EXTENSION
CONTRACT L200
NORTHGATE STATION TO NE 200TH STREET

SIGNAL SIGHT DISTANCE EVALUATION
AT 1ST AVE NE AND I-5 NB RAMPS

DRAWING No.: **EXHIBIT SD-14**
LOCATION ID: L85
SHEET No.: 14
REV: 1

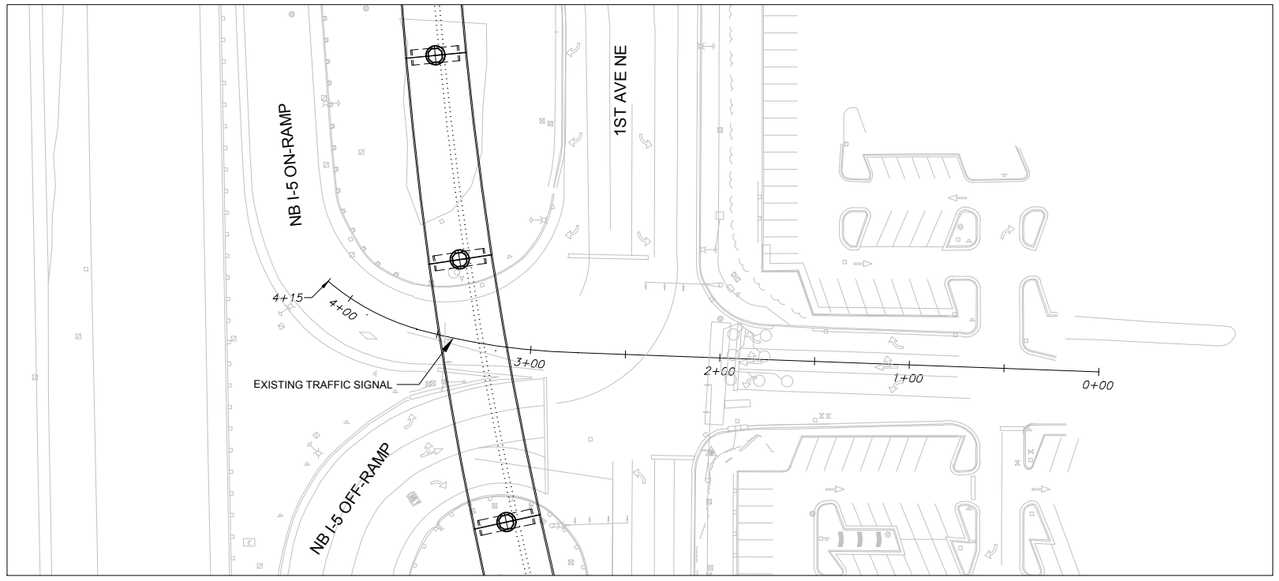
12/13/16 | 3:49 PM | LJAMES
C:\CADD\LIB\PW\LJAMES\WEST\DMS85038L100SEA_LJWORKING.DWG

Xrefs:
xLLE-SEAT-VBP
xL200-L85-SEP100
xL200-GB-TB22x34

LYNNWOOD LINK - COLUMN SIGHT DISTANCE EVALUATION

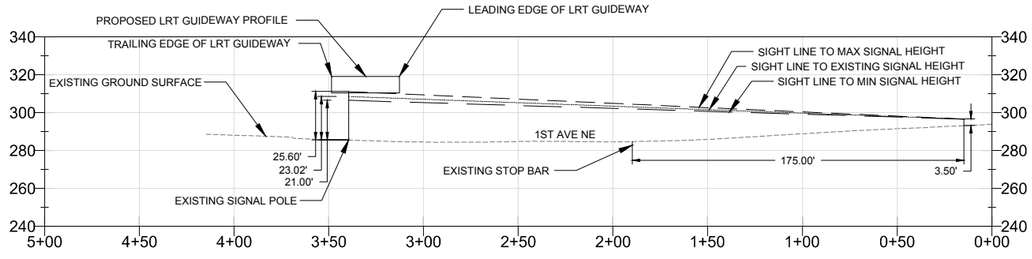
REFERENCE: WSDOT 2014 DM EX. 1250-5
MUTCD 2009 TABLE 4D-2

ASSUMPTIONS: DESIGN SPEED OF 20 MPH BASED ON WSDOT 2014 DM EX. 1250-5, CURVE RADIUS OF 65' AND SUPERELEVATION RATE OF 3%. CITY OF SEATTLE ARTERIAL SPEED LIMIT IS 30 MPH.
REQUIRED SIGHT DISTANCE FOR SIGNAL VISIBILITY PER MUTCD 2009 TABLE 4D-2 IS 175'.
DRIVER EYE HEIGHT ASSUMED 3.5' (WSDOT 2014 DM 1260.03).
MINIMUM HEIGHT FROM ROAD SURFACE TO BOTTOM OF SIGNAL HEAD IS 15' PER MUTCD 2009 PG. 465; MAXIMUM TOP OF SIGNAL HEIGHT IS 25.6'. ASSUMED MIN. TOP OF SIGNAL HEIGHT IS 21' (16.5' FOR TRUCK CLEARANCE PLUS 4.5' FOR 3-DISPLAY SIGNAL HEAD).
ASSUMED LRT GUIDEWAY VERTICAL CLEARANCE IS 24.66' MIN. FROM DESIGN.



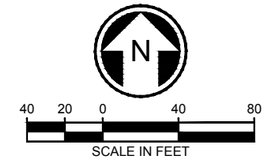
SIGHT LINE CLEARANCES
(BETWEEN BOTTOM OF LRT GUIDEWAY AND SIGHT LINES TO EXISTING SIGNAL POLE)
(NEGATIVE VALUES INDICATE SIGHT LINE OBSTRUCTED BY GUIDEWAY)

- SIGHT LINE TO MAX SIGNAL HEIGHT
  - LEADING EDGE: 0.51'
  - TRAILING EDGE: -1.09'
- SIGHT LINE TO EXISTING SIGNAL HEIGHT
  - LEADING EDGE: 2.88'
  - TRAILING EDGE: 1.56'
- SIGHT LINE TO MIN SIGNAL HEIGHT
  - LEADING EDGE: 4.73'
  - TRAILING EDGE: 3.64'



CRITERIA PER MUTCD 2009 TABLE 4D-2

- MINIMUM SIGHT DISTANCE FOR SIGNAL VISIBILITY
  - 20 MPH - 175 FT
  - 25 MPH - 215 FT
  - 30 MPH - 270 FT
  - 35 MPH - 325 FT
  - 40 MPH - 390 FT
  - 45 MPH - 460 FT



No.	DATE	DSN	CHK	APP	REVISION

DESIGNED BY: L. JAMES
DRAWN BY: L. JAMES
CHECKED BY: P. CHU
APPROVED BY: P. CHU

SUBMITTED BY:
DATE:
REVIEWED BY:
DATE:
DATE:

HNTB Jacobs trusted design partners

LINE IS 1" AT FULL SCALE

SOUNDTRANSIT

SCALE: 1" = 40'
FILENAME: L100SEA_LJWORKING
CONTRACT No.:

LYNNWOOD LINK EXTENSION
CONTRACT L200
NORTHGATE STATION TO NE 200TH STREET

SIGNAL SIGHT DISTANCE EVALUATION
AT 1ST AVE NE AND I-5 NB RAMPS

DRAWING No.: **EXHIBIT SD-15**
LOCATION ID: L85
SHEET No.: 15
REV: 1

12/13/16 | 3:50 PM | LJAMES
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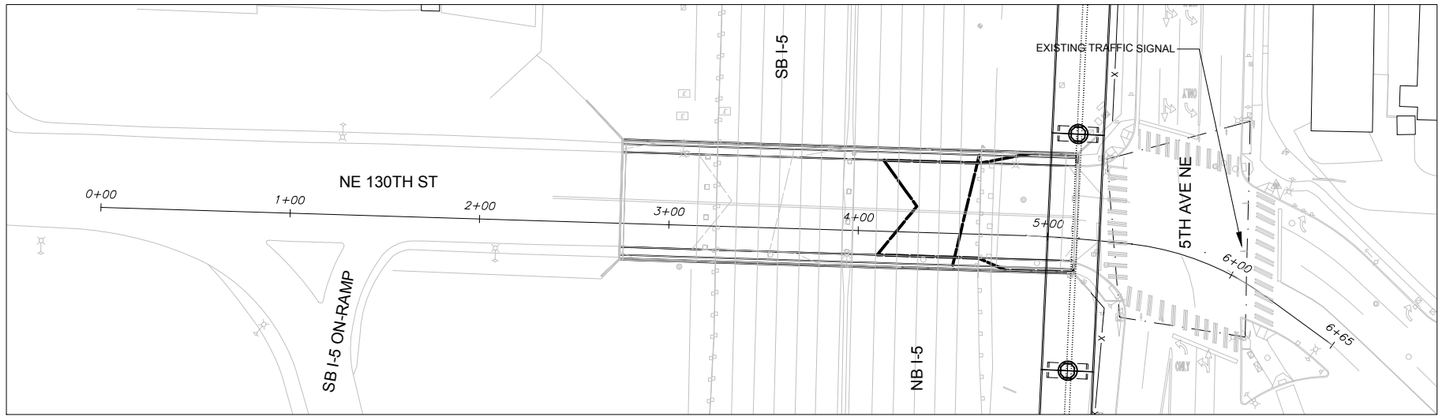
Xrefs:
xLLE-SEAT-VBP
xLLE-SHLN-VBP
xL200-L85-CRP100
xL200-L85-SEP100
xL200-L85-CMP100
xL200-GB-TB22x34

LYNNWOOD LINK - COLUMN SIGHT DISTANCE EVALUATION

REFERENCE: WSDOT 2014 DM EX. 1250-5
MUTCD 2009 TABLE 4D-2

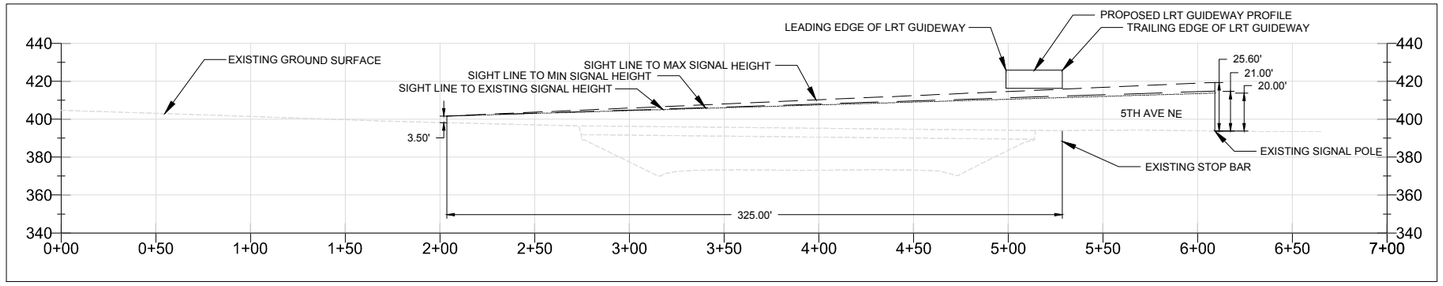
ASSUMPTIONS: DESIGN SPEED OF 35 MPH. POSTED SPEED LIMIT IS 30 MPH.
REQUIRED SIGHT DISTANCE FOR SIGNAL VISIBILITY PER MUTCD 2009 TABLE 4D-2 IS 325'.
DRIVER EYE HEIGHT ASSUMED 3.5' (WSDOT 2014 DM 1260.03).
MINIMUM HEIGHT FROM ROAD SURFACE TO BOTTOM OF SIGNAL HEAD IS 15' PER MUTCD 2009 PG. 465; MAXIMUM TOP OF SIGNAL HEIGHT IS 25.6'. ASSUMED MIN. TOP OF SIGNAL HEIGHT IS 21' (16.5' FOR TRUCK CLEARANCE PLUS 4.5' FOR 3-DISPLAY SIGNAL HEAD).
ASSUMED LRT GUIDEWAY VERTICAL CLEARANCE ABOVE EXISTING ROAD SURFACE IS 22.27' MIN. FROM DESIGN.
FUTURE GROUND SURFACE ASSUMED 6' ABOVE EXISTING (BASED ON 16.5' NE 130TH ST BRIDGE CLEARANCE, 9.33' WF100G GIRDERS).



SIGHT LINE CLEARANCES (EXISTING SURFACE)
(BETWEEN BOTTOM OF LRT GUIDEWAY AND SIGHT LINES TO EXISTING SIGNAL POLE; NEGATIVE VALUES INDICATE SIGHT LINE OBSTRUCTED BY GUIDEWAY)

- SIGHT LINE TO MAX SIGNAL HEIGHT
  - LEADING EDGE: 1.73'
  - TRAILING EDGE: 0.43'
- SIGHT LINE TO MIN SIGNAL HEIGHT
  - LEADING EDGE: 5.08'
  - TRAILING EDGE: 4.11'
- SIGHT LINE TO EXISTING SIGNAL HEIGHT
  - LEADING EDGE: 5.81'
  - TRAILING EDGE: 4.92'

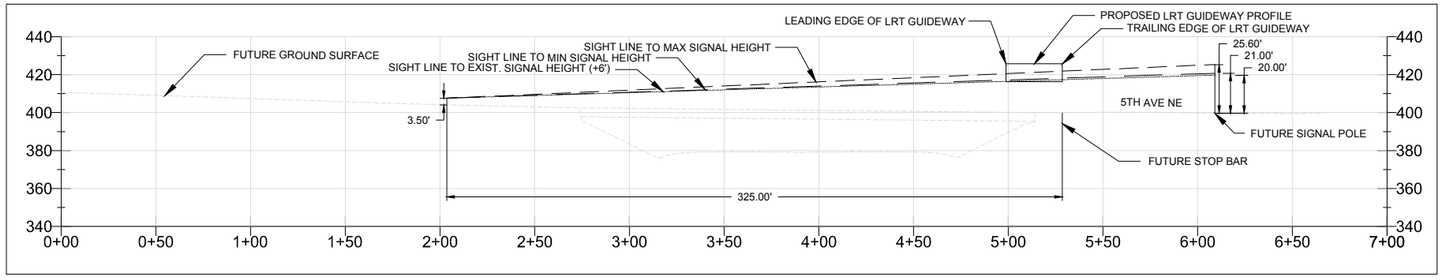
EXISTING GROUND SURFACE/SIGHT LINES



SIGHT LINE CLEARANCES (FUTURE SURFACE)
(BETWEEN BOTTOM OF LRT GUIDEWAY AND SIGHT LINES TO EXISTING SIGNAL POLE AT 6' ABOVE EXISTING HEIGHT; NEGATIVE VALUES INDICATE SIGHT LINE OBSTRUCTED BY GUIDEWAY)

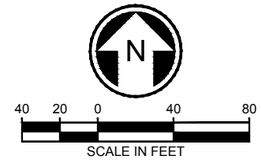
- SIGHT LINE TO MAX SIGNAL HEIGHT
  - LEADING EDGE: -4.27'
  - TRAILING EDGE: -5.57'
- SIGHT LINE TO MIN SIGNAL HEIGHT
  - LEADING EDGE: -0.92'
  - TRAILING EDGE: -1.89'
- SIGHT LINE TO EXIST. SIGNAL HEIGHT (+6')
  - LEADING EDGE: -0.19'
  - TRAILING EDGE: -1.08'

FUTURE GROUND SURFACE/SIGHT LINES (6' ABOVE EXISTING)



CRITERIA PER MUTCD 2009 TABLE 4D-2

- MINIMUM SIGHT DISTANCE FOR SIGNAL VISIBILITY
  - 20 MPH - 175 FT
  - 25 MPH - 215 FT
  - 30 MPH - 270 FT
  - 35 MPH - 325 FT
  - 40 MPH - 390 FT
  - 45 MPH - 460 FT



No.	DATE	DSN	CHK	APP	REVISION

DESIGNED BY: L. JAMES
DRAWN BY: L. JAMES
CHECKED BY: P. CHU
APPROVED BY: P. CHU

SUBMITTED BY: | DATE: | REVIEWED BY: | DATE:

HNTB Jacobs trusted design partners

LINE IS 1" AT FULL SCALE

SOUNDTRANSIT

DATE:

SCALE: 1" = 40'
FILENAME: L200SEA_LJWORKING
CONTRACT No.:

LYNNWOOD LINK EXTENSION
CONTRACT L200
NORTHGATE STATION TO NE 200TH STREET

SIGNAL SIGHT DISTANCE EVALUATION
AT NE 130TH ST AND 5TH AVE NE

DRAWING No.: **EXHIBIT SD-16**
LOCATION ID: L85
SHEET No.: 16
REV: 1

12/13/16 | 3:54 PM | LJAMES
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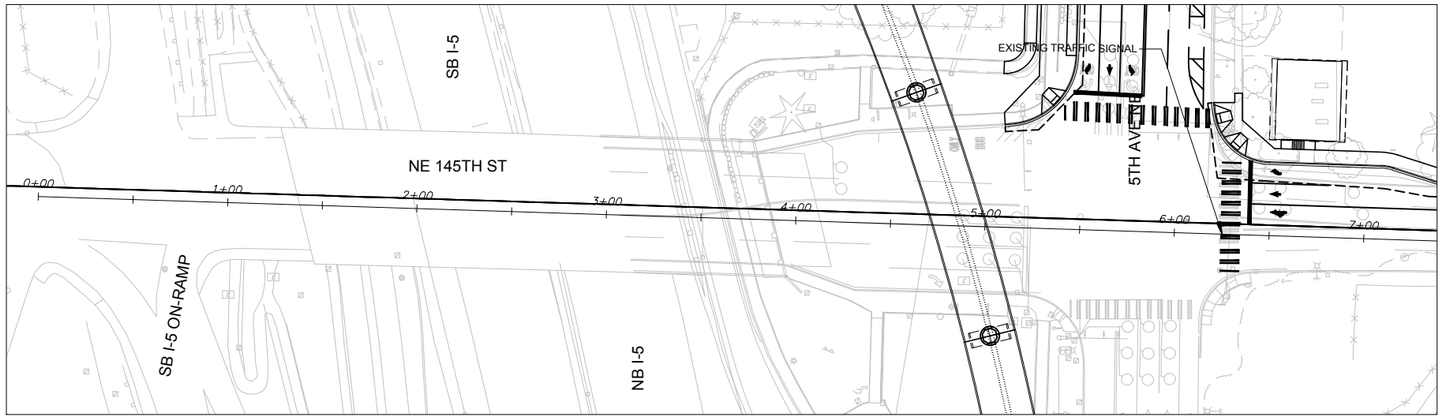
Xrefs:
xLLE-SEAT-VBP
xLLE-SHLN-VBP
xL200-L85-CRP100
xL200-L85-SEP100
xL200-L85-CMP100
xL200-GB-TB22x34

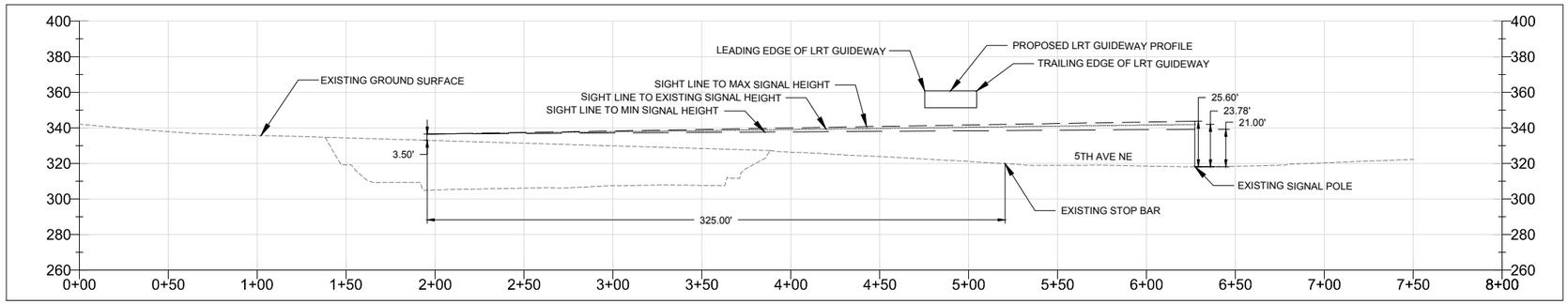
LYNNWOOD LINK - COLUMN SIGHT DISTANCE EVALUATION

REFERENCE: WSDOT 2014 DM EX. 1250-5
MUTCD 2009 TABLE 4D-2

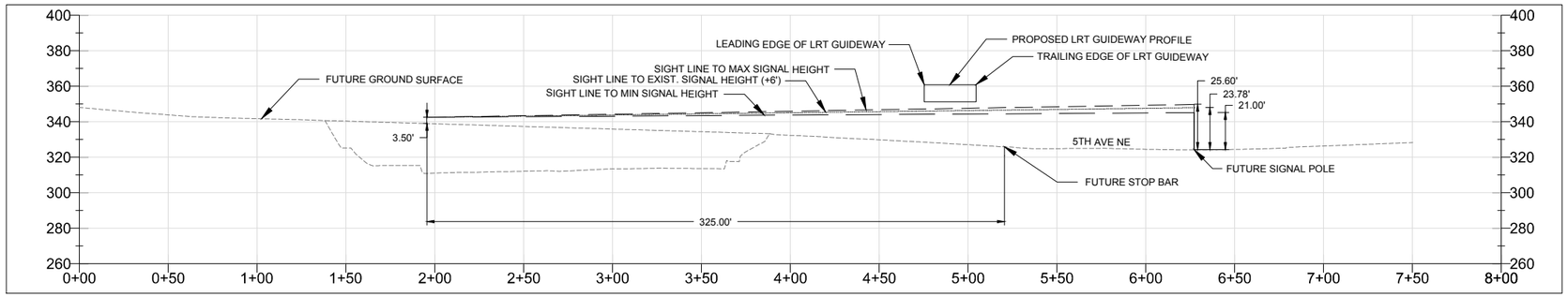
ASSUMPTIONS: DESIGN SPEED OF 35 MPH. POSTED SPEED LIMIT IS 35 MPH.
REQUIRED SIGHT DISTANCE FOR SIGNAL VISIBILITY PER MUTCD 2009 TABLE 4D-2 IS 325'.
DRIVER EYE HEIGHT ASSUMED 3.5' (WSDOT 2014 DM 1260.03).
MINIMUM HEIGHT FROM ROAD SURFACE TO BOTTOM OF SIGNAL HEAD IS 15' PER MUTCD 2009 PG. 465; MAXIMUM TOP OF SIGNAL HEIGHT IS 25.6'. ASSUMED MIN. TOP OF SIGNAL HEIGHT IS 21' (16.5' FOR TRUCK CLEARANCE PLUS 4.5' FOR 3-DISPLAY SIGNAL HEAD).
ASSUMED LRT GUIDEWAY VERTICAL CLEARANCE ABOVE EXISTING ROAD SURFACE IS 28.81' MIN. FROM DESIGN.
FUTURE GROUND SURFACE ASSUMED 6' ABOVE EXISTING (BASED ON 16.5' NE 145TH ST BRIDGE CLEARANCE, 9.33' WF100G GIRDERS).



EXISTING GROUND SURFACE/SIGHT LINES



FUTURE GROUND SURFACE/SIGHT LINES (6' ABOVE EXISTING)



SIGHT LINE CLEARANCES (EXISTING SURFACE)
(BETWEEN BOTTOM OF LRT GUIDEWAY AND SIGHT LINES TO EXISTING SIGNAL POLE; NEGATIVE VALUES INDICATE SIGHT LINE OBSTRUCTED BY GUIDEWAY)

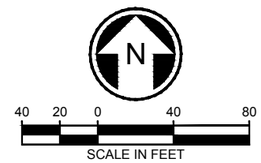
- SIGHT LINE TO MAX SIGNAL HEIGHT
  - LEADING EDGE: 10.10'
  - TRAILING EDGE: 9.61'
- SIGHT LINE TO EXISTING SIGNAL HEIGHT
  - LEADING EDGE: 11.28'
  - TRAILING EDGE: 10.91'
- SIGHT LINE TO MIN SIGNAL HEIGHT
  - LEADING EDGE: 13.08'
  - TRAILING EDGE: 12.91'

SIGHT LINE CLEARANCES (FUTURE SURFACE)
(BETWEEN BOTTOM OF LRT GUIDEWAY AND SIGHT LINES TO EXISTING SIGNAL POLE AT 6' ABOVE EXISTING HEIGHT; NEGATIVE VALUES INDICATE SIGHT LINE OBSTRUCTED BY GUIDEWAY)

- SIGHT LINE TO MAX SIGNAL HEIGHT
  - LEADING EDGE: 4.10'
  - TRAILING EDGE: 3.61'
- SIGHT LINE TO EXIST. SIGNAL HEIGHT (+6')
  - LEADING EDGE: 5.28'
  - TRAILING EDGE: 4.92'
- SIGHT LINE TO MIN SIGNAL HEIGHT
  - LEADING EDGE: 7.08'
  - TRAILING EDGE: 6.91'

CRITERIA PER MUTCD 2009 TABLE 4D-2

- MINIMUM SIGHT DISTANCE FOR SIGNAL VISIBILITY
  - 20 MPH - 175 FT
  - 25 MPH - 215 FT
  - 30 MPH - 270 FT
  - 35 MPH - 325 FT
  - 40 MPH - 390 FT
  - 45 MPH - 460 FT



No.	DATE	DSN	CHK	APP	REVISION

DESIGNED BY: L. JAMES
DRAWN BY: L. JAMES
CHECKED BY: P. CHU
APPROVED BY: P. CHU
SUBMITTED BY:
DATE:
REVIEWED BY:
DATE:
DATE:
LINE IS 1" AT FULL SCALE
SCALE: 1" = 40'
FILENAME: L200SEA_LJWORKING
CONTRACT No.:

HNTB Jacobs trusted design partners
SOUNDTRANSIT

LYNNWOOD LINK EXTENSION
CONTRACT L200
NORTHGATE STATION TO NE 200TH STREET

SIGNAL SIGHT DISTANCE EVALUATION
AT NE 145TH ST AND 5TH AVE NE

DRAWING No.: **EXHIBIT SD-17**
LOCATION ID: L85
SHEET No.: 17
REV: 1

12/13/16 | 3:55 PM | LJAMES
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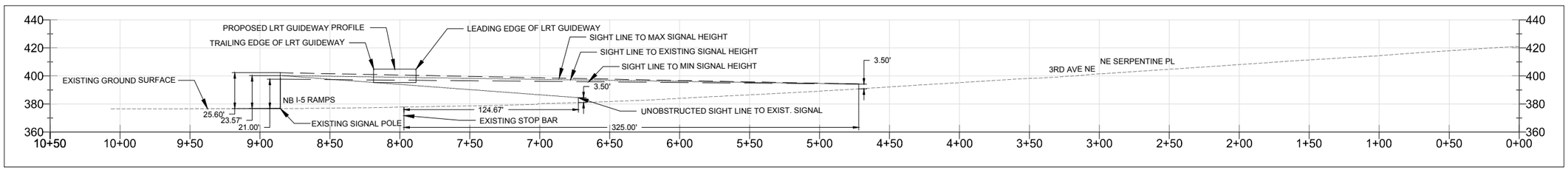
Xrefs:
xL200-L85-SEP100
xLLE-SHLN-VBP
xL200-GB-TB22x34
xL200-L85-CMP100
xL200-L85-CRP100
xL200-L85-TSP100

LYNNWOOD LINK - SIGNAL SIGHT DISTANCE EVALUATION

REFERENCE: WSDOT 2014 DM EX. 1250-5
MUTCD 2009 TABLE 4D-2

ASSUMPTIONS: DESIGN SPEED OF 35 MPH. POSTED SPEED LIMIT IS 35 MPH.
REQUIRED SIGHT DISTANCE FOR SIGNAL VISIBILITY PER MUTCD 2009 TABLE 4D-2 IS 325'.
DRIVER EYE HEIGHT ASSUMED 3.5' (WSDOT 2014 DM 1260.03).
MINIMUM HEIGHT FROM ROAD SURFACE TO BOTTOM OF SIGNAL HEAD IS 15' PER MUTCD 2009 PG. 465; MAXIMUM TOP OF SIGNAL HEIGHT IS 25.6'. ASSUMED MIN. TOP OF SIGNAL HEIGHT IS 21' (16.5' FOR TRUCK CLEARANCE PLUS 4.5' FOR 3-DISPLAY SIGNAL HEAD).
ASSUMED LRT GUIDEWAY VERTICAL CLEARANCE IS 17.38' MIN. FROM DESIGN.

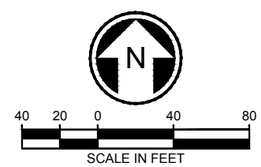


CRITERIA PER MUTCD 2009 TABLE 4D-2

- MINIMUM SIGHT DISTANCE FOR SIGNAL VISIBILITY
  - 20 MPH - 175 FT
  - 25 MPH - 215 FT
  - 30 MPH - 270 FT
  - 35 MPH - 325 FT
  - 40 MPH - 390 FT
  - 45 MPH - 460 FT

SIGHT LINE CLEARANCES
(BETWEEN BOTTOM OF LRT GUIDEWAY AND SIGHT LINES TO EXISTING SIGNAL POLE)
(NEGATIVE VALUES INDICATE SIGHT LINE OBSTRUCTED BY GUIDEWAY)

- SIGHT LINE TO MAX SIGNAL HEIGHT
  - LEADING EDGE: -5.09'
  - TRAILING EDGE: -5.68'
- SIGHT LINE TO EXISTING SIGNAL HEIGHT
  - LEADING EDGE: -3.53'
  - TRAILING EDGE: -3.97'
- SIGHT LINE TO MIN SIGNAL HEIGHT
  - LEADING EDGE: -1.57'
  - TRAILING EDGE: -1.82'



No.	DATE	DSN	CHK	APP	REVISION

DESIGNED BY: L. JAMES
DRAWN BY: L. JAMES
CHECKED BY: P. CHU
APPROVED BY: P. CHU

SUBMITTED BY:
DATE:
REVIEWED BY:
DATE:
DATE:

HNTB Jacobs trusted design partners

LINE IS 1" AT FULL SCALE

SOUNDTRANSIT

SCALE: 1" = 40'
FILENAME: L200B_LJ_SIGHTDIST
CONTRACT No.:

LYNNWOOD LINK EXTENSION
CONTRACT L200
NORTHGATE STATION TO NE 200TH STREET

SIGNAL SIGHT DISTANCE EVALUATION
AT NE 175TH ST AND I-5 NB RAMPS

DRAWING No.: **EXHIBIT SD-18**
LOCATION ID: L85
SHEET No.: 18
REV: 1

01/25/17 | 3:02 PM | LJAMES
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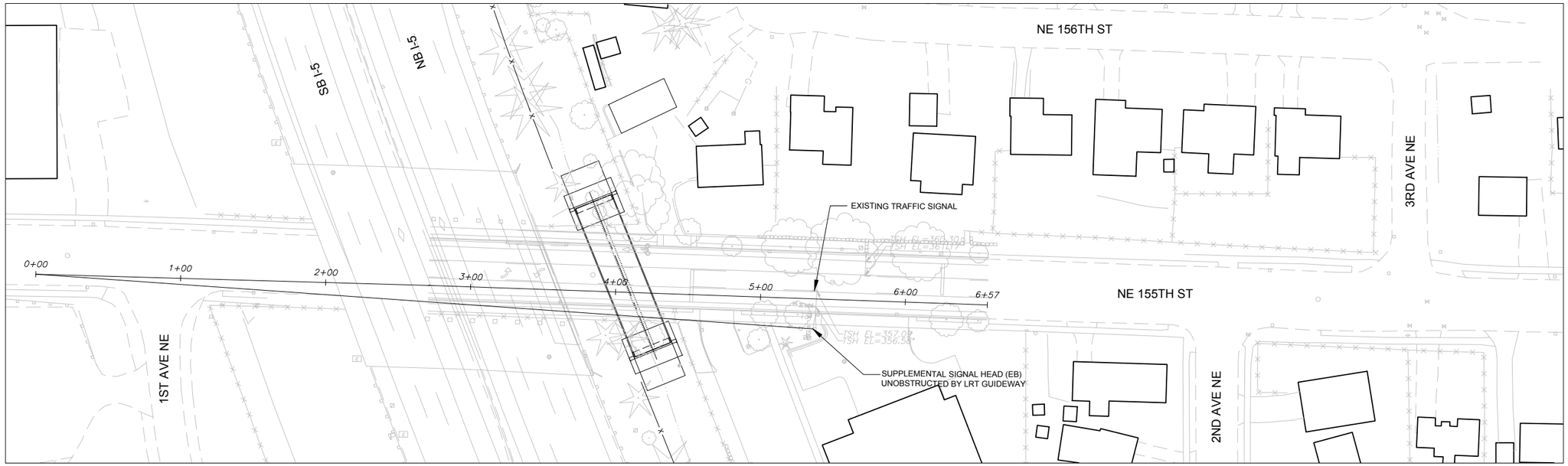
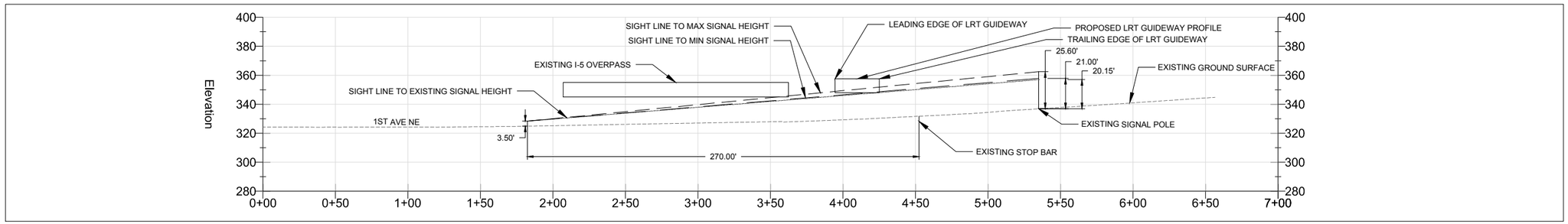
Xrefs:
xL200-L85-SEP100
xLLE-SHLN-VBP
xL200-GB-TB22x34
xL200-L85-CMP100
xL200-L85-CRP100
xL200-L85-TSP100

LYNNWOOD LINK - SIGNAL SIGHT DISTANCE EVALUATION

REFERENCE: WSDOT 2014 DM EX. 1250-5
MUTCD 2009 TABLE 4D-2

ASSUMPTIONS: DESIGN SPEED OF 30 MPH. POSTED SPEED LIMIT IS 30 MPH.
REQUIRED SIGHT DISTANCE FOR SIGNAL VISIBILITY PER MUTCD 2009 TABLE 4D-2 IS 270'.
DRIVER EYE HEIGHT ASSUMED 3.5' (WSDOT 2014 DM 1260.03).
MINIMUM HEIGHT FROM ROAD SURFACE TO BOTTOM OF SIGNAL HEAD IS 15' PER MUTCD 2009 PG. 465; MAXIMUM TOP OF SIGNAL HEIGHT IS 25.6'. ASSUMED MIN. TOP OF SIGNAL HEIGHT IS 21' (16.5' FOR TRUCK CLEARANCE PLUS 4.5' FOR 3-DISPLAY SIGNAL HEAD).
ASSUMED LRT GUIDEWAY VERTICAL CLEARANCE IS 17.62' MIN. FROM DESIGN.



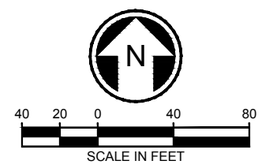


CRITERIA PER MUTCD 2009 TABLE 4D-2

- MINIMUM SIGHT DISTANCE FOR SIGNAL VISIBILITY
  - 20 MPH - 175 FT
  - 25 MPH - 215 FT
  - 30 MPH - 270 FT
  - 35 MPH - 325 FT
  - 40 MPH - 390 FT
  - 45 MPH - 460 FT

SIGHT LINE CLEARANCES
(BETWEEN BOTTOM OF LRT GUIDEWAY AND SIGHT LINES TO EXISTING SIGNAL POLE)
(NEGATIVE VALUES INDICATE SIGHT LINE OBSTRUCTED BY GUIDEWAY)

- SIGHT LINE TO MAX SIGNAL HEIGHT
  - LEADING EDGE: -0.88'
  - TRAILING EDGE: -3.84'
- SIGHT LINE TO MIN SIGNAL HEIGHT
  - LEADING EDGE: 1.88'
  - TRAILING EDGE: -0.67'
- SIGHT LINE TO EXISTING SIGNAL HEIGHT
  - LEADING EDGE: 2.39'
  - TRAILING EDGE: -0.09'



No.	DATE	DSN	CHK	APP	REVISION

DESIGNED BY: L. JAMES
DRAWN BY: L. JAMES
CHECKED BY: P. CHU
APPROVED BY: P. CHU
SUBMITTED BY:
DATE:
REVIEWED BY:
DATE:
DATE:

HNTB Jacobs trusted design partners

LINE IS 1" AT FULL SCALE

SOUNDTRANSIT

SCALE: 1" = 40'
FILENAME: L200B_LJ_SIGHTDIST
CONTRACT No.:

LYNNWOOD LINK EXTENSION
CONTRACT L200
NORTHGATE STATION TO NE 200TH STREET

SIGNAL SIGHT DISTANCE EVALUATION
AT NE 155TH ST AND I-5 OVERPASS

DRAWING No.: **EXHIBIT SD-19**
LOCATION ID: L85
SHEET No.: 19
REV: 1

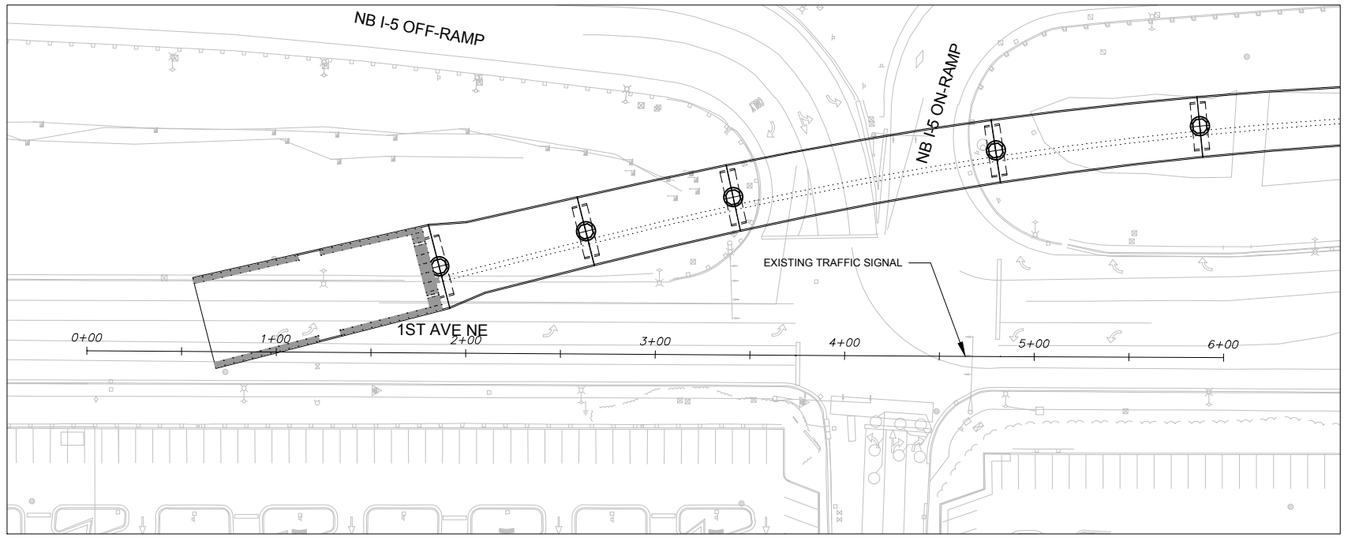
01/25/17 | 3:05 PM | LJAMES
C:\CADD\LIB\PW\LJAMES\WEST\DMS86979\L200B_LJ_SIGHTDIST.DWG

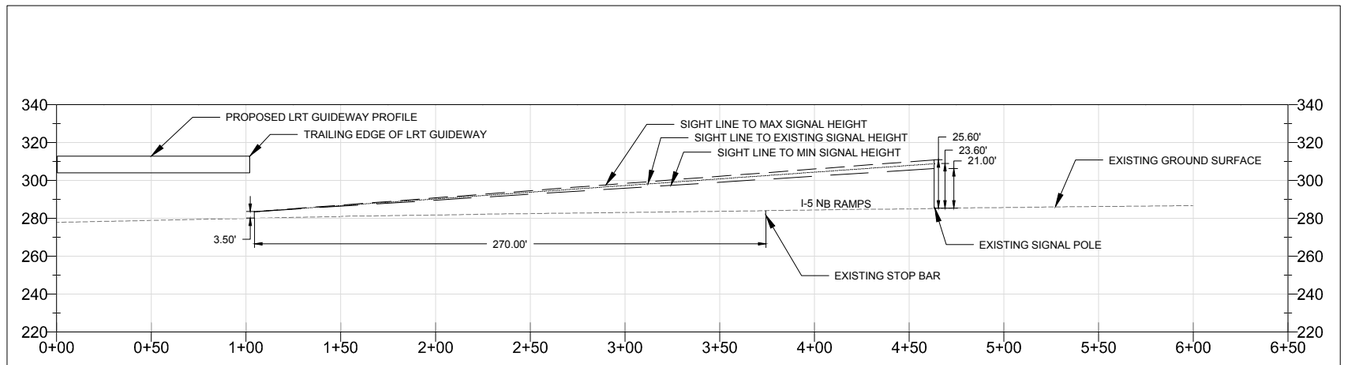
Xrefs:
xLLE-SEAT-VBP
xL200-LB5-SEP100
xL200-GB-TB22x34

LYNNWOOD LINK - COLUMN SIGHT DISTANCE EVALUATION

REFERENCE: WSDOT 2014 DM EX. 1250-5
MUTCD 2009 TABLE 4D-2

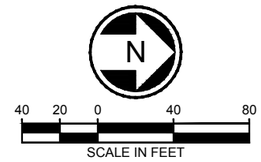
ASSUMPTIONS: DESIGN SPEED IS 30 MPH. CITY OF SEATTLE ARTERIAL SPEED LIMIT IS 30 MPH.
REQUIRED SIGHT DISTANCE FOR SIGNAL VISIBILITY PER MUTCD 2009 TABLE 4D-2 IS 270'.
DRIVER EYE HEIGHT ASSUMED 3.5' (WSDOT 2014 DM 1260.03).
MINIMUM HEIGHT FROM ROAD SURFACE TO BOTTOM OF SIGNAL HEAD IS 15' PER MUTCD 2009 PG. 465; MAXIMUM TOP OF SIGNAL HEIGHT IS 25.6'. ASSUMED MIN. TOP OF SIGNAL HEIGHT IS 21' (16.5' FOR TRUCK CLEARANCE PLUS 4.5' FOR 3-DISPLAY SIGNAL HEAD).
ASSUMED LRT GUIDEWAY VERTICAL CLEARANCE IS 24.13' MIN. FROM DESIGN.





CRITERIA PER MUTCD 2009 TABLE 4D-2

- MINIMUM SIGHT DISTANCE FOR SIGNAL VISIBILITY
  - 20 MPH - 175 FT
  - 25 MPH - 215 FT
  - 30 MPH - 270 FT
  - 35 MPH - 325 FT
  - 40 MPH - 390 FT
  - 45 MPH - 460 FT



No.	DATE	DSN	CHK	APP	REVISION

DESIGNED BY: L. JAMES
DRAWN BY: L. JAMES
CHECKED BY: P. CHU
APPROVED BY: P. CHU

SUBMITTED BY: | DATE: | REVIEWED BY: | DATE:

HNTB Jacobs trusted design partners

LINE IS 1" AT FULL SCALE

SOUNDTRANSIT

SCALE: 1" = 40'
FILENAME: L100_LJ_SIGHTDIST
CONTRACT No.:
DATE:

LYNNWOOD LINK EXTENSION
CONTRACT L200
NORTHGATE STATION TO NE 200TH STREET

SIGNAL SIGHT DISTANCE EVALUATION
AT 1ST AVE NE AND I-5 NB RAMPS

DRAWING No.: **EXHIBIT SD-20**
LOCATION ID: L85
SHEET No.: 20
REV: 1

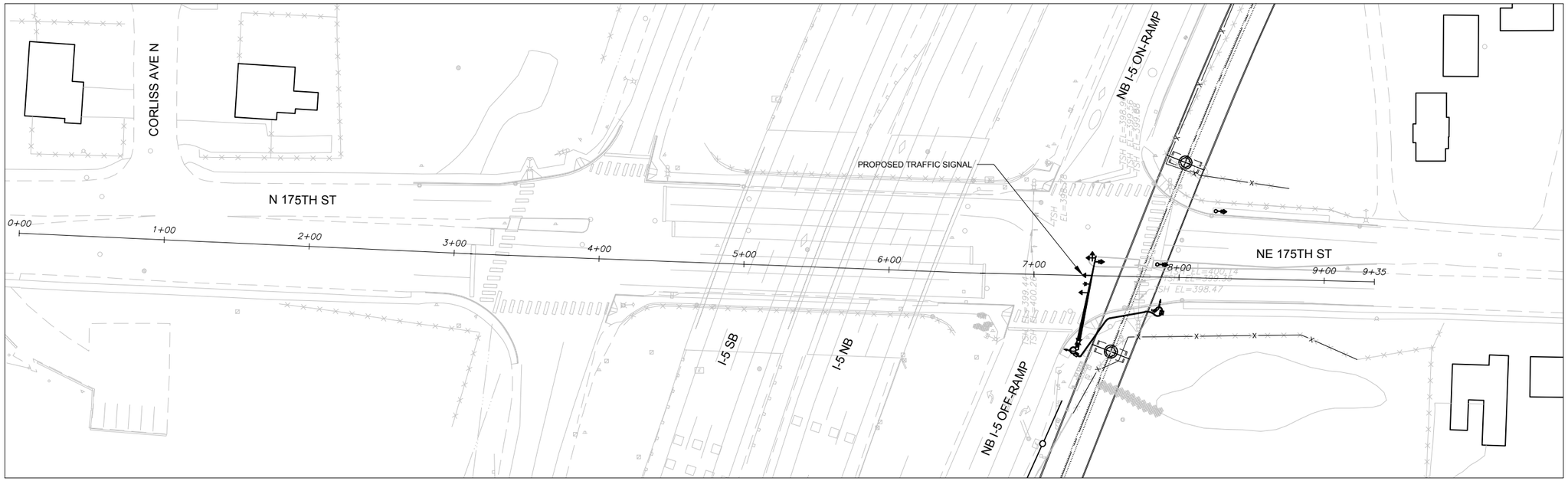
01/20/17 | 1:17 PM | L JAMES
C:\CADDLIB\PW\LJAMES\WEST\DMS86979L100_LJ_SIGHTDIST.DWG

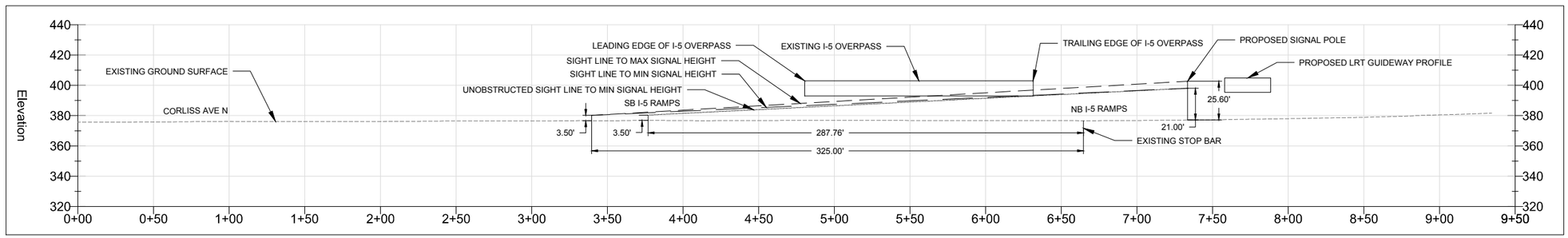
Xrefs:
xL200-L85-SEP100
xLLE-SHLN-VBP
xL200-GB-TB22x34
xL200-L85-CMP100
xL200-L85-CRP100
xL200-L85-TSP100

LYNNWOOD LINK - SIGNAL SIGHT DISTANCE EVALUATION

REFERENCE: WSDOT 2014 DM EX. 1250-5
MUTCD 2009 TABLE 4D-2

ASSUMPTIONS: DESIGN SPEED OF 35 MPH. POSTED SPEED LIMIT IS 35 MPH.
REQUIRED SIGHT DISTANCE FOR SIGNAL VISIBILITY PER MUTCD 2009 TABLE 4D-2 IS 325'.
DRIVER EYE HEIGHT ASSUMED 3.5' (WSDOT 2014 DM 1260.03).
MINIMUM HEIGHT FROM ROAD SURFACE TO BOTTOM OF SIGNAL HEAD IS 15' PER MUTCD 2009 PG. 465; MAXIMUM TOP OF SIGNAL HEIGHT IS 25.6'. ASSUMED MIN. TOP OF SIGNAL HEIGHT IS 21' (16.5' FOR TRUCK CLEARANCE PLUS 4.5' FOR 3-DISPLAY SIGNAL HEAD).
ASSUMED LRT GUIDEWAY VERTICAL CLEARANCE IS 17.38' MIN. FROM DESIGN.





CRITERIA PER MUTCD 2009 TABLE 4D-2

- MINIMUM SIGHT DISTANCE FOR SIGNAL VISIBILITY
  - 20 MPH - 175 FT
  - 25 MPH - 215 FT
  - 30 MPH - 270 FT
  - 35 MPH - 325 FT
  - 40 MPH - 390 FT
  - 45 MPH - 460 FT

SIGHT LINE CLEARANCES
(BETWEEN BOTTOM OF I-5 OVERPASS AND SIGHT LINES TO PROPOSED SIGNAL POLE)
(NEGATIVE VALUES INDICATE SIGHT LINE OBSTRUCTED BY I-5 OVERPASS)

- SIGHT LINE TO MAX SIGNAL HEIGHT
  - LEADING EDGE: 4.80'
  - TRAILING EDGE: -3.84'
- SIGHT LINE TO MIN SIGNAL HEIGHT
  - LEADING EDGE: 6.44'
  - TRAILING EDGE: -0.43'

N

40 20 0 40 80
SCALE IN FEET

No.	DATE	DSN	CHK	APP	REVISION

DESIGNED BY: L. JAMES
DRAWN BY: L. JAMES
CHECKED BY: P. CHU
APPROVED BY: P. CHU

SUBMITTED BY: | DATE: | REVIEWED BY: | DATE:

HNTB Jacobs trusted design partners

LINE IS 1" AT FULL SCALE

SOUNDTRANSIT

DATE:

SCALE: 1" = 40'
FILENAME: L200B_LJ_SIGHTDIST
CONTRACT No.:

LYNNWOOD LINK EXTENSION
CONTRACT L200
NORTHGATE STATION TO NE 200TH STREET

SIGNAL SIGHT DISTANCE EVALUATION
AT NE 175TH ST AND I-5 NB RAMPS

DRAWING No.: **EXHIBIT SD-21**
LOCATION ID: L85
SHEET No.: 21
REV: 1

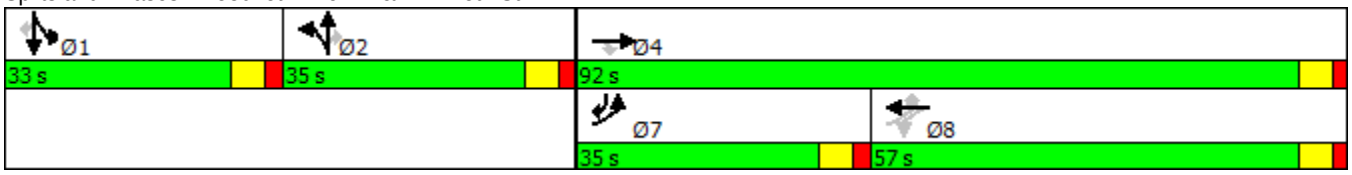
01/25/17 | 2:58 PM | LJAMES
C:\CADD\LIB\PW\LJAMES\WEST\DMS869791L200B_LJ_SIGHTDIST.DWG

APPENDIX D: SYNCHRO ANALYSIS – DESIGN REFINEMENT

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	405	635	75	5	840	325	360	330	410	80	235	420
Future Volume (vph)	405	635	75	5	840	325	360	330	410	80	235	420
Satd. Flow (prot)	1728	3575	1599	0	3490	1561	1466	3152	1544	1728	1819	1546
Flt Permitted	0.108				0.951		0.950	0.986		0.950		
Satd. Flow (perm)	196	3575	1544	0	3319	1518	1464	3150	1479	1705	1819	1526
Satd. Flow (RTOR)			61			121			303			61
Confl. Peds. (#/hr)	7		4	4		7	1		11	11		1
Confl. Bikes (#/hr)						1			4			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Shared Lane Traffic (%)							38%					
Lane Group Flow (vph)	426	668	79	0	889	342	235	491	432	84	247	442
Turn Type	D.P+P	NA	Perm	Perm	NA	Perm	Split	NA	Perm	Split	NA	pm+ov
Protected Phases	7	4			8		2	2		1	1	7
Permitted Phases	8		4	8		8			2			1
Total Split (s)	35.0	92.0	92.0	57.0	57.0	57.0	35.0	35.0	35.0	33.0	33.0	35.0
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	75.9	82.0	82.0		46.8	46.8	27.9	27.9	27.9	24.2	24.2	53.4
Actuated g/C Ratio	0.50	0.54	0.54		0.31	0.31	0.18	0.18	0.18	0.16	0.16	0.35
v/c Ratio	1.09	0.35	0.09		0.87	0.62	0.88	0.85	0.83	0.31	0.86	0.76
Control Delay	113.6	20.9	6.2		60.6	34.1	91.9	75.5	33.1	61.1	89.6	30.7
Queue Delay	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.2
Total Delay	113.6	20.9	6.2		60.6	34.1	91.9	75.5	33.1	61.1	93.3	30.9
LOS	F	C	A		E	C	F	E	C	E	F	C
Approach Delay		53.6			53.3			63.0			54.1	
Approach LOS		D			D			E			D	

Intersection Summary	
Cycle Length: 160	
Actuated Cycle Length: 152.2	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.09	
Intersection Signal Delay: 56.1	Intersection LOS: E
Intersection Capacity Utilization 92.3%	ICU Level of Service F
Analysis Period (min) 15	

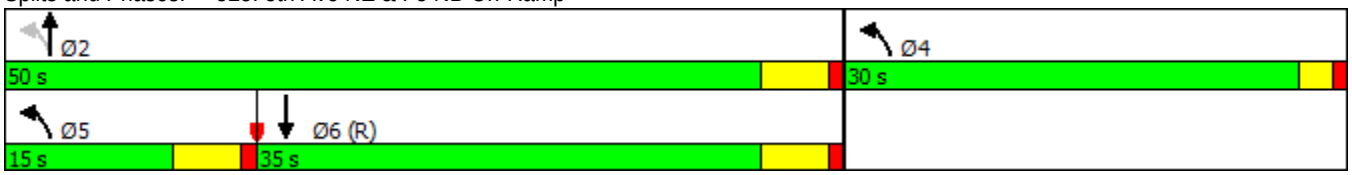
Splits and Phases: 530: 5th Ave NE & NE 145th St



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	Ø4	Ø5
Lane Configurations								
Traffic Volume (vph)	0	0	640	420	735	45		
Future Volume (vph)	0	0	640	420	735	45		
Satd. Flow (prot)	0	0	1752	1632	3527	0		
Flt Permitted			0.229					
Satd. Flow (perm)	0	0	422	1632	3527	0		
Satd. Flow (RTOR)					9			
Confl. Peds. (#/hr)			18			18		
Confl. Bikes (#/hr)		1						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Heavy Vehicles (%)	100%	100%	2%	2%	2%	2%		
Bus Blockages (#/hr)	4	4	0	0	0	0		
Parking (#/hr)				3				
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	674	442	821	0		
Turn Type			pm+pt	NA	NA			
Protected Phases			4 5	2	6		4	5
Permitted Phases			2					
Total Split (s)				50.0	35.0		30.0	15.0
Total Lost Time (s)				5.0	5.0			
Act Effct Green (s)			77.0	51.5	36.5			
Actuated g/C Ratio			0.96	0.64	0.46			
v/c Ratio			0.68	0.42	0.51			
Control Delay			9.4	9.7	6.6			
Queue Delay			1.6	0.8	0.0			
Total Delay			11.0	10.5	6.6			
LOS			B	B	A			
Approach Delay				10.8	6.6			
Approach LOS				B	A			

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 68 (85%), Referenced to phase 6:SBT, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.68	
Intersection Signal Delay: 9.0	Intersection LOS: A
Intersection Capacity Utilization 64.8%	ICU Level of Service C
Analysis Period (min) 15	

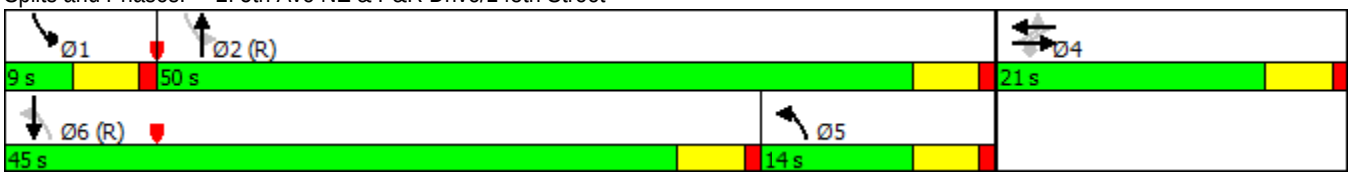
Splits and Phases: 525: 5th Ave NE & I-5 NB On-Ramp



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	5	75	5	5	5	160	255	5	5	700	85
Future Volume (vph)	20	5	75	5	5	5	160	255	5	5	700	85
Satd. Flow (prot)	0	1790	1583	0	1750	0	1734	1820	0	1787	1846	0
Flt Permitted		0.784			0.922		0.098			0.591		
Satd. Flow (perm)	0	1460	1583	0	1640	0	179	1820	0	1112	1846	0
Satd. Flow (RTOR)					5			2			13	
Peak Hour Factor	0.80	0.80	0.80	0.95	0.95	0.95	0.80	0.95	0.95	0.95	0.95	0.80
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	31	94	0	15	0	200	273	0	5	843	0
Turn Type	Perm	NA	Perm	Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4		4	4			6			2		
Total Split (s)	21.0	21.0	21.0	21.0	21.0		14.0	50.0		9.0	45.0	
Total Lost Time (s)		5.0	5.0		5.0		5.0	5.0		5.0	5.0	
Act Effct Green (s)		12.5	12.5		12.5		54.7	58.9		58.7	45.7	
Actuated g/C Ratio		0.16	0.16		0.16		0.68	0.74		0.73	0.57	
v/c Ratio		0.14	0.38		0.06		0.67	0.20		0.01	0.80	
Control Delay		28.3	33.4		22.1		25.9	2.8		4.4	23.4	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		28.3	33.4		22.1		25.9	2.8		4.4	23.4	
LOS		C	C		C		C	A		A	C	
Approach Delay		32.1			22.1			12.6			23.2	
Approach LOS		C			C			B			C	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 56 (70%), Referenced to phase 2:NBSB and 6:NBSB, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 20.5	Intersection LOS: C
Intersection Capacity Utilization 68.6%	ICU Level of Service C
Analysis Period (min) 15	

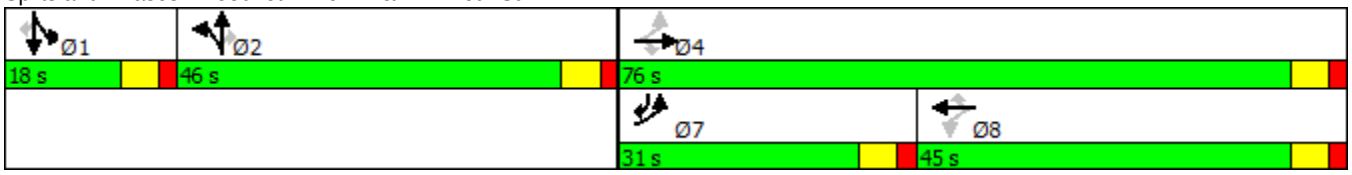
Splits and Phases: 2: 5th Ave NE & P&R Drive/148th Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	485	810	145	5	755	395	380	670	575	80	100	165
Future Volume (vph)	485	810	145	5	755	395	380	670	575	80	100	165
Satd. Flow (prot)	1762	3646	1631	0	3490	1561	1495	3250	1575	1695	1784	1516
Flt Permitted	0.104				0.949		0.950	0.997		0.950		
Satd. Flow (perm)	193	3646	1553	0	3312	1522	1495	3250	1555	1695	1784	1516
Satd. Flow (RTOR)			88			176			140			98
Confl. Peds. (#/hr)	7		9	9		7						
Confl. Bikes (#/hr)									1			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	1%	1%	1%	4%	4%	4%
Shared Lane Traffic (%)							11%					
Lane Group Flow (vph)	511	853	153	0	800	416	356	749	605	84	105	174
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	Split	NA	Perm	Split	NA	pm+ov
Protected Phases	7	4			8		2	2		1	1	7
Permitted Phases	4		4	8		8			2			1
Total Split (s)	31.0	76.0	76.0	45.0	45.0	45.0	46.0	46.0	46.0	18.0	18.0	31.0
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	68.6	68.6	68.6		37.6	37.6	40.0	40.0	40.0	11.2	11.2	36.3
Actuated g/C Ratio	0.50	0.50	0.50		0.27	0.27	0.29	0.29	0.29	0.08	0.08	0.26
v/c Ratio	1.34	0.47	0.19		0.89	0.77	0.82	0.79	1.10	0.61	0.72	0.37
Control Delay	204.9	23.8	8.9		60.9	36.5	62.7	52.9	103.5	80.6	89.3	11.5
Queue Delay	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	204.9	23.8	8.9		60.9	36.5	62.7	52.9	103.5	80.6	89.3	11.5
LOS	F	C	A		E	D	E	D	F	F	F	B
Approach Delay		83.3			52.6			72.8			50.0	
Approach LOS		F			D			E			D	

Intersection Summary	
Cycle Length: 140	
Actuated Cycle Length: 137.9	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.34	
Intersection Signal Delay: 69.3	Intersection LOS: E
Intersection Capacity Utilization 93.4%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 530: 5th Ave NE & NE 145th St



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	Ø4	Ø5
Lane Configurations								
Traffic Volume (vph)	0	0	660	890	345	10		
Future Volume (vph)	0	0	660	890	345	10		
Satd. Flow (prot)	0	0	1752	1844	3542	0		
Flt Permitted			0.461					
Satd. Flow (perm)	0	0	850	1844	3542	0		
Satd. Flow (RTOR)					5			
Confl. Peds. (#/hr)						55		
Confl. Bikes (#/hr)						15		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	695	937	374	0		
Turn Type			pm+pt	NA	NA			
Protected Phases			4 5	2	6		4	5
Permitted Phases			2					
Total Split (s)				50.0	35.0		20.0	15.0
Total Lost Time (s)				5.0	5.0			
Act Effct Green (s)			67.0	48.8	33.8			
Actuated g/C Ratio			0.96	0.70	0.48			
v/c Ratio			0.59	0.73	0.22			
Control Delay			2.6	12.3	13.5			
Queue Delay			0.2	2.0	0.0			
Total Delay			2.9	14.3	13.5			
LOS			A	B	B			
Approach Delay				9.4	13.5			
Approach LOS				A	B			

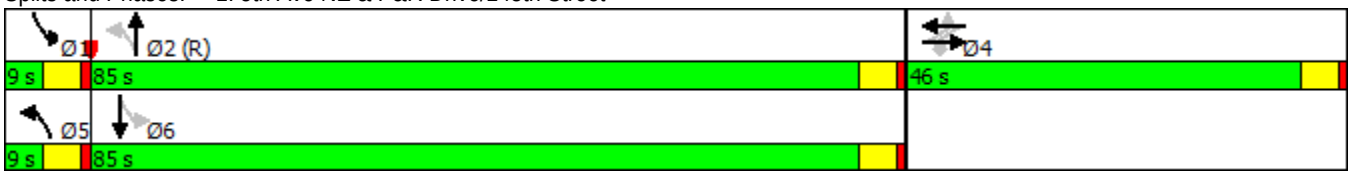
Intersection Summary	
Cycle Length: 70	
Actuated Cycle Length: 70	
Offset: 24 (34%), Referenced to phase 2:NBTL, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.73	
Intersection Signal Delay: 10.2	Intersection LOS: B
Intersection Capacity Utilization 54.8%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 525: 5th Ave NE & I-5 NB ON-Ramp

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	5	140	10	5	5	80	810	0	10	205	20
Future Volume (vph)	100	5	140	10	5	5	80	810	0	10	205	20
Satd. Flow (prot)	0	1521	1346	0	1694	0	1734	1825	0	1787	1801	0
Flt Permitted		0.721			0.870		0.575			0.208		
Satd. Flow (perm)	0	1010	913	0	1322	0	893	1825	0	391	1801	0
Satd. Flow (RTOR)					5						7	
Confl. Peds. (#/hr)	30		145	145		30	55		70	70		55
Confl. Bikes (#/hr)									15			15
Peak Hour Factor	0.80	0.80	0.80	0.95	0.95	0.95	0.80	0.95	0.95	0.95	0.95	0.80
Heavy Vehicles (%)	20%	2%	20%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	131	175	0	21	0	100	853	0	11	241	0
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4		4	4			2			6		
Total Split (s)	46.0	46.0	46.0	46.0	46.0		9.0	85.0		9.0	85.0	
Total Lost Time (s)		5.0	5.0		5.0		5.0	5.0		5.0	5.0	
Act Effct Green (s)		31.3	31.3		31.3		96.7	95.1		93.7	89.7	
Actuated g/C Ratio		0.22	0.22		0.22		0.69	0.68		0.67	0.64	
v/c Ratio		0.58	0.86		0.07		0.16	0.69		0.04	0.21	
Control Delay		57.4	86.0		32.0		5.7	14.4		8.7	11.9	
Queue Delay		0.0	0.0		0.0		0.0	4.6		0.0	0.0	
Total Delay		57.4	86.0		32.0		5.7	19.0		8.7	11.9	
LOS		E	F		C		A	B		A	B	
Approach Delay		73.8			32.0			17.6			11.8	
Approach LOS		E			C			B			B	

Intersection Summary	
Cycle Length: 140	
Actuated Cycle Length: 140	
Offset: 0 (0%), Referenced to phase 2:NBTL, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 28.0	Intersection LOS: C
Intersection Capacity Utilization 71.8%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: 5th Ave NE & P&R Drive/148th Street



Synchro 9 Report
43: NE 185th St & 5th Ave NE

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	89	507	566	84	87	171
Future Volume (vph)	89	507	566	84	87	171
Satd. Flow (prot)	1745	1837	1698	0	1442	1290
Flt Permitted	0.248				0.950	
Satd. Flow (perm)	455	1837	1698	0	1439	1241
Satd. Flow (RTOR)			17			228
Confl. Peds. (#/hr)	48			48	1	4
Confl. Bikes (#/hr)						6
Peak Hour Factor	0.80	0.90	0.90	0.80	0.75	0.75
Heavy Vehicles (%)	2%	2%	2%	2%	3%	3%
Parking (#/hr)					8	8
Shared Lane Traffic (%)						
Lane Group Flow (vph)	111	563	734	0	116	228
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Total Split (s)	69.0	69.0	69.0		31.0	31.0
Total Lost Time (s)	5.0	5.0	5.0		5.0	5.0
Act Effct Green (s)	29.2	29.2	29.2		12.5	12.5
Actuated g/C Ratio	0.56	0.56	0.56		0.24	0.24
v/c Ratio	0.44	0.55	0.77		0.34	0.49
Control Delay	13.0	9.5	14.9		23.5	7.8
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	13.0	9.5	15.0		23.5	7.8
LOS	B	A	B		C	A
Approach Delay		10.0	15.0		13.1	
Approach LOS		B	B		B	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 52.5	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.77	
Intersection Signal Delay: 12.7	Intersection LOS: B
Intersection Capacity Utilization 65.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 43: NE 185th St & 5th Ave NE

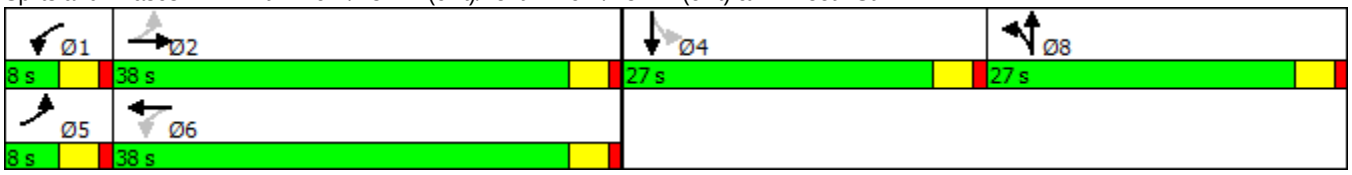
44: 7th Ave N/TC DR (exit)/187th Ave N/TC DR (exit) & NE 185th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	460	114	26	440	0	190	5	119	0	5	20
Future Volume (vph)	20	460	114	26	440	0	190	5	119	0	5	20
Satd. Flow (prot)	1175	1753	0	1710	1800	0	1677	1469	0	0	696	0
Flt Permitted	0.245			0.105			0.950					
Satd. Flow (perm)	303	1753	0	189	1800	0	1225	1469	0	0	696	0
Satd. Flow (RTOR)		14						125			27	
Confl. Peds. (#/hr)	113		5	5		113	130					130
Confl. Bikes (#/hr)									6			
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.95	0.95	0.95	0.75	0.75	0.75
Heavy Vehicles (%)	50%	2%	2%	1%	1%	50%	3%	2%	3%	80%	80%	80%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	25	718	0	33	550	0	200	130	0	0	34	0
Turn Type	pm+pt	NA		pm+pt	NA		Split	NA			NA	
Protected Phases	5	2		1	6		8	8			4	
Permitted Phases	2			6						4		
Total Split (s)	8.0	38.0		8.0	38.0		27.0	27.0		27.0	27.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	
Act Effct Green (s)	38.9	36.7		39.6	38.2		15.9	15.9			19.2	
Actuated g/C Ratio	0.46	0.43		0.46	0.45		0.19	0.19			0.23	
v/c Ratio	0.14	0.94		0.20	0.68		0.64	0.35			0.19	
Control Delay	18.0	51.2		19.0	29.8		44.2	9.7			16.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay	18.0	51.2		19.0	29.8		44.2	9.7			16.9	
LOS	B	D		B	C		D	A			B	
Approach Delay		50.1			29.2			30.6			16.9	
Approach LOS		D			C			C			B	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 85.3
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 38.4 — Intersection LOS: D
Intersection Capacity Utilization 56.9% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 44: 7th Ave N/TC DR (exit)/187th Ave N/TC DR (exit) & NE 185th St



Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	58	491	30	3	373	20	26	5	11	16	5	67
Future Vol, veh/h	58	491	30	3	373	20	26	5	11	16	5	67
Conflicting Peds, #/hr	4	0	3	3	0	4	1	0	7	7	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	100	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	-2	-	-	0	-
Peak Hour Factor	98	98	98	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	1	1	1	1	1	1	3	3	3	0	0	0
Mvmt Flow	59	501	31	3	393	21	27	5	12	17	5	71

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	418	0	0	535	0	0	1086	1062	526	1063	1066	408
Stage 1	-	-	-	-	-	-	638	638	-	413	413	-
Stage 2	-	-	-	-	-	-	448	424	-	650	653	-
Critical Hdwy	4.11	-	-	4.11	-	-	6.73	6.13	6.03	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	5.73	5.13	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.73	5.13	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.209	-	-	3.527	4.027	3.327	3.5	4	3.3
Pot Cap-1 Maneuver	1146	-	-	1038	-	-	218	250	566	203	224	648
Stage 1	-	-	-	-	-	-	497	504	-	620	597	-
Stage 2	-	-	-	-	-	-	618	614	-	461	467	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1145	-	-	1032	-	-	182	235	562	186	211	646
Mov Cap-2 Maneuver	-	-	-	-	-	-	182	235	-	186	211	-
Stage 1	-	-	-	-	-	-	470	477	-	586	593	-
Stage 2	-	-	-	-	-	-	544	610	-	421	442	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0.1	24.4	16.3
HCM LOS			C	C

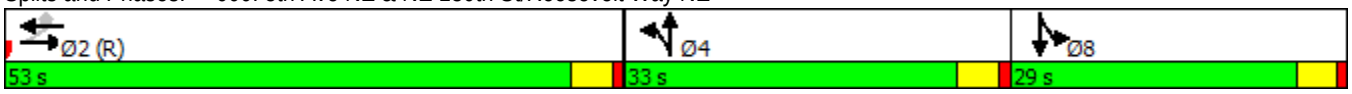
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	229	1145	-	-	1032	-	-	412
HCM Lane V/C Ratio	0.193	0.052	-	-	0.003	-	-	0.225
HCM Control Delay (s)	24.4	8.3	-	-	8.5	-	-	16.3
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.7	0.2	-	-	0	-	-	0.9

APPENDIX E: SYNCHRO ANALYSIS – MAINTENANCE OF TRAFFIC

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	542	154	0	666	107	448	56	111	54	249	23
Future Volume (vph)	42	542	154	0	666	107	448	56	111	54	249	23
Satd. Flow (prot)	0	3338	0	0	3387	1567	1664	3144	0	1626	3263	0
Flt Permitted		0.849					0.950	0.972		0.950	0.999	
Satd. Flow (perm)	0	2842	0	0	3387	1547	1662	3142	0	1624	3263	0
Satd. Flow (RTOR)		36				114		44			7	
Confl. Peds. (#/hr)							1		2	2		1
Confl. Bikes (#/hr)						2						
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Shared Lane Traffic (%)							50%			10%		
Lane Group Flow (vph)	0	786	0	0	709	114	238	417	0	51	295	0
Turn Type	Perm	NA			NA	Perm	Split	NA		Split	NA	
Protected Phases		2			2		4	4		8	8	
Permitted Phases	2					2						
Total Split (s)	53.0	53.0			53.0	53.0	33.0	33.0		29.0	29.0	
Total Lost Time (s)		4.5			4.5	4.5	4.5	4.5		4.5	4.5	
Act Effct Green (s)		48.5			48.5	48.5	28.5	28.5		24.5	24.5	
Actuated g/C Ratio		0.42			0.42	0.42	0.25	0.25		0.21	0.21	
v/c Ratio		0.64			0.50	0.16	0.58	0.51		0.15	0.42	
Control Delay		28.1			25.8	4.3	44.5	35.7		38.2	40.3	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		28.1			25.8	4.3	44.5	35.7		38.2	40.3	
LOS		C			C	A	D	D		D	D	
Approach Delay		28.1			22.8			38.9			40.0	
Approach LOS		C			C			D			D	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 115	
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green	
Control Type: Pretimed	
Maximum v/c Ratio: 0.64	
Intersection Signal Delay: 30.7	Intersection LOS: C
Intersection Capacity Utilization 94.5%	ICU Level of Service F
Analysis Period (min) 15	

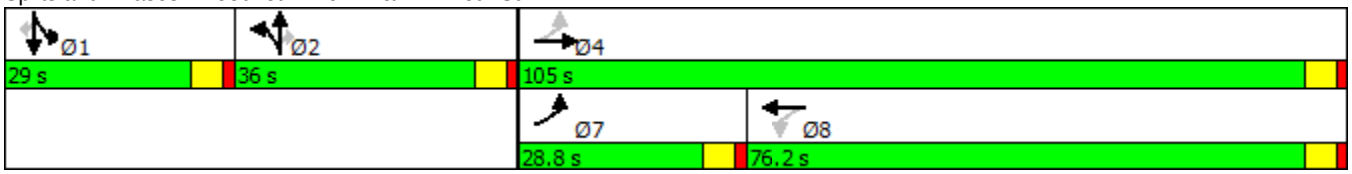
Splits and Phases: 600: 5th Ave NE & NE 130th St/Roosevelt Way NE



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	241	426	56	45	754	205	318	274	336	40	202	288
Future Volume (vph)	241	426	56	45	754	205	318	274	336	40	202	288
Satd. Flow (prot)	1745	3530	0	0	3365	0	1480	3180	1560	1624	2027	1507
Flt Permitted	0.086				0.888		0.950	0.985		0.950		
Satd. Flow (perm)	158	3530	0	0	2992	0	1478	3178	1506	1604	2027	1486
Satd. Flow (RTOR)		14			23				373			266
Confl. Peds. (#/hr)	1		7	7		1	1		9	9		1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Shared Lane Traffic (%)							39%					
Lane Group Flow (vph)	268	535	0	0	1116	0	215	442	373	44	224	320
Turn Type	pm+pt	NA		Perm	NA		Split	NA	Perm	Split	NA	Perm
Protected Phases	7	4			8		2	2		1	1	
Permitted Phases	4			8					2			1
Total Split (s)	28.8	105.0		76.2	76.2		36.0	36.0	36.0	29.0	29.0	29.0
Total Lost Time (s)	5.5	5.5			5.5		5.5	5.5	5.5	5.5	5.5	5.5
Act Effct Green (s)	91.3	91.3			62.9		27.8	27.8	27.8	21.1	21.1	21.1
Actuated g/C Ratio	0.58	0.58			0.40		0.18	0.18	0.18	0.13	0.13	0.13
v/c Ratio	0.83	0.26			0.92		0.82	0.79	0.65	0.20	0.82	0.75
Control Delay	60.6	16.4			56.9		88.6	74.1	11.1	67.1	91.7	25.3
Queue Delay	0.0	0.4			0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.6	16.8			56.9		88.6	74.1	11.1	67.1	91.7	25.3
LOS	E	B			E		F	E	B	E	F	C
Approach Delay		31.4			56.9			54.3			53.8	
Approach LOS		C			E			D			D	

Intersection Summary	
Cycle Length: 170	
Actuated Cycle Length: 157.1	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 49.8	Intersection LOS: D
Intersection Capacity Utilization 84.9%	ICU Level of Service E
Analysis Period (min) 15	

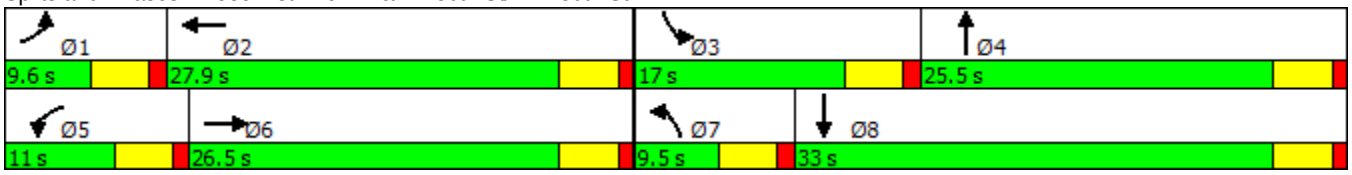
Splits and Phases: 530: 5th Ave NE & NE 145th St



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	731	55	111	583	185	19	93	90	231	349	46
Future Volume (vph)	67	731	55	111	583	185	19	93	90	231	349	46
Satd. Flow (prot)	1652	3382	0	1635	3246	0	1685	1759	0	1668	1844	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1649	3382	0	1635	3246	0	1676	1759	0	1668	1844	0
Satd. Flow (RTOR)		9			54			59			9	
Confl. Peds. (#/hr)	2					2	8					8
Confl. Bikes (#/hr)			1									2
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	0%	0%	0%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	68	802	0	113	784	0	19	187	0	236	403	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases												
Total Split (s)	9.6	26.5		11.0	27.9		9.5	25.5		17.0	33.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Act Effct Green (s)	5.1	19.6		6.4	23.2		5.1	10.9		11.9	25.8	
Actuated g/C Ratio	0.08	0.29		0.10	0.35		0.08	0.16		0.18	0.38	
v/c Ratio	0.54	0.81		0.73	0.68		0.15	0.56		0.80	0.56	
Control Delay	51.3	30.5		61.9	22.9		35.8	24.8		50.7	20.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	51.3	30.5		61.9	22.9		35.8	24.8		50.7	20.6	
LOS	D	C		E	C		D	C		D	C	
Approach Delay		32.1			27.8			25.8			31.8	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 67.1	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 30.0	Intersection LOS: C
Intersection Capacity Utilization 68.5%	ICU Level of Service C
Analysis Period (min) 15	

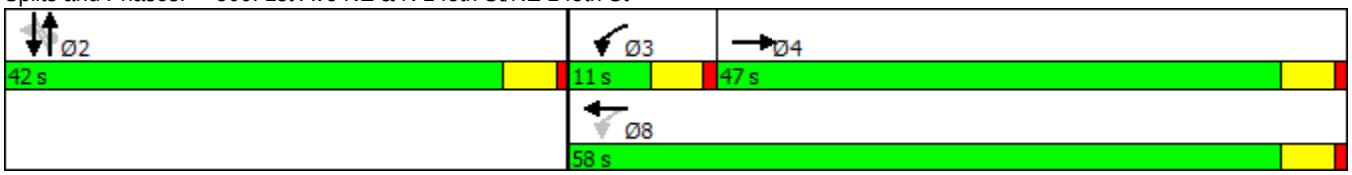
Splits and Phases: 585: 1st Ave NE & N 130th St/NE 130th St



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1181	35	139	614	15	18	44	149	165	168	4
Future Volume (vph)	0	1181	35	139	614	15	18	44	149	165	168	4
Satd. Flow (prot)	0	3490	0	0	3328	0	0	1400	0	0	1686	0
Flt Permitted					0.503			0.953			0.664	
Satd. Flow (perm)	0	3490	0	0	1689	0	0	1340	0	0	1144	0
Satd. Flow (RTOR)		4			3			138			1	
Confl. Peds. (#/hr)	2		4	4		2	1		6	6		1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Parking (#/hr)							4	4	4			
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1336	0	0	844	0	0	232	0	0	370	0
Turn Type		NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		4		3	8			2			2	
Permitted Phases				8			2			2		
Total Split (s)		47.0		11.0	58.0		42.0	42.0		42.0	42.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Act Effct Green (s)		53.2			53.2			31.9			31.9	
Actuated g/C Ratio		0.56			0.56			0.34			0.34	
v/c Ratio		0.68			1.26dl			0.43			0.96	
Control Delay		18.2			33.9			12.3			69.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		18.2			33.9			12.3			69.8	
LOS		B			C			B			E	
Approach Delay		18.2			33.9			12.3			69.8	
Approach LOS		B			C			B			E	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 95.2	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.96	
Intersection Signal Delay: 29.3	Intersection LOS: C
Intersection Capacity Utilization 103.6%	ICU Level of Service G
Analysis Period (min) 15	
dl Defacto Left Lane. Recode with 1 though lane as a left lane.	

Splits and Phases: 500: 1st Ave NE & N 145th St/NE 145th St

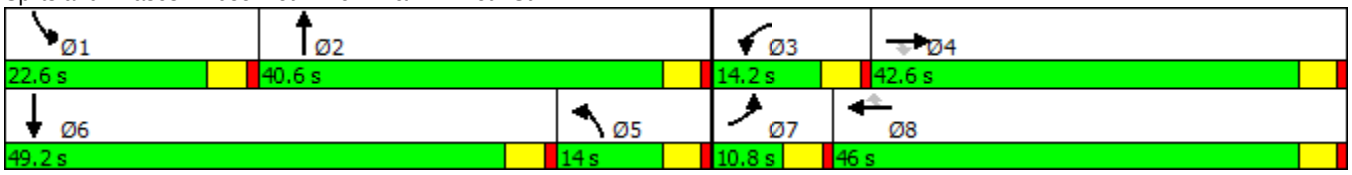


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	47	436	88	88	425	59	87	146	46	141	833	220
Future Volume (vph)	47	436	88	88	425	59	87	146	46	141	833	220
Satd. Flow (prot)	1734	1704	1552	1752	1721	1567	1753	3222	0	1760	3246	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1716	1704	1493	1728	1721	1519	1728	3222	0	1712	3246	0
Satd. Flow (RTOR)			136			136		35			31	
Confl. Peds. (#/hr)	11		15	15		11	36		12	12		36
Confl. Bikes (#/hr)			1			1			2			
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	48	449	91	91	438	61	90	198	0	145	1086	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Total Split (s)	10.8	42.6	42.6	14.2	46.0	46.0	14.0	40.6		22.6	49.2	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Act Effct Green (s)	6.1	33.0	33.0	8.7	38.2	38.2	8.6	36.1		13.3	40.8	
Actuated g/C Ratio	0.06	0.30	0.30	0.08	0.35	0.35	0.08	0.33		0.12	0.37	
v/c Ratio	0.50	0.87	0.17	0.65	0.73	0.10	0.66	0.18		0.68	0.89	
Control Delay	72.6	56.1	2.1	74.8	41.2	0.3	75.5	23.8		64.6	41.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	72.6	56.1	2.1	74.8	41.2	0.3	75.5	23.8		64.6	41.9	
LOS	E	E	A	E	D	A	E	C		E	D	
Approach Delay		49.1			42.2			39.9			44.6	
Approach LOS		D			D			D			D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 109.5
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 44.5 — Intersection LOS: D
Intersection Capacity Utilization 78.3% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 635: 15th Ave NE & NE 125th St

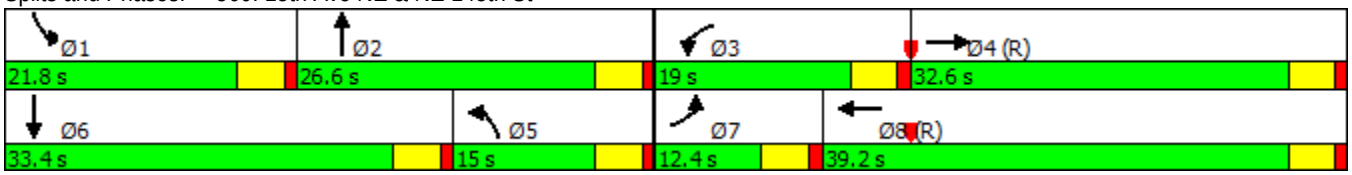


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	84	605	122	184	742	78	111	180	69	160	763	85
Future Volume (vph)	84	605	122	184	742	78	111	180	69	160	763	85
Satd. Flow (prot)	1752	3283	0	1787	3400	0	1645	3119	0	1787	3393	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1747	3283	0	1771	3400	0	1636	3119	0	1757	3393	0
Satd. Flow (RTOR)		23			12			51			12	
Confl. Peds. (#/hr)	8		17	17		8	14		17	17		14
Confl. Bikes (#/hr)									2			
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	5%	5%	5%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	85	734	0	186	828	0	112	252	0	162	857	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Total Split (s)	12.4	32.6		19.0	39.2		15.0	26.6		21.8	33.4	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Act Effct Green (s)	7.4	29.5		13.1	37.2		10.5	26.3		13.1	28.9	
Actuated g/C Ratio	0.07	0.30		0.13	0.37		0.10	0.26		0.13	0.29	
v/c Ratio	0.66	0.75		0.79	0.65		0.65	0.29		0.69	0.87	
Control Delay	69.1	36.8		66.1	29.4		61.7	25.3		56.6	44.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	69.1	36.8		66.1	29.4		61.7	25.3		56.6	44.0	
LOS	E	D		E	C		E	C		E	D	
Approach Delay		40.1			36.1			36.5			46.0	
Approach LOS		D			D			D			D	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 40.3 — Intersection LOS: D
Intersection Capacity Utilization 76.2% — ICU Level of Service D
Analysis Period (min) 15

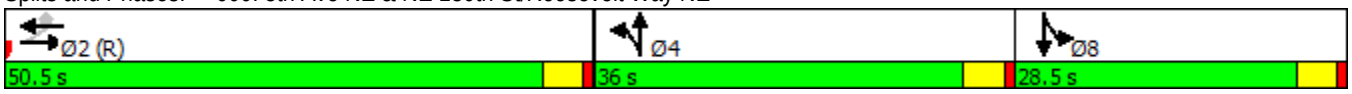
Splits and Phases: 560: 15th Ave NE & NE 145th St



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	549	0	0	666	0	353	0	111	10	3	9
Future Volume (vph)	0	549	0	0	666	0	353	0	111	10	3	9
Satd. Flow (prot)	0	3455	0	0	3387	1844	1664	3080	0	1626	2947	0
Flt Permitted							0.950	0.970		0.950	0.991	
Satd. Flow (perm)	0	3455	0	0	3387	1844	1662	3077	0	1623	2946	0
Satd. Flow (RTOR)								102			10	
Confl. Peds. (#/hr)							1		2	2		1
Confl. Bikes (#/hr)						2						
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Shared Lane Traffic (%)							50%			24%		
Lane Group Flow (vph)	0	584	0	0	709	0	188	306	0	8	16	0
Turn Type		NA			NA	Perm	Split	NA		Split	NA	
Protected Phases		2			2		4	4		8	8	
Permitted Phases	2					2						
Total Split (s)	50.5	50.5			50.5	50.5	36.0	36.0		28.5	28.5	
Total Lost Time (s)		4.5			4.5	4.5	4.5	4.5		4.5	4.5	
Act Effct Green (s)		46.0			46.0		31.5	31.5		24.0	24.0	
Actuated g/C Ratio		0.40			0.40		0.27	0.27		0.21	0.21	
v/c Ratio		0.42			0.52		0.41	0.33		0.02	0.03	
Control Delay		26.1			27.9		37.5	23.0		36.6	23.1	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		26.1			27.9		37.5	23.0		36.6	23.1	
LOS		C			C		D	C		D	C	
Approach Delay		26.1			27.9			28.5			27.6	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 115	
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green	
Control Type: Pretimed	
Maximum v/c Ratio: 0.52	
Intersection Signal Delay: 27.5	Intersection LOS: C
Intersection Capacity Utilization 45.9%	ICU Level of Service A
Analysis Period (min) 15	

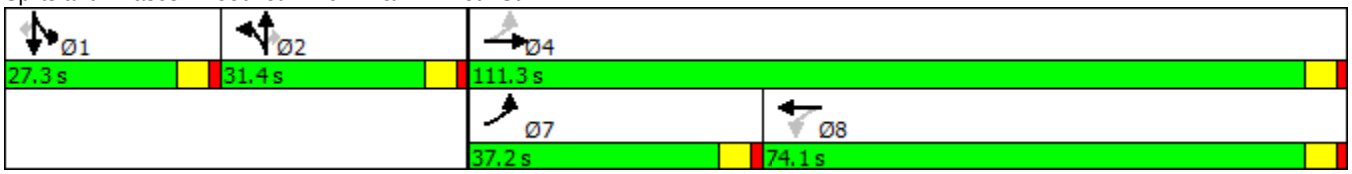
Splits and Phases: 600: 5th Ave NE & NE 130th St/Roosevelt Way NE



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	283	444	0	0	754	366	317	70	334	40	0	288
Future Volume (vph)	283	444	0	0	754	366	317	70	334	40	0	288
Satd. Flow (prot)	1745	3610	0	0	3303	0	1480	3122	1560	1624	2027	1507
Flt Permitted	0.061						0.950	0.967		0.950		
Satd. Flow (perm)	112	3610	0	0	3303	0	1477	3116	1506	1598	2027	1486
Satd. Flow (RTOR)					58				371			321
Confl. Peds. (#/hr)	1		7	7		1	1		9	9		1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Shared Lane Traffic (%)							50%					
Lane Group Flow (vph)	314	493	0	0	1245	0	176	254	371	44	0	320
Turn Type	pm+pt	NA			NA		Split	NA	Perm	Split		Perm
Protected Phases	7	4			8		2	2		1	1	
Permitted Phases	4			8					2			1
Total Split (s)	37.2	111.3		74.1	74.1		31.4	31.4	31.4	27.3	27.3	27.3
Total Lost Time (s)	5.5	5.5			5.5		5.5	5.5	5.5	5.5	5.5	5.5
Act Effct Green (s)	94.3	94.3			59.5		22.7	22.7	22.7	10.6		10.6
Actuated g/C Ratio	0.65	0.65			0.41		0.16	0.16	0.16	0.07		0.07
v/c Ratio	0.78	0.21			0.90		0.76	0.52	0.68	0.37		0.79
Control Delay	55.7	10.9			47.8		82.1	62.6	12.3	77.5		21.2
Queue Delay	0.0	0.0			0.0		0.0	0.0	0.0	0.0		0.0
Total Delay	55.7	10.9			47.8		82.1	62.6	12.3	77.5		21.2
LOS	E	B			D		F	E	B	E		C
Approach Delay		28.3			47.8			43.6			28.0	
Approach LOS		C			D			D			C	

Intersection Summary	
Cycle Length: 170	
Actuated Cycle Length: 144.7	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.90	
Intersection Signal Delay: 39.6	Intersection LOS: D
Intersection Capacity Utilization 78.3%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 530: 5th Ave NE & NE 145th St



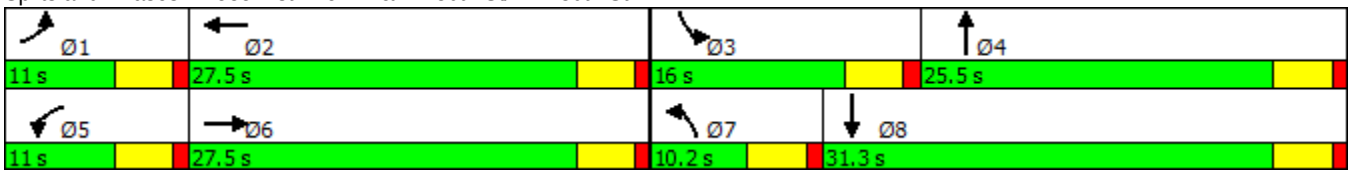
585: 1st Ave NE & N 130th St/NE 130th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	576	172	109	499	162	91	121	85	201	419	58
Future Volume (vph)	105	576	172	109	499	162	91	121	85	201	419	58
Satd. Flow (prot)	1652	3285	0	1635	3242	0	1685	1782	0	1668	1842	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1649	3285	0	1635	3242	0	1677	1782	0	1668	1842	0
Satd. Flow (RTOR)		49			55			43			9	
Confl. Peds. (#/hr)	2					2	8					8
Confl. Bikes (#/hr)			1									2
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	0%	0%	0%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	107	764	0	111	674	0	93	210	0	205	487	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases												
Total Split (s)	11.0	27.5		11.0	27.5		10.2	25.5		16.0	31.3	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Act Effct Green (s)	6.3	19.4		6.4	19.5		5.7	15.9		10.6	23.6	
Actuated g/C Ratio	0.09	0.27		0.09	0.28		0.08	0.22		0.15	0.33	
v/c Ratio	0.73	0.82		0.76	0.72		0.69	0.48		0.83	0.79	
Control Delay	65.8	31.4		69.7	27.2		64.0	23.4		60.2	33.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	65.8	31.4		69.7	27.2		64.0	23.4		60.2	33.5	
LOS	E	C		E	C		E	C		E	C	
Approach Delay		35.7			33.2			35.8			41.4	
Approach LOS		D			C			D			D	

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 70.9
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 36.4 — Intersection LOS: D
Intersection Capacity Utilization 73.2% — ICU Level of Service D
Analysis Period (min) 15

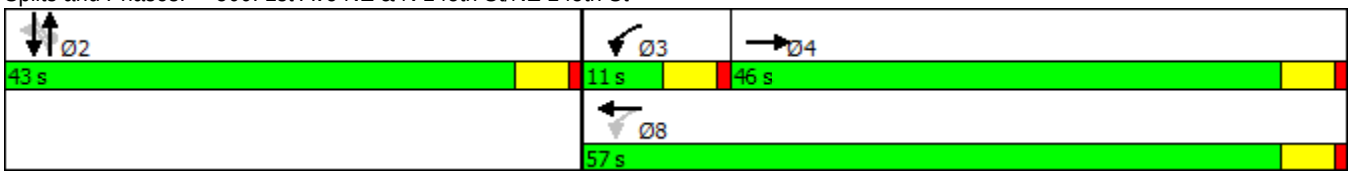
Splits and Phases: 585: 1st Ave NE & N 130th St/NE 130th St



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1147	69	139	613	15	19	45	191	161	186	4
Future Volume (vph)	0	1147	69	139	613	15	19	45	191	161	186	4
Satd. Flow (prot)	0	3469	0	0	3328	0	0	1390	0	0	1689	0
Flt Permitted					0.498			0.957			0.637	
Satd. Flow (perm)	0	3469	0	0	1672	0	0	1335	0	0	1098	0
Satd. Flow (RTOR)		7			3			153			1	
Confl. Peds. (#/hr)	2		4	4		2	1		6	6		1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Parking (#/hr)							4	4	4			
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1336	0	0	843	0	0	280	0	0	385	0
Turn Type		NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		4		3	8			2			2	
Permitted Phases				8			2			2		
Total Split (s)		46.0		11.0	57.0		43.0	43.0		43.0	43.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Act Effct Green (s)		52.1			52.1			34.6			34.6	
Actuated g/C Ratio		0.54			0.54			0.36			0.36	
v/c Ratio		0.71			1.42dl			0.49			0.98	
Control Delay		20.0			41.1			13.5			72.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		20.0			41.1			13.5			72.6	
LOS		C			D			B			E	
Approach Delay		20.0			41.1			13.5			72.6	
Approach LOS		C			D			B			E	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 96.8	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.98	
Intersection Signal Delay: 32.7	Intersection LOS: C
Intersection Capacity Utilization 106.7%	ICU Level of Service G
Analysis Period (min) 15	
dl Defacto Left Lane. Recode with 1 though lane as a left lane.	

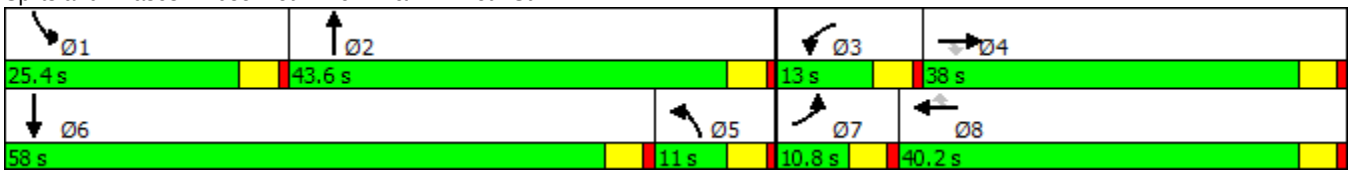
Splits and Phases: 500: 1st Ave NE & N 145th St/NE 145th St



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	47	405	82	88	336	148	69	218	46	172	1054	220
Future Volume (vph)	47	405	82	88	336	148	69	218	46	172	1054	220
Satd. Flow (prot)	1734	1704	1552	1752	1721	1567	1753	3268	0	1760	3272	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1714	1704	1493	1727	1721	1519	1735	3268	0	1717	3272	0
Satd. Flow (RTOR)			136			151		22			26	
Confl. Peds. (#/hr)	11		15	15		11	36		12	12		36
Confl. Bikes (#/hr)			1			1			2			
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	48	418	85	91	346	153	71	272	0	177	1314	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Total Split (s)	10.8	38.0	38.0	13.0	40.2	40.2	11.0	43.6		25.4	58.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Act Effct Green (s)	6.0	30.8	30.8	8.1	35.2	35.2	6.5	40.8		15.5	49.9	
Actuated g/C Ratio	0.05	0.27	0.27	0.07	0.31	0.31	0.06	0.36		0.14	0.44	
v/c Ratio	0.52	0.90	0.17	0.73	0.65	0.27	0.72	0.23		0.73	0.90	
Control Delay	75.3	64.9	1.8	85.8	42.3	6.5	92.2	25.2		65.9	39.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	75.3	64.9	1.8	85.8	42.3	6.5	92.2	25.2		65.9	39.2	
LOS	E	E	A	F	D	A	F	C		E	D	
Approach Delay		56.1			39.7			39.0			42.4	
Approach LOS		E			D			D			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 113.4	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.90	
Intersection Signal Delay: 44.0	Intersection LOS: D
Intersection Capacity Utilization 82.1%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 635: 15th Ave NE & NE 125th St



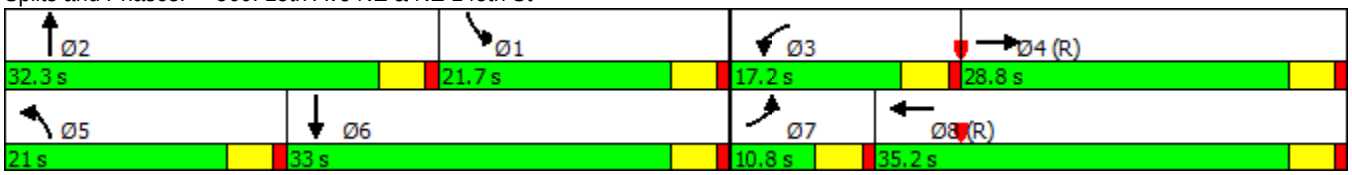
Synchro 9 Report
560: 15th Ave NE & NE 145th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	604	140	225	702	78	272	180	70	160	956	80
Future Volume (vph)	83	604	140	225	702	78	272	180	70	160	956	80
Satd. Flow (prot)	1752	3270	0	1787	3396	0	1645	3119	0	1787	3406	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1747	3270	0	1771	3396	0	1638	3119	0	1757	3406	0
Satd. Flow (RTOR)		26			12			57			9	
Confl. Peds. (#/hr)	8		17	17		8	14		17	17		14
Confl. Bikes (#/hr)									2			
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	5%	5%	5%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	84	751	0	227	788	0	275	253	0	162	1047	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Total Split (s)	10.8	28.8		17.2	35.2		21.0	32.3		21.7	33.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Act Effct Green (s)	6.3	24.3		12.7	30.7		16.5	27.8		17.2	28.5	
Actuated g/C Ratio	0.06	0.24		0.13	0.31		0.16	0.28		0.17	0.28	
v/c Ratio	0.77	0.92		1.00	0.75		1.01	0.28		0.53	1.07	
Control Delay	87.6	54.0		106.3	36.0		101.5	22.6		44.7	85.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	87.6	54.0		106.3	36.0		101.5	22.6		44.7	85.1	
LOS	F	D		F	D		F	C		D	F	
Approach Delay		57.4			51.7			63.7			79.7	
Approach LOS		E			D			E			E	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.07
Intersection Signal Delay: 64.2 — Intersection LOS: E
Intersection Capacity Utilization 93.1% — ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 560: 15th Ave NE & NE 145th St

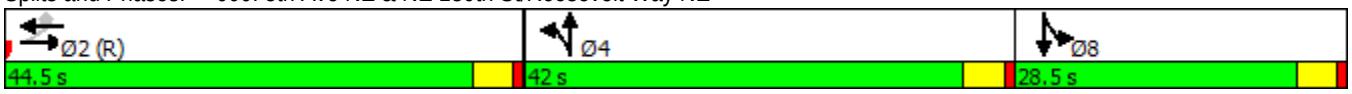


Synchro 9 Report
600: 5th Ave NE & NE 130th St/Roosevelt Way NE

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	592	92	0	746	110	783	273	233	120	91	21
Future Volume (vph)	43	592	92	0	746	110	783	273	233	120	91	21
Satd. Flow (prot)	0	3399	0	0	3455	1599	1680	3200	0	1643	3221	0
Flt Permitted		0.761					0.950	0.980		0.950	0.986	
Satd. Flow (perm)	0	2594	0	0	3455	1568	1669	3191	0	1639	3219	0
Satd. Flow (RTOR)		15				94		46			13	
Confl. Peds. (#/hr)	4		12	12		4	6		5	5		6
Confl. Bikes (#/hr)						1			1			1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	0%
Shared Lane Traffic (%)							44%			36%		
Lane Group Flow (vph)	0	758	0	0	777	115	457	886	0	80	162	0
Turn Type	Perm	NA			NA	Perm	Split	NA		Split	NA	
Protected Phases		2			2		4	4		8	8	
Permitted Phases	2					2						
Total Split (s)	44.5	44.5			44.5	44.5	42.0	42.0		28.5	28.5	
Total Lost Time (s)		4.5			4.5	4.5	4.5	4.5		4.5	4.5	
Act Effct Green (s)		40.0			40.0	40.0	37.5	37.5		24.0	24.0	
Actuated g/C Ratio		0.35			0.35	0.35	0.33	0.33		0.21	0.21	
v/c Ratio		0.83			0.65	0.19	0.84	0.82		0.23	0.24	
Control Delay		43.0			34.6	8.4	50.9	41.5		40.0	35.8	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		43.0			34.6	8.4	50.9	41.5		40.0	35.8	
LOS		D			C	A	D	D		D	D	
Approach Delay		43.0			31.2			44.7			37.2	
Approach LOS		D			C			D			D	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 115	
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green	
Control Type: Pretimed	
Maximum v/c Ratio: 0.84	
Intersection Signal Delay: 40.0	Intersection LOS: D
Intersection Capacity Utilization 101.6%	ICU Level of Service G
Analysis Period (min) 15	

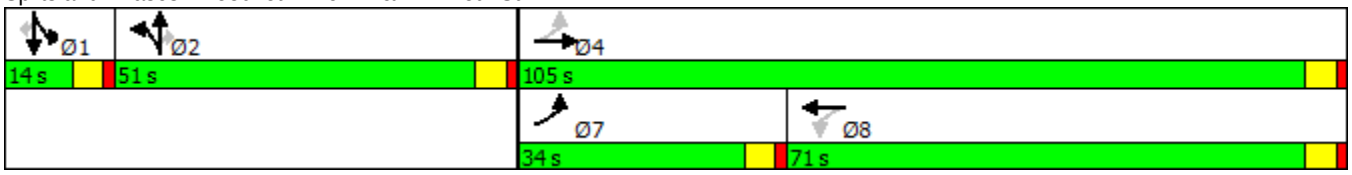
Splits and Phases: 600: 5th Ave NE & NE 130th St/Roosevelt Way NE



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	373	907	141	3	682	285	348	597	443	21	55	91
Future Volume (vph)	373	907	141	3	682	285	348	597	443	21	55	91
Satd. Flow (prot)	1762	3550	0	0	3348	0	1510	3283	1591	1593	1987	1478
Flt Permitted	0.091				0.952		0.950	0.997		0.950		
Satd. Flow (perm)	169	3550	0	0	3187	0	1510	3283	1557	1588	1987	1478
Satd. Flow (RTOR)		17			44				176			92
Confl. Peds. (#/hr)	4		7	7		4			3	3		
Confl. Bikes (#/hr)			2						2			
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	0%	0%	0%	3%	3%	3%
Shared Lane Traffic (%)							12%					
Lane Group Flow (vph)	377	1058	0	0	980	0	310	645	447	21	56	92
Turn Type	pm+pt	NA		Perm	NA		Split	NA	Perm	Split	NA	Perm
Protected Phases	7	4			8		2	2		1	1	
Permitted Phases	4			8					2			1
Total Split (s)	34.0	105.0		71.0	71.0		51.0	51.0	51.0	14.0	14.0	14.0
Total Lost Time (s)	5.5	5.5			5.5		5.5	5.5	5.5	5.5	5.5	5.5
Act Effct Green (s)	86.7	86.7			52.1		40.1	40.1	40.1	8.0	8.0	8.0
Actuated g/C Ratio	0.57	0.57			0.34		0.26	0.26	0.26	0.05	0.05	0.05
v/c Ratio	0.94	0.52			0.87		0.78	0.74	0.83	0.25	0.53	0.56
Control Delay	74.9	20.8			53.9		67.2	57.7	45.8	82.6	93.8	27.1
Queue Delay	0.0	0.7			0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.9	21.5			53.9		67.2	57.7	45.8	82.6	93.8	27.1
LOS	E	C			D		E	E	D	F	F	C
Approach Delay		35.6			53.9			56.0			56.1	
Approach LOS		D			D			E			E	

Intersection Summary	
Cycle Length: 170	
Actuated Cycle Length: 151.5	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.94	
Intersection Signal Delay: 48.1	Intersection LOS: D
Intersection Capacity Utilization 93.7%	ICU Level of Service F
Analysis Period (min) 15	

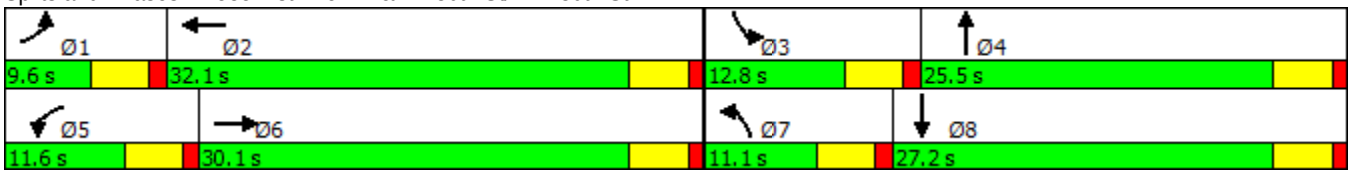
Splits and Phases: 530: 5th Ave NE & NE 145th St



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	47	705	25	86	923	240	46	330	108	150	135	50
Future Volume (vph)	47	705	25	86	923	240	46	330	108	150	135	50
Satd. Flow (prot)	1685	3469	0	1668	3325	0	1685	1823	0	1685	1813	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1680	3469	0	1667	3325	0	1677	1823	0	1684	1813	0
Satd. Flow (RTOR)		5			44			20			24	
Confl. Peds. (#/hr)	6		1	1		6	5		1	1		5
Confl. Bikes (#/hr)			1						1			1
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	48	753	0	89	1199	0	47	451	0	155	191	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases												
Total Split (s)	9.6	30.1		11.6	32.1		11.1	25.5		12.8	27.2	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Act Effct Green (s)	5.1	24.7		6.4	28.0		5.6	20.0		8.1	26.7	
Actuated g/C Ratio	0.07	0.33		0.09	0.37		0.07	0.27		0.11	0.36	
v/c Ratio	0.42	0.66		0.63	0.95		0.37	0.90		0.86	0.29	
Control Delay	47.5	25.8		56.1	40.4		43.7	50.4		76.0	19.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	47.5	25.8		56.1	40.4		43.7	50.4		76.0	19.4	
LOS	D	C		E	D		D	D		E	B	
Approach Delay		27.1			41.5			49.7			44.7	
Approach LOS		C			D			D			D	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 75.1	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.95	
Intersection Signal Delay: 39.3	Intersection LOS: D
Intersection Capacity Utilization 84.7%	ICU Level of Service E
Analysis Period (min) 15	

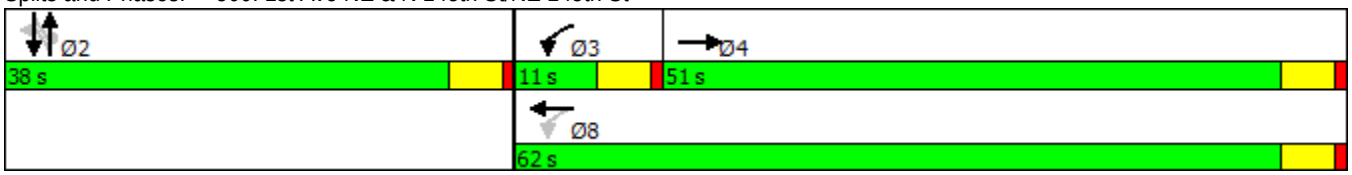
Splits and Phases: 585: 1st Ave NE & N 130th St/NE 130th St



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	897	14	116	1017	49	58	224	181	36	64	12
Future Volume (vph)	0	897	14	116	1017	49	58	224	181	36	64	12
Satd. Flow (prot)	0	3499	0	0	3396	0	0	1531	0	0	1693	0
Flt Permitted					0.666			0.945			0.721	
Satd. Flow (perm)	0	3499	0	0	2273	0	0	1456	0	0	1240	0
Satd. Flow (RTOR)		2			7			35			7	
Confl. Peds. (#/hr)	1		1	1		1			6	6		
Confl. Bikes (#/hr)						1						
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Parking (#/hr)							4	4	4			
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	949	0	0	1231	0	0	482	0	0	118	0
Turn Type		NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		4		3	8			2			2	
Permitted Phases				8			2			2		
Total Split (s)		51.0		11.0	62.0		38.0	38.0		38.0	38.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Act Effct Green (s)		57.0			57.0			31.8			31.8	
Actuated g/C Ratio		0.58			0.58			0.32			0.32	
v/c Ratio		0.47			0.94			0.98			0.29	
Control Delay		13.3			34.4			68.3			25.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		13.3			34.4			68.3			25.8	
LOS		B			C			E			C	
Approach Delay		13.3			34.4			68.3			25.8	
Approach LOS		B			C			E			C	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 98.8	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.98	
Intersection Signal Delay: 32.7	Intersection LOS: C
Intersection Capacity Utilization 99.2%	ICU Level of Service F
Analysis Period (min) 15	

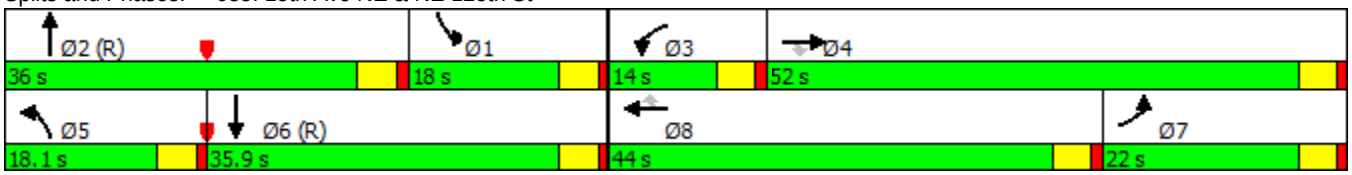
Splits and Phases: 500: 1st Ave NE & N 145th St/NE 145th St



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	576	93	98	489	151	106	617	86	145	369	126
Future Volume (vph)	203	576	93	98	489	151	106	617	86	145	369	126
Satd. Flow (prot)	1751	1721	1567	1769	1738	1583	1805	3387	0	1743	3207	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1748	1721	1453	1721	1738	1559	1781	3387	0	1697	3207	0
Satd. Flow (RTOR)			136			136		12			38	
Confl. Peds. (#/hr)	2		36	36		2	15		24	24		15
Confl. Bikes (#/hr)									3			4
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	207	588	95	100	499	154	108	718	0	148	506	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Total Split (s)	22.0	52.0	52.0	14.0	44.0	44.0	18.1	36.0		18.0	35.9	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Act Effct Green (s)	16.4	44.7	44.7	9.0	37.4	37.4	11.0	35.7		12.5	37.3	
Actuated g/C Ratio	0.14	0.37	0.37	0.08	0.31	0.31	0.09	0.30		0.10	0.31	
v/c Ratio	0.87	0.92	0.15	0.75	0.92	0.27	0.65	0.71		0.81	0.50	
Control Delay	70.6	44.7	0.8	86.6	63.7	7.7	70.9	42.6		84.4	34.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	70.6	44.7	0.8	86.6	63.7	7.7	70.9	42.6		84.4	34.5	
LOS	E	D	A	F	E	A	E	D		F	C	
Approach Delay		46.0			55.3			46.3			45.8	
Approach LOS		D			E			D			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 53 (44%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 48.3	Intersection LOS: D
Intersection Capacity Utilization 80.1%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 635: 15th Ave NE & NE 125th St

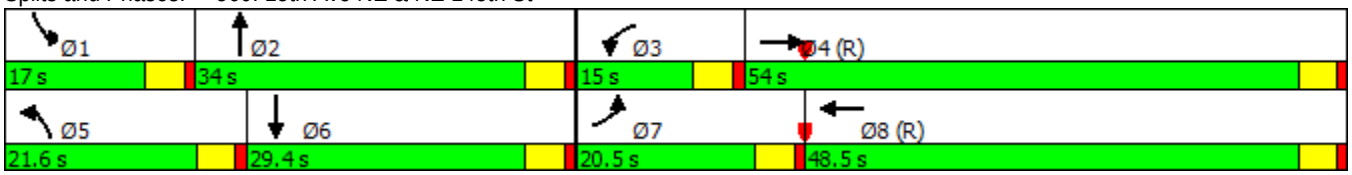


Synchro 9 Report
560: 15th Ave NE & NE 145th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	170	1008	164	114	753	181	173	648	96	146	315	116
Future Volume (vph)	170	1008	164	114	753	181	173	648	96	146	315	116
Satd. Flow (prot)	1787	3353	0	1805	3358	0	1694	3299	0	1823	3334	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1771	3353	0	1788	3358	0	1656	3299	0	1796	3334	0
Satd. Flow (RTOR)		18			28			13			40	
Confl. Peds. (#/hr)	24		28	28		24	25		25	25		25
Confl. Bikes (#/hr)			2						1			2
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	2%	2%	2%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	173	1196	0	116	953	0	177	759	0	149	439	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Total Split (s)	20.5	54.0		15.0	48.5		21.6	34.0		17.0	29.4	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Act Effct Green (s)	14.4	50.1		9.9	45.6		15.4	30.1		11.9	26.6	
Actuated g/C Ratio	0.12	0.42		0.08	0.38		0.13	0.25		0.10	0.22	
v/c Ratio	0.81	0.85		0.78	0.74		0.82	0.91		0.83	0.57	
Control Delay	78.3	38.2		86.9	35.6		78.8	58.7		87.2	41.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	78.3	38.2		86.9	35.6		78.8	58.7		87.2	41.5	
LOS	E	D		F	D		E	E		F	D	
Approach Delay		43.3			41.1			62.5			53.0	
Approach LOS		D			D			E			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.91	
Intersection Signal Delay: 48.7	Intersection LOS: D
Intersection Capacity Utilization 84.1%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 560: 15th Ave NE & NE 145th St

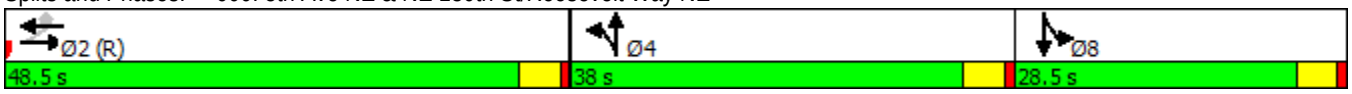


Synchro 9 Report
600: 5th Ave NE & NE 130th St/Roosevelt Way NE

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	642	0	0	746	0	458	0	233	11	5	16
Future Volume (vph)	0	642	0	0	746	0	458	0	233	11	5	16
Satd. Flow (prot)	0	3490	0	0	3455	1881	1680	3053	0	1643	2919	0
Flt Permitted							0.950	0.976		0.950	0.998	
Satd. Flow (perm)	0	3490	0	0	3455	1881	1666	3040	0	1636	2918	0
Satd. Flow (RTOR)								239			17	
Confl. Peds. (#/hr)	4		12	12		4	6		5	5		6
Confl. Bikes (#/hr)						1			1			1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	0%
Shared Lane Traffic (%)							48%			10%		
Lane Group Flow (vph)	0	669	0	0	777	0	248	472	0	10	23	0
Turn Type		NA			NA	Perm	Split	NA		Split	NA	
Protected Phases		2			2		4	4		8	8	
Permitted Phases	2					2						
Total Split (s)	48.5	48.5			48.5	48.5	38.0	38.0		28.5	28.5	
Total Lost Time (s)		4.5			4.5	4.5	4.5	4.5		4.5	4.5	
Act Effct Green (s)		44.0			44.0		33.5	33.5		24.0	24.0	
Actuated g/C Ratio		0.38			0.38		0.29	0.29		0.21	0.21	
v/c Ratio		0.50			0.59		0.51	0.45		0.03	0.04	
Control Delay		28.7			30.5		38.3	17.2		36.7	19.1	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		28.7			30.5		38.3	17.2		36.7	19.1	
LOS		C			C		D	B		D	B	
Approach Delay		28.7			30.5			24.5			24.5	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 115	
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green	
Control Type: Pretimed	
Maximum v/c Ratio: 0.59	
Intersection Signal Delay: 27.9	Intersection LOS: C
Intersection Capacity Utilization 65.7%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 600: 5th Ave NE & NE 130th St/Roosevelt Way NE



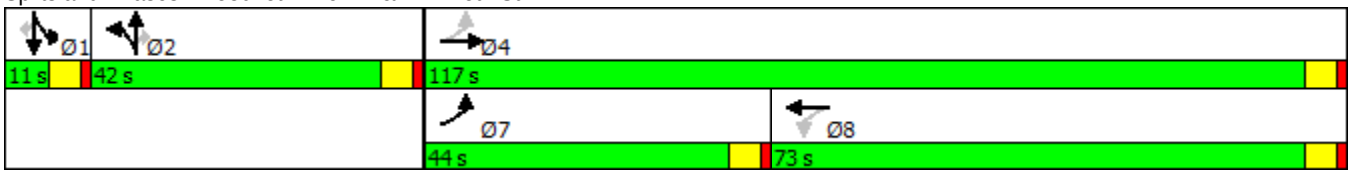
Synchro 9 Report
530: 5th Ave NE & NE 145th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	410	960	0	0	682	564	321	231	409	21	0	91
Future Volume (vph)	410	960	0	0	682	564	321	231	409	21	0	91
Satd. Flow (prot)	1762	3646	0	0	3253	0	1510	3230	1591	1593	1987	1478
Flt Permitted	0.059						0.950	0.981		0.950		
Satd. Flow (perm)	109	3646	0	0	3253	0	1510	3230	1557	1586	1987	1478
Satd. Flow (RTOR)					146				167			384
Confl. Peds. (#/hr)	4		7	7		4			3	3		
Confl. Bikes (#/hr)			2						2			
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	0%	0%	0%	3%	3%	3%
Shared Lane Traffic (%)							44%					
Lane Group Flow (vph)	414	970	0	0	1259	0	181	376	413	21	0	92
Turn Type	pm+pt	NA			NA		Split	NA	Perm	Split		Perm
Protected Phases	7	4			8		2	2		1	1	
Permitted Phases	4			8					2			1
Total Split (s)	44.0	117.0		73.0	73.0		42.0	42.0	42.0	11.0	11.0	11.0
Total Lost Time (s)	5.5	5.5			5.5		5.5	5.5	5.5	5.5	5.5	5.5
Act Effct Green (s)	104.9	104.9			62.0		32.7	32.7	32.7	5.6		5.6
Actuated g/C Ratio	0.66	0.66			0.39		0.20	0.20	0.20	0.04		0.04
v/c Ratio	0.91	0.41			0.93		0.59	0.57	0.92	0.38		0.22
Control Delay	72.8	13.7			54.5		67.2	61.7	63.1	100.1		1.2
Queue Delay	9.4	0.9			0.0		0.0	0.0	0.0	0.0		0.0
Total Delay	82.2	14.6			54.5		67.2	61.7	63.1	100.1		1.2
LOS	F	B			D		E	E	E	F		A
Approach Delay		34.8			54.5			63.3			19.6	
Approach LOS		C			D			E			B	

Intersection Summary

Cycle Length: 170
Actuated Cycle Length: 159.9
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 48.4 — Intersection LOS: D
Intersection Capacity Utilization 94.9% — ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 530: 5th Ave NE & NE 145th St

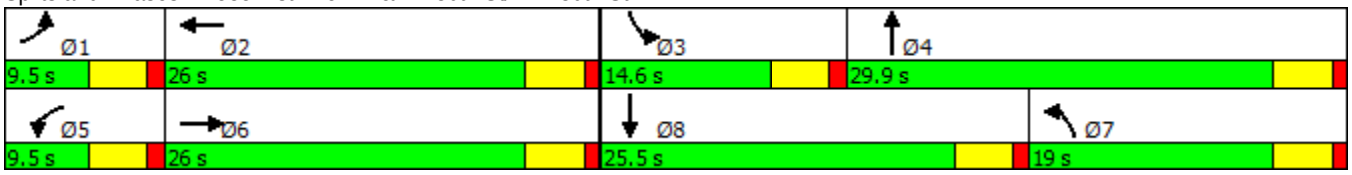


Synchro 9 Report
585: 1st Ave NE & N 130th St/NE 130th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	85	592	101	85	661	173	304	430	103	184	190	54
Future Volume (vph)	85	592	101	85	661	173	304	430	103	184	190	54
Satd. Flow (prot)	1685	3401	0	1668	3325	0	1685	1840	0	1685	1830	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1678	3401	0	1666	3325	0	1678	1840	0	1684	1830	0
Satd. Flow (RTOR)		24			40			16			17	
Confl. Peds. (#/hr)	6		1	1		6	5		1	1		5
Confl. Bikes (#/hr)			1						1			1
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	88	714	0	88	859	0	313	549	0	190	252	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases												
Total Split (s)	9.5	26.0		9.5	26.0		19.0	29.9		14.6	25.5	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Act Effct Green (s)	5.0	21.1		5.0	21.1		19.6	24.4		9.8	14.6	
Actuated g/C Ratio	0.06	0.27		0.06	0.27		0.25	0.31		0.13	0.19	
v/c Ratio	0.81	0.77		0.83	0.93		0.74	0.94		0.91	0.71	
Control Delay	88.9	32.0		90.9	45.0		42.4	52.6		79.6	38.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	88.9	32.0		90.9	45.0		42.4	52.6		79.6	38.9	
LOS	F	C		F	D		D	D		E	D	
Approach Delay		38.3			49.3			48.9			56.4	
Approach LOS		D			D			D			E	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 78.3	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.94	
Intersection Signal Delay: 47.3	Intersection LOS: D
Intersection Capacity Utilization 82.7%	ICU Level of Service E
Analysis Period (min) 15	

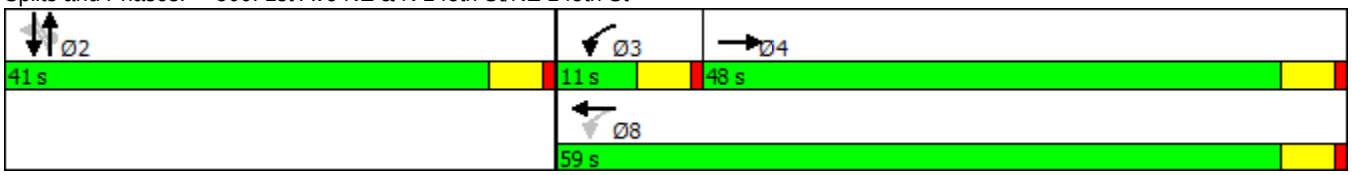
Splits and Phases: 585: 1st Ave NE & N 130th St/NE 130th St



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	810	101	116	991	47	83	231	218	35	70	12
Future Volume (vph)	0	810	101	116	991	47	83	231	218	35	70	12
Satd. Flow (prot)	0	3439	0	0	3396	0	0	1524	0	0	1696	0
Flt Permitted					0.648			0.926			0.753	
Satd. Flow (perm)	0	3439	0	0	2212	0	0	1423	0	0	1297	0
Satd. Flow (RTOR)		17			7			39			7	
Confl. Peds. (#/hr)	1		1	1		1			6	6		
Confl. Bikes (#/hr)						1						
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Parking (#/hr)							4	4	4			
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	949	0	0	1202	0	0	554	0	0	122	0
Turn Type		NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		4		3	8			2			2	
Permitted Phases				8			2			2		
Total Split (s)		48.0		11.0	59.0		41.0	41.0		41.0	41.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Act Effct Green (s)		54.0			54.0			36.0			36.0	
Actuated g/C Ratio		0.54			0.54			0.36			0.36	
v/c Ratio		0.51			1.00			1.03			0.26	
Control Delay		15.5			51.1			78.1			23.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		15.5			51.1			78.1			23.1	
LOS		B			D			E			C	
Approach Delay		15.5			51.1			78.1			23.1	
Approach LOS		B			D			E			C	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 43.2	Intersection LOS: D
Intersection Capacity Utilization 104.6%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 500: 1st Ave NE & N 145th St/NE 145th St

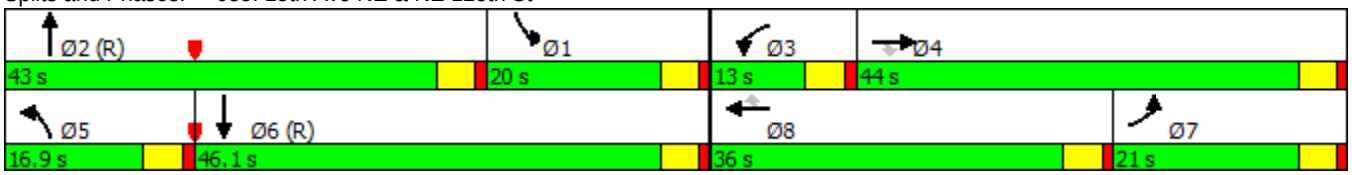


Synchro 9 Report
635: 15th Ave NE & NE 125th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	522	89	98	399	241	87	883	86	199	420	126
Future Volume (vph)	203	522	89	98	399	241	87	883	86	199	420	126
Satd. Flow (prot)	1751	1721	1567	1769	1738	1583	1805	3416	0	1743	3221	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1748	1721	1453	1717	1738	1559	1783	3416	0	1711	3221	0
Satd. Flow (RTOR)			136			197		9			36	
Confl. Peds. (#/hr)	2		36	36		2	15		24	24		15
Confl. Bikes (#/hr)									3			4
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	207	533	91	100	407	246	89	989	0	203	558	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Total Split (s)	21.0	44.0	44.0	13.0	36.0	36.0	16.9	43.0		20.0	46.1	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Act Effct Green (s)	16.7	38.7	38.7	8.3	30.4	30.4	9.8	39.8		15.2	45.1	
Actuated g/C Ratio	0.14	0.32	0.32	0.07	0.25	0.25	0.08	0.33		0.13	0.38	
v/c Ratio	0.86	0.96	0.16	0.82	0.93	0.45	0.61	0.87		0.92	0.45	
Control Delay	69.4	59.0	0.8	98.7	72.0	11.6	69.7	47.2		95.1	28.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	69.4	59.0	0.8	98.7	72.0	11.6	69.7	47.2		95.1	28.3	
LOS	E	E	A	F	E	B	E	D		F	C	
Approach Delay		55.2			55.8			49.1			46.1	
Approach LOS		E			E			D			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 52 (43%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.96	
Intersection Signal Delay: 51.4	Intersection LOS: D
Intersection Capacity Utilization 86.3%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 635: 15th Ave NE & NE 125th St



Synchro 9 Report
560: 15th Ave NE & NE 145th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	165	978	217	116	750	181	452	696	125	146	365	115
Future Volume (vph)	165	978	217	116	750	181	452	696	125	146	365	115
Satd. Flow (prot)	1787	3324	0	1805	3358	0	1694	3282	0	1823	3353	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1771	3324	0	1788	3358	0	1658	3282	0	1799	3353	0
Satd. Flow (RTOR)		24			25			18			31	
Confl. Peds. (#/hr)	24		28	28		24	25		25	25		25
Confl. Bikes (#/hr)			2						1			2
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	2%	2%	2%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	168	1219	0	118	950	0	461	838	0	149	489	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Total Split (s)	17.0	45.3		12.8	41.1		35.4	43.7		18.2	26.5	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Act Effct Green (s)	12.4	40.8		8.3	36.7		30.9	40.4		12.5	22.0	
Actuated g/C Ratio	0.10	0.34		0.07	0.31		0.26	0.34		0.10	0.18	
v/c Ratio	0.91	1.06		0.95	0.91		1.06	0.75		0.79	0.76	
Control Delay	100.1	83.0		124.8	52.6		102.3	39.9		80.0	52.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	100.1	83.0		124.8	52.6		102.3	39.9		80.0	52.3	
LOS	F	F		F	D		F	D		E	D	
Approach Delay		85.1			60.6			62.0			58.8	
Approach LOS		F			E			E			E	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 68.5 — Intersection LOS: E
Intersection Capacity Utilization 99.2% — ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 560: 15th Ave NE & NE 145th St