Appendix J – Transportation Documentation

- Traffic Study (2006)
- On-Site Queuing Technical Memorandum (2006)
- Construction Traffic Technical Memorandum (2006)
- WSDOT Property Acquisition Meeting. Meeting Minutes. March 31, 2006. WSDOT Urban Corridor Office.
- Impacts of I-5/SR 509 Project on the Bow Lake Transfer Station. King County Solid Waste Division (2006).
- Local Street Traffic Impact Evaluation for King County Transfer Stations. King County Solid Waste Division (2005).
- Summary of Preliminary Transportation Assessment – Bow Lake Transfer Station. King county Solid Waste Division (2004).

Traffic Impact Analysis

BOW LAKE TRANSFER/RECYCLING STATION

Prepared for:

King County Solid Waste Division

December 2006

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Executive Summary

This report summarizes the traffic impact analysis results for the Bow Lake Transfer/ Recycling Station. The transfer station is located in unincorporated King County and the City of Tukwila. The station is located north of the S 188th Street/Orillia Road S intersection. The eight-acre site is bound on the west by I-5 and overlooks the Duwamish Valley to the east. The site is accessed from the S 188th Street/Orillia Road S intersection. The Bow Lake Transfer/Recycling Station is being upgraded primarily to meet current building and environmental standards, improve safety and efficiency, and accommodate projected regional growth trends. Construction is expected to be complete by the year 2011.

The traffic analysis was for the weekday AM and PM peak hours, which represent peak commuter traffic volumes on the roadway network. A Saturday peak hour was also analyzed since Saturday is the peak period of traffic flow attracted to the site. The primary State Environmental Policy Act (SEPA) analysis reviews existing conditions, year 2011 baseline conditions, and 2011 with-project conditions which reflect a horizon year consistent with project buildout. A future year 2030 planning level analysis is also included to support the long-range Master Plan. Five intersections were studied, which were:

- S 188th Street/Military Road S;
- S 188th Street/I-5 Southbound (SB) Ramps;
- S 188th Street/I-5 Northbound (NB) Ramps;
- S 188th Street/Orillia Road S (Bow Lake Transfer/Recycling Station Access); and
- Orillia Road S/S 200th Street.

Additional analysis was also conducted to measure the potential impacts of Bow Lake traffic when the proposed Tukwila South Project is included in the baseline conditions. Information contained in the Bow Lake Traffic Impact Analysis related to the proposed Tukwila South Project was derived from the Draft Environmental Impact Statement (DEIS) developed by La Pianta, LLC for that proposal. All technical and other information concerning that site was presumed to be accurate, and no additional independent analysis for that proposed site's development and traffic conditions was prepared by The Transpo Group, Inc.. Tukwila South is proposing mixed-use development of up to 14 million square feet under near-term (2015) and long-term (2030) build-out years. The Tukwila South Year 2015 Alternative 1 build-out is forecast to generate about 3,727 net new PM peak hour trips, and the Year 2030 Alternative 1 build-out is forecast to generate about 13,975 net new PM peak hour trips. This traffic would access the street system at S 180th Street and S 200th Street.

The existing conditions analysis shows that the five study intersections all operate at level of service (LOS) D or better during both the weekday AM and PM peak hours. During the Saturday peak hour, all intersections operate at LOS B, with the exception of S 188th Street/Military Road S which operates at LOS C. All intersection operations remain similar under 2011 baseline conditions.

The Bow Lake Transfer/Recycling Station is a currently operating site with existing and measurable traffic volumes. The methodology for estimating future traffic volumes is based on a linear increase of existing traffic volumes based on solid waste forecasts provided by the King County Solid Waste Division. As stated in econometric model forecasting prepared by the Solid Waste Division, it is estimated that the tonnage of solid waste disposal will increase by about 16 percent from year 2006 to 2011. Existing peak hour traffic volumes accessing the site were increased by 16 percent to estimate the net new trips accessing the site by year 2011. By year 2011 there is expected to be 12 net new trips during the AM peak hour, 7 net new trips during the PM peak hour, and 29 net new trips during the Saturday peak hour. When compared to baseline intersection total entering volume (TEV), the project trips account for less that 1 percent of the volume at the study intersections during the weekday AM and PM peak hours. On Saturday, the project trips account for about 2 percent of the TEV at S 188th Street/Orillia Road S (site access) and 1 percent or less at all remaining study intersections. Since traffic volumes vary by 5 to10 percent from day-to-day, it is unlikely the average driver will notice these projected related forecast volume increases.

As can be expected due to the low volume impact on the study intersections, the with-project LOS does not change from baseline conditions. Since the project related traffic volumes are so light, the LOS is unchanged at most study intersections when comparing baseline to with-project conditions.

These results are echoed with the year 2030 long-range analysis, as well as the additional analysis that includes the Tukwila South Project traffic volumes in the baseline conditions. Under the long-range 2030 analysis, as well as the 2011 and 2030 analyses that include Tukwila South traffic volumes, when compared to with-Bow Lake project conditions, the LOS is similar between baseline and with-project conditions. The insignificant impacts of the Bow Lake project are a result of the project's future traffic volumes which have been calculated as comprising a small percentage of the overall traffic volumes on the roadway network.

Introduction

This report summarizes the transportation impact analysis (TIA) conducted for the Bow Lake Transfer/Recycling Station located in unincorporated King County and Tukwila, Washington. The analysis is consistent with TIA guidelines for a SEPA checklist.

Project Location and Description

The Bow Lake Transfer/Recycling Station is located north of the S 188th Street/Orillia Road S intersection in unincorporated King County and the City of Tukwila. The transfer station was constructed in 1977. The eight-acre site is located along the east edge of I-5 overlooking the Duwamish Valley. The site vicinity is shown in Figure 1. The transfer station operates 24 hours per day, Monday through Friday, and from 8:30 am to 5:30 pm on weekends. The site is open to commercial haulers, residential self-haulers, and business self-haul customers. The site is accessed from the S 188th Street/Orillia Road S intersection.

The Bow Lake Transfer/Recycling Station is being upgraded to meet current building and environmental standards, improve safety and operational efficiency, and accommodate projected future regional growth trends. It will incorporate solid waste management efficiencies that will help keep disposal rates as low as possible when the County's remaining landfill reaches capacity and solid waste is exported to an out-of-county disposal site.

Specific proposed improvements include:

- An expanded recycling area, including a yard waste area;
- A larger transfer building that will have easier-to-use waste unloading areas, which should reduce customer wait times;
- An enclosed transfer building;
- An enhanced site layout to improve on-site circulation and increased on-site vehicle queuing storage;
- Two preload compactors to improve operational efficiency and decrease the number of transfer trailer truck trips required to/from the transfer station;
- Improved building design; and
- Environmental enhancements to the storm and waste water system to protect public health.

It should be noted that the proposed improvements don't necessarily equate to increased site traffic generation. The site is being improved to accommodate the growing demands from local and regional population increases. At the same time, operational enhancements are being provided to provide enhanced compaction of solid waste to reduce the number of trailer truck trips to/from the site.

One of the site improvements will be new compaction technology know as a "preload compactor". This relates to the loading and compacting of waste containers which are used to transport waste from Bow Lake final disposal sites. The current practice is to top-load a waste transfer trailer and lightly compact the material with a knuckleboom crane. This practice allows transfer trailers to carry about 18 tons of waste. The new preload compactor will allow transfer trailers to carry about 27 to 30 tons of waste. In the short term, this could equate to 50 to 67 percent fewer truck trips from this site. The project will be completed by 2011.

Study Approach

The analysis of traffic operations of five off-site intersections focuses on the weekday AM and PM peak hour, as well as a Saturday peak hour. The AM and PM peak hours are typically the time periods with the highest roadway traffic volumes representative of commuter traffic. The Saturday peak hour represents the time period when the site generates their highest volume of trips. The following intersections were selected for study:

- S 188th Street/Military Road S;
- S 188th Street/I-5 Southbound (SB) Ramps;
- S 188th Street/I-5 Northbound (NB) Ramps;
- S 188th Street/Orillia Road S (Bow Lake Transfer/Recycling Station Access); and
- Orillia Road S/S 200th Street.

The following sections document existing, future baseline (without-project), and future with-project conditions within the study area. Project impacts are identified by comparing forecast with-project conditions against forecast baseline conditions. Potential mitigation measures are identified where necessary to offset these impacts. The report is divided into the following primary sections:

- **Existing Conditions** documents the current (year 2006) conditions within the study area. Existing levels of service at study intersections are calculated based on existing intersection geometry and traffic volumes. This section also includes descriptions of transportation facilities within the study area and on roadways adjacent to the site. This study documents AM, PM, and Saturday peak hour traffic operations at the study intersections.
- **Future Baseline Conditions (Without-Project)** documents the conditions expected to prevail in the study area in year 2011 without the proposed project. The operations analyses include all roadway improvements and increases in traffic volume resulting from other planned developments in the vicinity of the project site by year 2011.
- **Future With-Project Conditions** documents the impact of a "typical day" of the proposed project relative to year 2011 baseline conditions. A "typical day" is the

estimate of traffic that is expected to be generated by the normal use of the facility. The impacts are measured by comparing with-project conditions to the year 2011 baseline, which is the proposed year of opening. All SEPA-based mitigation will be based on year of opening (year 2011) conditions.

- **Cumulative Analysis with Tukwila South** documents the conditions expected to prevail in the study area when the Tukwila South Project traffic volumes are included in the background (baseline) conditions.
- **Proposed Mitigation** documents the results of the analysis and identifies measures to offset potential transportation impacts, if necessary.

Figure 1
Site Vicinity

Bow Lake Transfer/Recycling Station

The Transpo Group

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Existing Conditions

This section of the report provides an inventory of existing transportation conditions throughout the study area. This inventory serves as the foundation from which future traffic conditions are forecast and evaluated. The following paragraphs describe the vicinity roadway network, existing traffic volumes and operations, and safety.

Roadway Network

The following roadways comprise the primary roadway system in the project site vicinity. Furthermore, these roadways are anticipated to accommodate a majority of the project-generated traffic and, in doing so, would experience the greatest project impacts. The following paragraphs describe the general characteristics of these roadways.

I-5 is a north-south interstate freeway facility providing regional access to the area. In the project vicinity, I-405 is five lanes (four general purpose lanes and one High Occupancy Vehicle [HOV} lane in both directions).

S 188th Street is classified as a principal arterial, providing access to I-5. It connects with Orillia Road, just east of the site and continues west to Normandy Park, near Puget Sound. It is a five-lane facility near the project site, providing left-turn lanes at each of the study intersections. There are paved shoulders within the project vicinity. Sidewalks are on the north side of the roadway starting just west of Military Road.

Orillia Road S is a principal arterial located southwest of the site. It connects S 188th Street and I-5 with the valley floor to the east via S 200th Street and S 212th Street. Orillia Road is a four-lane roadway with a posted speed limit of 40 mph. It has 11- and 12-foot lanes with 4- to 5-foot paved bicycle lanes. There is curb and gutter, as well as intermittent sidewalks.

Traffic Volumes

The weekday AM and PM peak hour was selected for the analysis since it is the time period that typically accounts for the highest background traffic volumes, and thus results in the most congested periods for a traffic analysis. A Saturday peak hour was also selected for analysis since this represents a time period when traffic volumes at the transfer station are typically the highest. Existing weekday AM, PM, and Saturday peak hour turning movement counts were performed in the field by All Traffic Data Services, Inc.

Transfer station traffic volume is primarily comprised of two types of trips: self-hauled and commercially collected. Self-hauled trips are comprised of residents or small businesses delivering their solid waste. Commercially collected trips are from the large waste hauling companies. Table 1 summarized the vehicle volumes accessing the transfer station during the three peak hours.

Table 1. Existing Traffic Volumes: S 188th St/Orillia Rd S/Transfer Station

	Accessing Station[1]	TEV[2]	% Vol. Related to Station[3]
AM Peak Hour	73	2,833	2.6%
PM Peak Hour	44	3,457	1.3%
Sat. Peak Hour	181	1,222	14.8%

1. Total trips in/out from transfer station during peak hour counted.
2. TEV = total entering volume of intersection.
3. The percentage of intersection volume accessing the transfer station.

As Table 1 shows, the total volume accessing the transfer station is the lowest during the PM peak hour, which is when traffic volumes are the highest. The transfer station experiences higher volumes on a Saturday peak hour due to increased self-haul residential trips. Figure 2 shows the peak hour turning movement counts at all of the study intersections.

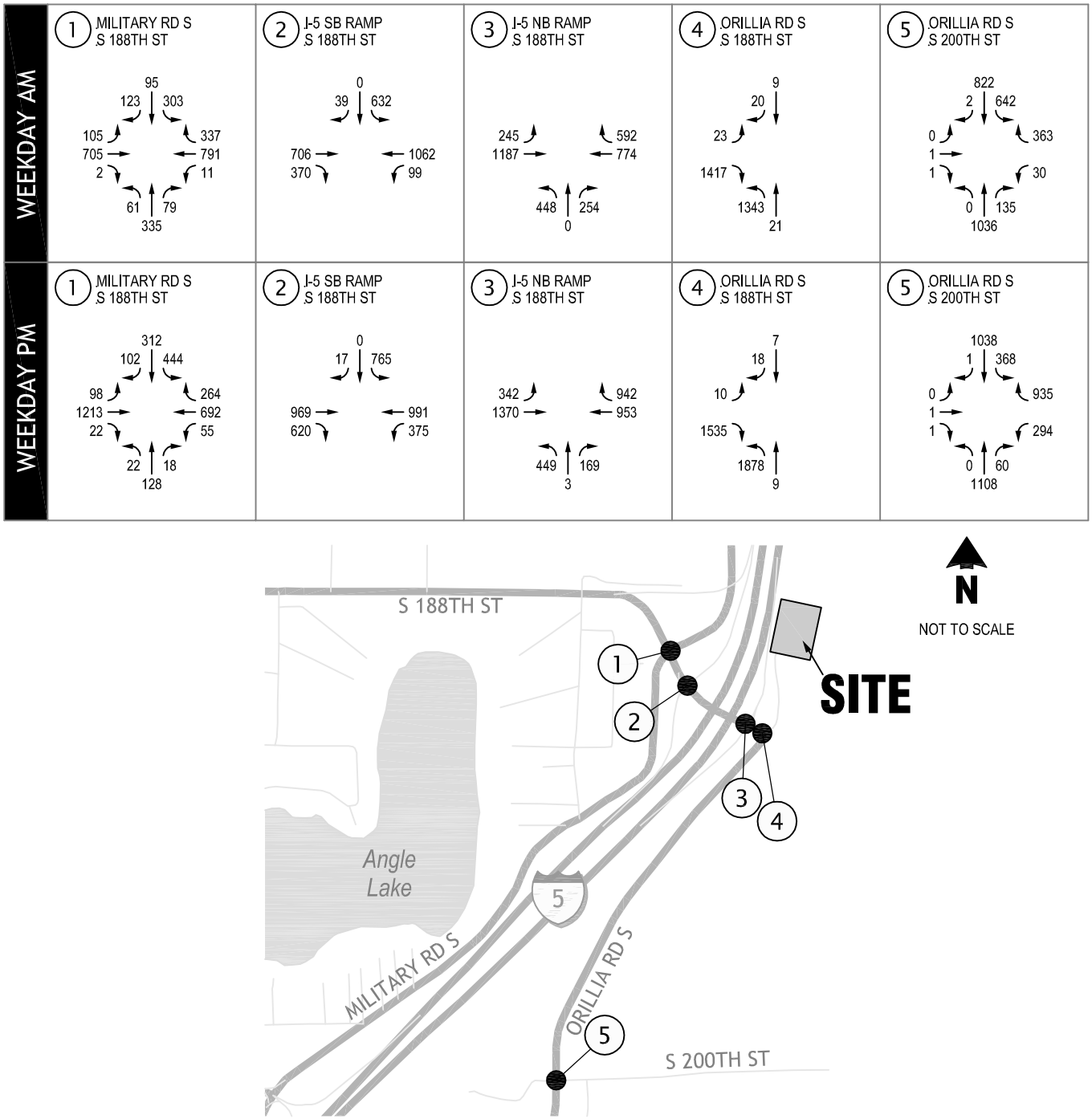

Figure 2

Existing Weekday AM, PM, and Sat. Peak Hour Volumes

Bow Lake Transfer/Recycling Station

The Transpo Group

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Traffic Operations

This section of the report summarizes existing traffic operations at the study intersections. The operations analysis section summarizes LOS calculations as well as off-site vehicle queuing.

Level of Service

A LOS analysis was conducted for the study intersections under existing conditions. Level of service is a qualitative measure of the performance of an intersection. Levels of service values range from LOS A, indicating good operation and low vehicle delays, to LOS F, which indicates congestion and longer vehicle delays. Appendix A contains a detailed explanation of LOS criteria and definitions.

Synchro v.6.0 (Build 612) was used to evaluate intersection levels of service based on the *2000 Highway Capacity Manual* (HCM) (Transportation Research Board, 2000) methodologies. As part of HCM methodologies, intersection operations are analyzed during the peak 15-minute period of the peak hour represented. Existing traffic volumes, lane geometries, and traffic controls were used to estimate existing traffic operations for the study intersections. The existing signal timing plans were obtained from the City of SeaTac, King County, and the Washington State Department of Transportation (WSDOT). Table 1 shows the LOS results for the study intersections. The detailed LOS worksheets are included in Appendix B of this report.

Table 2. Existing (2006) LOS Summary: Weekday AM, PM, and Sat. Peak Hours

	AM Peak Hour			PM Peak Hour			Sat. Peak Hour		
Intersection	**LOS[1]**	**Delay[2]**	**V/C[3] or WM[4]**	**LOS**	**Delay**	**V/C or WM**	**LOS**	**Delay**	**V/C or WM**
S 188th St/Military Rd S	D	51.8	0.92	D	38.4	0.76	C	28.3	0.59
S 188th St/I-5 SB Ramps	B	16.8	0.64	D	40.3	0.88	B	10.9	0.39
S 188th St/I-5 NB Ramps	C	23.3	0.79	C	30.8	0.86	B	15.7	0.51
Orillia Rd S/S 200th St	C	32.2	0.77	C	26.1	0.77	B	16.8	0.36
Unsignalized									
S 188th St/Orillia Rd S	A	4.0	NA	A	4.2	NA	A	1.4	NA
Worst Movement	*F*	*>120*	*SB[5]*	*F*	*>120*	*SB*	*B*	*13.2*	*SB*

1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.
5. SB = Southbound approach.
6. NB = Northbound approach.

King County LOS standards for an urban area is LOS E. Both WSDOT and the City of SeaTac LOS standards are LOS D. As Table 2 shows, all of the signalized study area intersections operate at LOS D or better during the weekday peak hours. All intersections operate well during the Saturday peak hour.

The unsignalized intersection of S 188th Street/Orillia Road S (site access) operates at LOS A as a whole. Only the southbound movement of the unsignalized intersection operates at LOS F during the weekday peak hours analyzed. The S 188th Street/Orillia Road southbound exit does not impact operations along the S 188th Street – Orillia Road corridor, only the ability for vehicles to exit the transfer station.

Off-Site Traffic Queuing

This section of the report summarizes the calculated queuing between the study area intersections. Due to the close spacing of these intersections, queues can occur that may inhibit an adjacent intersection from functioning properly. Queue calculations are summarized on S 188th Street for both the westbound and eastbound directions. On S 188th Street, westbound queues are estimated to measure potential blocking between: Military Road S and I-5 Northbound (NB) Ramps, I-5 NB Ramps and I-5 Southbound (SB) Ramps, and I-5 SB Ramps and Orillia Road S (site access). In the eastbound direction, queues are estimated to measure potential blocking between Orillia Road S and I-5 NB Ramps, I-5 NB Ramps and I-5 SB Ramps, as well as I-5 SB Ramps and Military Road S.

Synchro v.6.0 (Build 612) was used to evaluate intersection queuing. The 95th percentile (maximum) queuing data is reported from Synchro. The 95th percentile would be the worst case queue during the time period with the highest traffic volumes. Thus, the 95th percentile queues are likely to occur for 1 to 2 cycles during the peak 15-minutes of the weekday PM peak hour. However, queues could be longer if there are multiple intersection blockages that are impacting corridor operations, as Synchro and HCM calculations cannot account for these situations.

Table 3 provides an estimate of capacity between the intersections compared with 95th percentile queue (maximum). The purpose of this data is to provide an estimate of queues to use as a bench mark to measure queue impacts with increased future traffic volumes.

Table 3. Existing Intersection Queue Summary: Weekday AM and PM Peak Hours

Direction/Intersection	Capacity[1] (ft)	95th Percentile[2] Queue (ft)	Available Capacity? (ft)
AM Peak Hour			
Westbound			
S 188th St /Military Rd S	205	260	No
S 188th St /I-5 SB Ramps	490	200	Yes
S 188th St /I-5 NB Ramps	65	365	No
Eastbound			
S 188th St/Orillia Rd S	65	20	Yes
S 188th St /I-5 NB Ramps	490	330	Yes
S 188th St /I-5 SB Ramps	205	160	Yes
PM Peak Hour			
Westbound			
S 188th St /Military Rd S	205	245	No
S 188th St /I-5 SB Ramps	490	230	Yes
S 188th St /I-5 NB Ramps	65	600	No
Eastbound			
S 188th St/Orillia Rd S	65	20	Yes
S 188th St /I-5 NB Ramps	490	335	Yes
S 188th St /I-5 SB Ramps	205	255	No

1. Distance between intersections.
2. 95th percentile queue length in feet as reported by Synchro 6.0.

During the AM and PM peak hour in the westbound direction the I-5 SB Ramps/S 188th Street and S 188th Street/Orillia Road S intersections will experience blockages from adjacent intersections. During the PM peak hour in the eastbound direction the S 188th Street/Military Road S intersection will experience blockages resulting from the S 188th Street/I-5 SB Ramps intersection.

During the AM and PM peak hour the east-to-north left-turn into the project site (S 188th Street/Orillia Road S) does not queue into the adjacent intersection based on model calculations. However, the left-turns would be blocked due to queues on the westbound approach at the S 188th Street /I-5 NB Ramps intersection. Eastbound left-turns into the site will depend on westbound traffic not blocking the site access during the weekday AM and PM peak hours.

Traffic Safety

Records of reported accidents at study intersections were reviewed to help identify if any existing traffic safety issues exist. The most recent summary of accidents is for the period between January 1, 2002/2003 through July, 2005. The data was provided by the City of SeaTac, King County, and WSDOT. A historical review of the frequency of accidents was conducted at all study intersections. Typically, intersections with collision rates greater than 1.0 collisions per million entering vehicles (MEV) are earmarked for continued evaluation and potential safety improvements. A summary of the total average annual and MEV of reported accidents at each study intersection is provided in Table 4.

Table 4. Intersection Accident Data Summary

Intersection	Number of Accidents				Annual Average	MEV[1]
	2002/ 2003	2004	2005	Total		
S 188th St/Military Rd S	15	16	14	45	15.0	1.22
S 188th St/I-5 SB Ramps	9	10	8	27	9.0	0.66
S 188th St/I-5 NB Ramps	9	17	11	37	12.3	0.80
S 188th St/Orillia Rd S	6	11	8	25	8.3	0.66
Orillia Rd S/S 200th St	7	10	6	23	7.7	0.55

1. MEV = Million entering vehicles.

As Table 4 shows, the MEV is less than 1.0 at all of the study intersections with the exception of S 188th Street/Military Road S. This intersection has an average of 15 accidents per year over the last three years. The accidents were 12 rear-end, 5 angle, 4 turning, 5 head-on, 6 sideswipe, 4 fixed object, and 9 other. The City of SeaTac currently does not have accident safety analysis standards.

Transit Service

King County Metro Transit (MT) and Sound Transit (ST) provide service to an eastbound stop at the near side of S 188th Street/Military Road S. Transit service is provided by three routes:

- MT 180 provides service on 30-minute headways between Burien and Auburn.
- MT 194 provides service on 45-minute headways between Seattle and Federal Way.
- ST 574 provides service on 30-minute headways between SeaTac and Lakewood.

Future Baseline Conditions (Without-Project)

A future 2011 baseline (representing a without-project scenario) analysis was developed to identify forecast traffic conditions. Although traffic volumes at the existing driveway will increase with or without the proposed transfer station improvements, traffic volumes accessing the site were assumed to remain consistent with existing conditions in order to isolate growth in site-related traffic volumes for the with-project analysis.

The evaluations in this section establish a baseline for identifying project impacts, which will be based upon a comparison of baseline traffic conditions to with-project conditions. The future roadway network, traffic volumes, and traffic operations are defined in this section.

Traffic Volumes

Year 2011 baseline traffic volumes were established based on a forecast from a regional traffic forecasting model (TMODEL2). This model was derived from the Puget Sound Regional Council model (PSRC) and used for the SR 509 extension studies. The model has recently been updated to support the Port of Seattle (POS) Comprehensive Development Plan (CDP). Model roadway link data was plotted for a short-term year of 2010 and a long-term year of 2024. The short-term model plot shows traffic volumes are expected to remain about the same over the next four years. This is due to traffic shifts created by the City of Kent's South 228th Street Extension. Some traffic volumes are expected to shift from S 212th Street and Orillia Road S to the new S 228th Street extension. The long-term plots show expected traffic volume increases at an annual rate of 1 percent.

Although traffic volumes in the short-term are not expected to increase near the study area due to the S 228th Street extension project, to be conservative, existing (year 2006) traffic volumes were increased at an annual rate of 1 percent to estimate year 2011 forecast traffic volumes. The volumes were rounded to the nearest 5 vehicles, and the site access volumes were assumed to remain unchanged. Site access traffic volumes will be addressed under the with-project conditions section. Figure 3 shows the future 2011 baseline traffic volumes for the weekday AM and PM, and Saturday peak hours. These volumes will be used to estimate year 2011 baseline conditions.

Planned Transportation Improvements

No short-term (year 2011) transportation improvement projects that would enhance capacity were identified for the study intersections.

Traffic Operations

This section of the report summarizes baseline traffic operations at the study intersections. The operations analysis section summarizes baseline LOS calculations as well as off-site vehicle queuing.

Level of Service

Future traffic operations in the study area were evaluated based on the year 2011 forecast traffic volumes. Since no short-term planned improvements were identified, intersection channelization is consistent with existing conditions. The traffic operations analysis uses the same methodologies discussed in the evaluation of existing levels of service. Table 5 summarizes the weekday AM and PM baseline LOS results; existing conditions results are provided for comparison purposes. The detailed LOS worksheets are provided in Appendix B.

Table 5. 2011 Baseline LOS Summary: Weekday AM and PM Peak Hours

	AM Existing (2006)			AM Baseline (2011)		
Intersection	**LOS[1]**	**Delay[2]**	**V/C[3] or WM[4]**	**LOS**	**Delay**	**V/C or WM**
S 188th St/Military Rd S	D	51.8	0.92	D	46.7	1.03
S 188th St/I-5 SB Ramps	B	16.8	0.64	B	15.4	0.67
S 188th St/I-5 NB Ramps	C	23.3	0.79	C	24.0	0.78
Orillia Rd S/S 200th St	C	32.2	0.77	C	21.6	0.78
Unsignalized						
S 188th St/Orillia Rd S	A	4.0	NA	A	5.7	NA
Worst Movement	*F*	*>120*	*SB*	*F*	*>120*	*SB*
	PM Existing (2006)			**PM Baseline (2011)**		
Intersection	**LOS**	**Delay**	**V/C or WM**	**LOS**	**Delay**	**V/C or WM**
S 188th St/Military Rd S	D	38.4	0.76	C	33.5	0.82
S 188th St/I-5 SB Ramps	D	40.3	0.88	D	35.2	0.94
S 188th St/I-5 NB Ramps	C	30.8	0.86	C	30.3	0.90
Orillia Rd S/S 200th St	C	26.1	0.77	C	29.3	0.82
Unsignalized						
S 188th St/Orillia Rd S	A	4.2	NA	A	6.4	NA
Worst Movement	*F*	*>120*	*SB*	*F*	*>120*	*SB*

1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.

As Table 5 shows, under future baseline conditions all signalized intersections are calculated to operate at LOS D or better. The unsignalized S 188th Street/Orillia Rd S (site access) intersection continues to operate at LOS A as a whole, with the southbound movement expected to continue to operate at LOS F during the weekday peak hours.

Table 6 provides a summary of the Saturday peak hour LOS results. Both existing and baseline conditions are provided for comparison purposes.

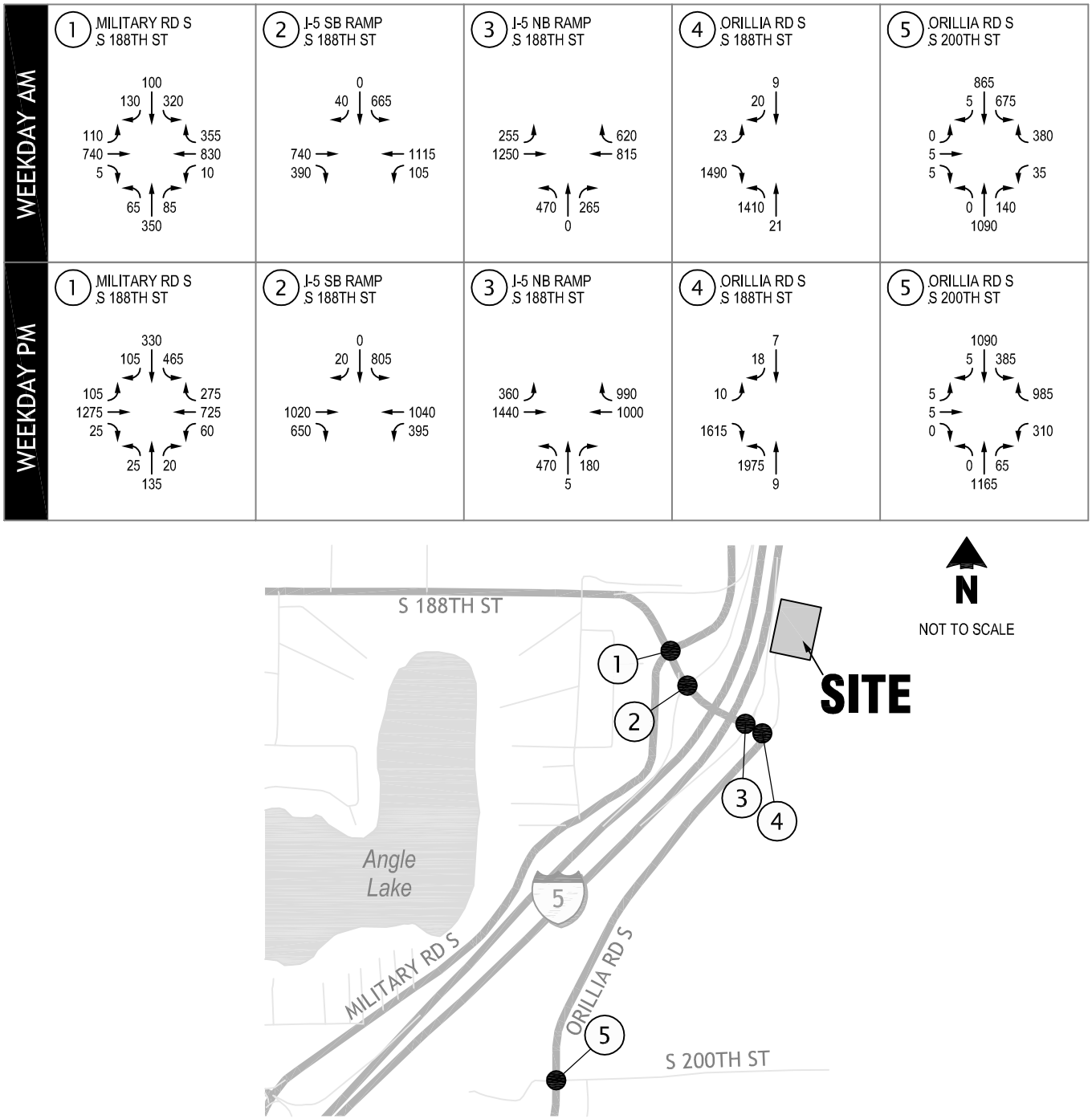

Figure 3

2011 Baseline AM and PM Weekday, and Sat. Peak Hour Volumes

Bow Lake Transfer/Recycling Station

The Transpo Group

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Table 6. 2011 Baseline LOS Summary: Saturday Peak Hour

	Existing (Sat. 2006)			Baseline (Sat. 2011)		
Intersection	**LOS[1]**	**Delay[2]**	**V/C[3] or WM[4]**	**LOS**	**Delay**	**V/C or WM**
S 188th St/Military Rd S	C	28.3	0.59	C	27.8	0.61
S 188th St/I-5 SB Ramps	B	10.9	0.39	A	9.3	0.41
S 188th St/I-5 NB Ramps	B	15.7	0.51	B	16.4	0.54
Orillia Rd S/S 200th St	B	16.8	0.36	B	17.3	0.38
Unsignalized						
S 188th St/Orillia Rd S	A	1.4	NA	A	1.4	NA
Worst Movement	*B*	*13.2*	*SB*	*B*	*13.6*	*B*

1. Level of service, based on *2000 Highway Capacity Manual* methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.

As Table 6 shows, all intersections operate well during the Saturday peak hour.

Off-Site Traffic Queuing

This section of the report summarizes the calculated queuing between the study area intersections for the forecast baseline conditions. Queue calculations are summarized on S 188th Street for both the westbound and eastbound directions. On S 188th Street in the westbound direction queues are estimated to measure potential blocking between: Military Road S and I-5 NB Ramps, I-5 NB Ramps and I-5 SB Ramps, and I-5 SB Ramps and Orillia Road S (site access). In the eastbound direction queues are estimated to measure potential blocking between Orillia Road S and I-5 NB Ramps, I-5 NB Ramps and I-5 SB Ramps, as well as I-5 SB Ramps and Military Road S.

Table 7 compares the existing with future baseline calculated queues. Capacity between intersections is shown to help identify if there is blocking between intersections during baseline conditions.

Table 7. 2011 Baseline Intersection Queue Summary: Weekday AM and PM Peak Hours

		AM Peak Hour		
		95th Percentile[2] Queue		Baseline
Direction/Intersection	Capacity[1] (ft)	Existing (ft)	Baseline (ft)	Available Capacity?
Westbound				
S 188th St /Military Rd S	205	260	365	No
S 188th St /I-5 SB Ramps	490	200	225	Yes
S 188th St /I-5 NB Ramps	65	365	290	No
Eastbound				
S 188th St/Orillia Rd S	65	20	20	Yes
S 188th St /I-5 NB Ramps	490	330	275	Yes
S 188th St /I-5 SB Ramps	205	160	150	Yes
		PM Peak Hour		
Westbound				
S 188th St /Military Rd S	205	245	230	No
S 188th St /I-5 SB Ramps	490	230	365	Yes
S 188th St /I-5 NB Ramps	65	600	620	No
Eastbound				
S 188th St/Orillia Rd S	65	20	20	Yes
S 188th St /I-5 NB Ramps	490	335	265	Yes
S 188th St /I-5 SB Ramps	205	255	450	No

1. Distance between intersections.
2. 95th percentile queue length in feet as reported by Synchro 6.0.

As Table 7 shows, during AM and PM peak hour conditions, the queuing results are similar between existing and baseline conditions.

Future With-Project Conditions

This section highlights forecast traffic conditions with the proposed project. The results were compared to baseline traffic conditions to identify project impacts. A description of project trip generation, trip distribution, and future traffic operations with the proposed project is provided in this section.

Trip Generation

The Bow Lake Transfer/Recycling Station is an existing site with exiting traffic volumes. The methodology for estimating future traffic volumes is based on a linear increase of existing traffic volumes based on solid waste forecasts provided by the King County Solid Waste Division. The Solid Waste Division forecasts the total annual waste tonnage based on historic data and the expected development in economic activities and population growth. Factors influencing the waste tonnage being disposed are income, tip fees, number of jobs, service area population, household size, and the structure of the job market.

Based on econometric model forecasting done by the Solid Waste Division, it is estimated that the tonnage of solid waste disposal will increase by about 16 percent from year 2006 to 2011. It is assumed that traffic volumes accessing the site will increase at a linear rate. Thus, existing peak hour traffic volumes accessing the site will be increased by 16 percent to estimate the net new trips accessing the site by year 2011. Table 8 summarizes the estimated weekday AM and PM, and Saturday peak hour net new project traffic volumes.

Table 8. 2011 Trip Generation Estimate Summary

	AM Peak Hour			PM Peak Hour			Sat. Peak Hour		
Land Use	**Total**	**In**	**Out**	**Total**	**In**	**Out**	**Total**	**In**	**Out**
Existing Traffic Volumes[1]	73	44	29	44	19	25	181	93	88
Increased by 16.0%[2]	85	51	34	51	22	29	210	108	102
Total Net New Project Trips	**12**	**7**	**5**	**7**	**3**	**4**	**29**	**15**	**14**

1. Based on existing year 2006 peak hour turning movement counts.
2. Growth rate based on County econometric model forecasts.

As Table 8 shows, by year 2011 there is expected to be 12 net new trips during the AM peak hour, 7 net new trips during the PM peak hour, and 29 net new trips during the Saturday peak hour. As this data shows, net new trips attracted to the site during the commuter peak hours is relatively low. Trips attracted to the site typically increase on weekends since this is the time period when residents (self-haul) have the opportunity to dispose of household waste.

These estimates are likely conservative, since no reduction to site truck volumes was applied due to the new preload compactor technology that will be used to load waste containers. In the short-term, this preload compactor application should reduce truck trips by 50 to 67 percent. In addition, the analysis is constructed to consider all growth

traffic as, in effect, Net New Project Trips. Since there are no plans to close the transfer station site if the improvements are not made, this results in a systematic overestimate of the actual effect of the proposal on off-site traffic. However, the analysis is constructed this way to assure that potential impacts are not underestimated.

Project Trip Distribution/Assignment

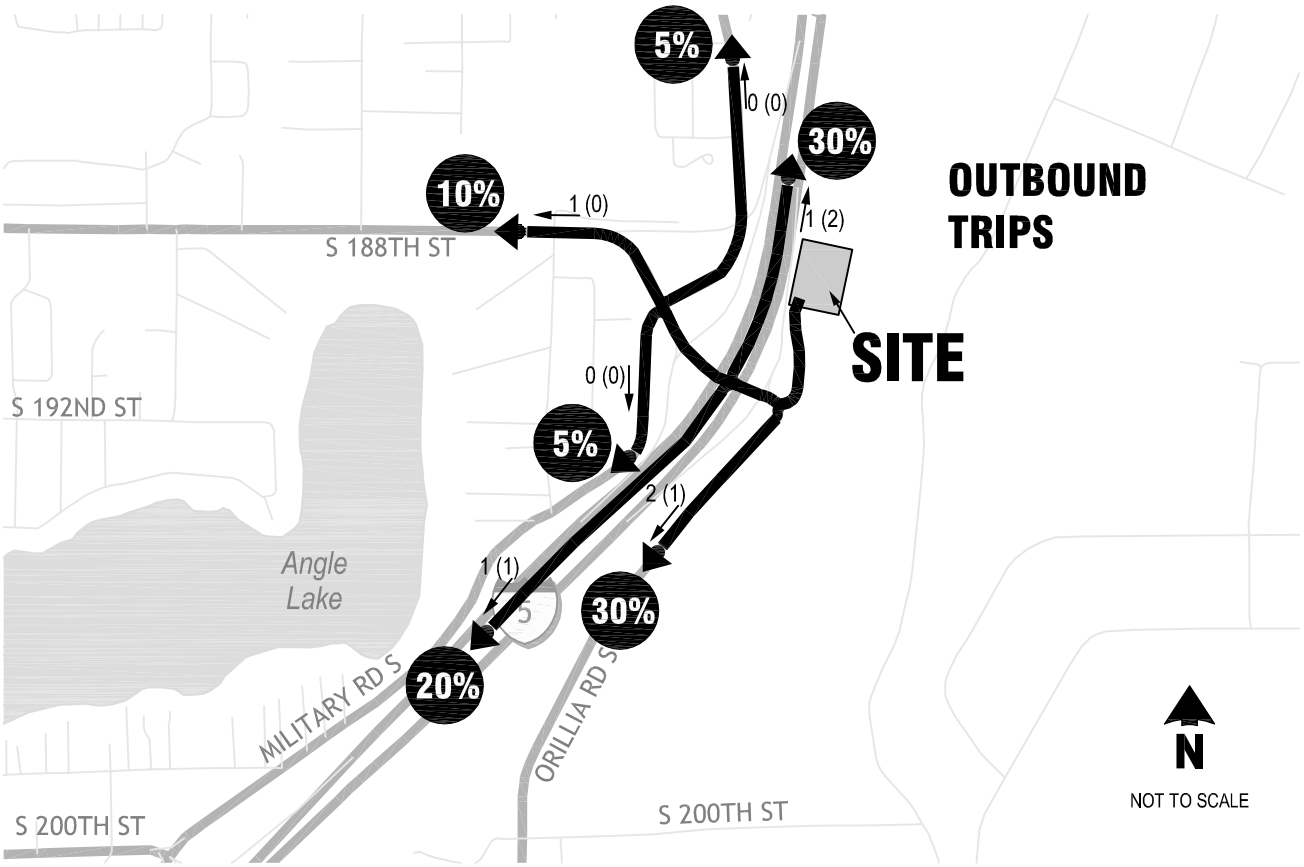
Project trip distribution is based on existing site access traffic volumes and an origin/destination study summarized in an April 2004 report called "Waste Monitoring Program." Existing turning movement counts were used to identify existing distribution patterns at the site access (S 188th Street/Orillia Road S). Beyond the site access, trip distributions were assigned to roadways based on the origin/destination study. Project trip distribution is illustrated in Figures 4 and 5. As Figure 4 shows, distribution was distinctly different for inbound and outbound trips during the weekday AM and PM peak hours and trips were assigned accordingly. As Figure 5 illustrates, during the Saturday peak hour outbound trips tend to mirror inbound trips.

These differences between weekday and weekend traffic patterns are likely due to the difference in trip types. Weekday peak hour site traffic is going to tend to attract more commercial-haulers then self-haulers; and when commercial-haulers finish dumping solid waste many trucks likely continue community service routes other than where they originated. Whereas a weekend will have a higher concentration of self-haul trips (residents), and likely return home after they unload.

2011 Traffic Volume

The project-generated traffic was added to the baseline traffic volumes to obtain the with-project volumes for the study intersections illustrated in Figure 6. These are the volumes used to estimate project impacts in the operations analysis.

To characterize potential traffic volume impacts, with-project traffic volumes were compared to 2011 baseline volumes to determine the percent impact of project traffic on study intersections. Table 9 summarizes the project's peak hour contribution to total entering traffic volumes at the study intersections.



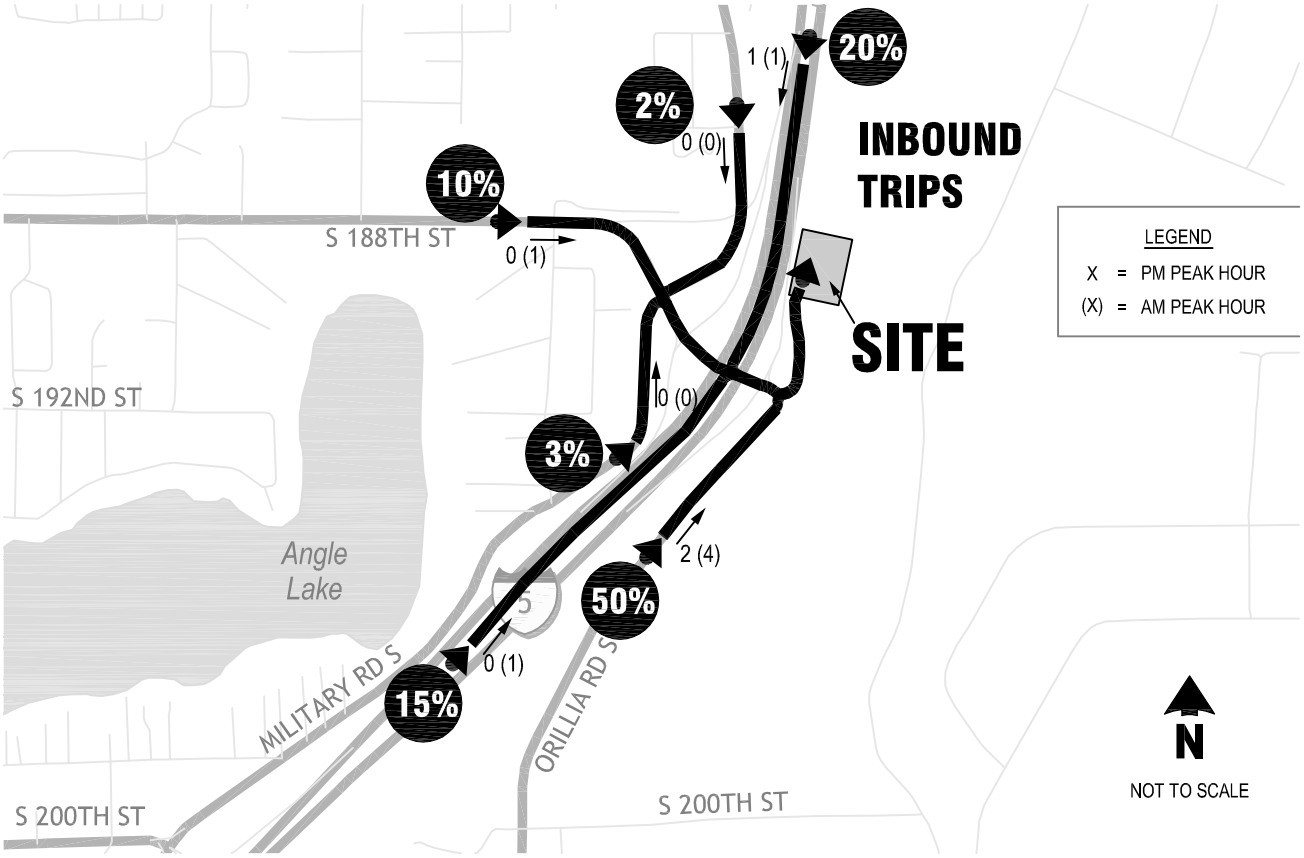


Figure 4

Project Trip Distribution and Assignment: Weekday Peak Hours

Bow Lake Transfer/Recycling Station

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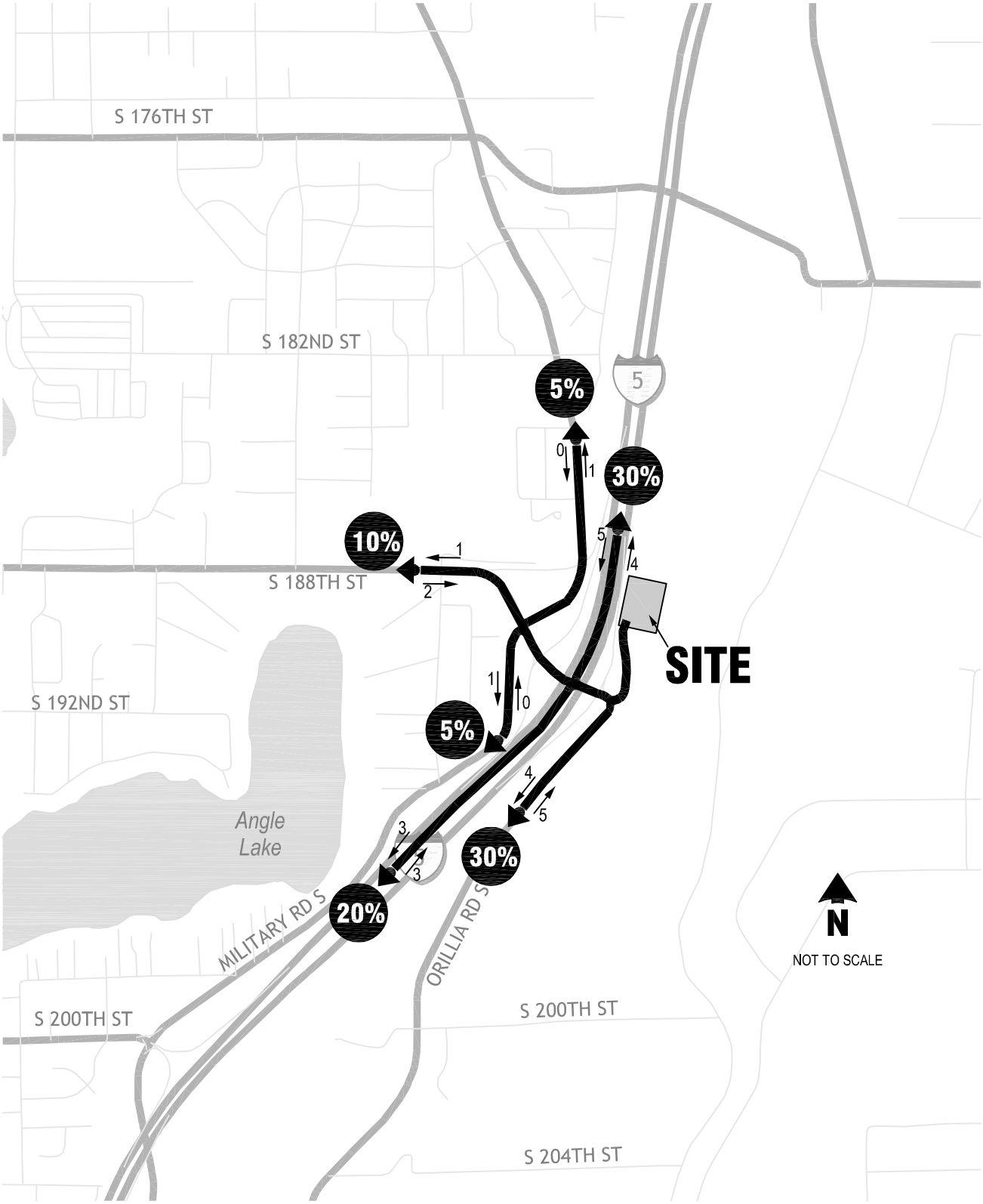

Figure 5

Project Trip Distribution and Assignment: Saturday Peak Hour

Bow Lake Transfer/Recycling Station

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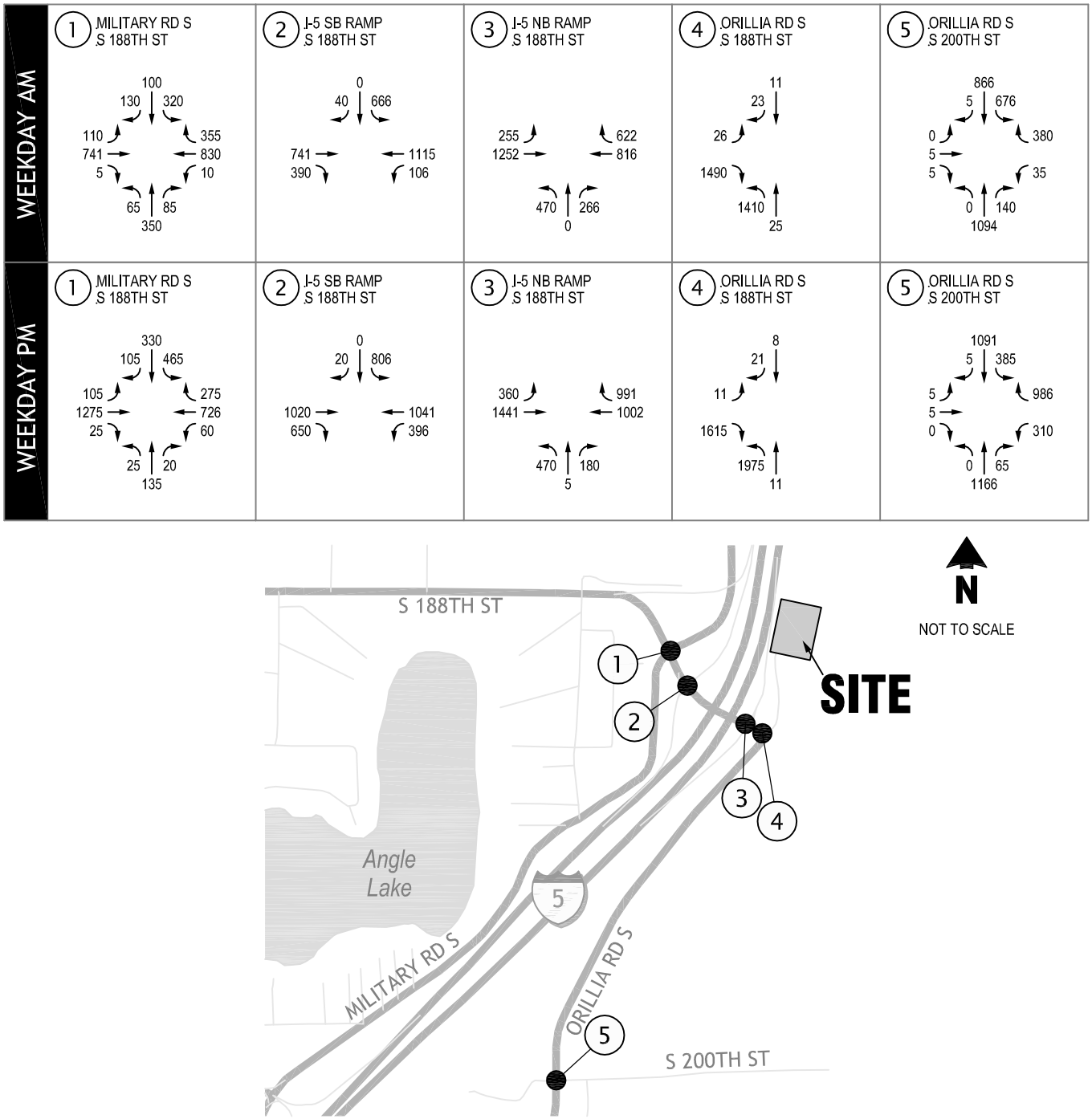

Figure 6

2011 With-Project AM and PM Weekday, and Sat. Volumes

Bow Lake Transfer/Recycling Station

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Table 9. 2011 Project Traffic Volume Impacts

Intersection	Intersection Total Entering Volume			
AM Peak Hour	**2011 Baseline**	**Project Traffic**	**2011 With-Project**	**% Impact**
S 188th St/Military Rd S	3,100	1	3,101	>0.1
S 188th St/I-5 SB Ramps	3,055	3	3,058	0.1
S 188th St/I-5 NB Ramps	3,675	6	3,681	0.2
S 188th St/Orillia Rd S	2,973	12	2,985	0.4
Orillia Rd S/S 200th St	3,200	6	3,206	0.2
PM Peak Hour	**2011 Baseline**	**Project Traffic**	**2011 With-Project**	**% Impact**
S 188th St/Military Rd S	3,545	1	3,546	>0.1
S 188th St/I-5 SB Ramps	3,930	3	3,933	0.1
S 188th St/I-5 NB Ramps	4,445	4	4,449	0.1
S 188th St/Orillia Rd S	3,634	7	3,641	0.2
Orillia Rd S/S 200th St	4,015	3	4,018	0.1
Sat. Peak Hour	**2011 Baseline**	**Project Traffic**	**2011 With-Project**	**% Impact**
S 188th St/Military Rd S	2,540	5	2,545	0.2
S 188th St/I-5 SB Ramps	2,225	13	2,238	0.6
S 188th St/I-5 NB Ramps	1,960	20	1,980	1.0
S 188th St/Orillia Rd S	1,276	29	1,305	2.3
Orillia Rd S/S 200th St	1,500	9	1,509	0.6

As Table 9 shows, during the AM and PM peak hours the expected increase in project-related traffic volumes will impact all study intersections by less than 1 percent. On Saturday project trips impact the site access driveway (188th Street/Orillia Road S) by about 2 percent. Project-related traffic volumes impact all remaining study intersections by less than 1 percent. Traffic volumes typically fluctuate about plus or minus 5 percent from day-to-day depending on factors such as the day of the week, weather, and traffic conditions elsewhere in the roadway network. Based on these results, it is unlikely that the average motorist would notice the forecast impact of increased site traffic volume. As noted above, even these impacts overstate the probable traffic impacts, since the waste stream forecasts are not dependent on the proposed action, and there are no plans to close the transfer station if the improvements are not made.

Traffic Operation Impacts

This section of the report summarizes with-project traffic operations at the study area intersections. The operations analysis section summarizes LOS calculations as well as off-site vehicle queuing. Baseline analysis results are provided to measure the degree of impact of project related traffic.

Level of Service

A LOS analysis was conducted for with-project conditions in order to quantify traffic operations in the study. The same HCM 2000 methodologies were applied and all intersection parameters such as channelization, intersection control, and signal timings were held consistent with those used in the evaluation of baseline conditions to measure

the degree of impact of the proposed project. With-project traffic operations forecasts are based on Figure 6 with-project traffic volumes. Table 10 summarizes the with-project LOS, baseline conditions are provided for comparison purposes. The detailed LOS worksheets are provided in Appendix B.

Table 10. 2011 With-Project LOS Summary: Weekday AM and PM Peak Hours

	AM Baseline			AM With-Project		
Intersection	**LOS[1]**	**Delay[2]**	**V/C[3] or WM[4]**	**LOS**	**Delay**	**V/C or WM**
S 188th St/Military Rd S	D	46.7	1.03	D	46.6	1.03
S 188th St/I-5 SB Ramps	B	15.4	0.67	B	15.4	0.67
S 188th St/I-5 NB Ramps	C	24.0	0.78	C	24.0	0.79
Orillia Rd S/S 200th St	C	21.6	0.78	C	21.7	0.79
Unsignalized						
S 188th St/Orillia Rd S	A	5.7	NA	A	8.1	NA
Worst Movement	*F*	*>120*	*SB*	*F*	*>120*	*SB*
	PM Baseline			**PM With Project**		
Intersection	**LOS**	**Delay**	**V/C or WM**	**LOS**	**Delay**	**V/C or WM**
S 188th St/Military Rd S	C	33.5	0.82	C	33.5	0.82
S 188th St/I-5 SB Ramps	D	35.2	0.94	D	35.3	0.94
S 188th St/I-5 NB Ramps	C	30.3	0.90	C	30.4	0.90
Orillia Rd S/S 200th St	C	29.3	0.82	C	29.3	0.82
Unsignalized						
S 188th St/Orillia Rd S	A	6.4	NA	C	22.2	NA
Worst Movement	*F*	*>120*	*SB*	*F*	*>120*	*SB*

1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.

As Table 10 shows, all of the study intersections are expected to remain at the same LOS as reported for baseline conditions during the weekday AM peak hour. During the PM peak hour, the overall operation of S 188th Street/Orillia Road S (site access) is expected to degrade from LOS A to LOS C. This change in LOS does not impact commuter traffic on S 188th Street. The change in LOS is due to the increased southbound delay at the site access, which results in increased delays for vehicles exiting the transfer station during the PM peak hour.

Table 11 provides a summary of the Saturday peak hour LOS results. Both baseline and with-project conditions are provided for comparison purposes.

Table 11. 2011 With-Project LOS Summary: Saturday Peak Hour

	Baseline (Sat.)			With-Project (Sat.)		
Intersection	LOS[1]	Delay[2]	V/C[3] or WM[4]	LOS	Delay	V/C or WM
S 188th St/Military Rd S	C	27.8	0.61	C	27.8	0.61
S 188th St/I-5 SB Ramps	A	9.3	0.41	A	9.4	0.41
S 188th St/I-5 NB Ramps	B	16.4	0.54	B	16.5	0.54
Orillia Rd S/S 200th St	B	17.3	0.38	B	17.3	0.38
Unsignalized						
S 188th St/Orillia Rd S	A	1.4	NA	A	1.6	NA
Worst Movement	*B*	*13.6*	*B*	*B*	*14.2*	*SB*

1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.

As Table 11 shows, all study intersections are expected to continue to operate well on a Saturday peak hour when project related traffic volumes are added.

As previously described, while impacts are calculated to be negligible, they are likely an overstatement of probable traffic impacts, since no change in the waste stream would occur as a result of the project, nor are there plans to close the transfer station in the event the improvements are not constructed.

Off-Site Traffic Queuing

This section of the report summarizes the calculated queuing between the study area intersections for the with-project conditions. Similarly to baseline conditions, queue calculations are summarized on S 188th Street for both the westbound and eastbound directions. On S 188th Street in the westbound direction queues are estimated to measure potential blocking between: Military Road S and I-5 NB Ramps, I-5 NB Ramps and I-5 SB Ramps, and I-5 SB Ramps and Orillia Road S (site access). In the eastbound direction, queues are estimated to measure potential blocking between Orillia Road S and I-5 NB Ramps, I-5 NB Ramps and I-5 SB Ramps, as well as I-5 SB Ramps and Military Road S.

Table 12 provides a summary of the with-project queue calculations. The baseline queue calculations are provided for comparison purposes to measure the project impacts on queues.

Table 12. 2011 With-Project Intersection Queue Summary: Weekday AM and PM Pk Hours

		AM Peak Hour		
		95th Percentile[2] Queue		With-Project
Direction/Intersection	Capacity[1] (ft)	Baseline (ft)	With-Project (ft)	Available Capacity?
Westbound				
S 188th St /Military Rd S	205	365	365	No
S 188th St /I-5 SB Ramps	490	225	225	Yes
S 188th St /I-5 NB Ramps	65	290	290	No
Eastbound				
S 188th St/Orillia Rd S	65	20	20	Yes
S 188th St /I-5 NB Ramps	490	275	275	Yes
S 188th St /I-5 SB Ramps	205	150	155	Yes
		PM Peak Hour		
Westbound				
S 188th St /Military Rd S	205	230	230	No
S 188th St /I-5 SB Ramps	490	365	365	Yes
S 188th St /I-5 NB Ramps	65	620	625	No
Eastbound				
S 188th St/Orillia Rd S	65	20	20	Yes
S 188th St /I-5 NB Ramps	490	265	265	Yes
S 188th St /I-5 SB Ramps	205	450	450	No

1. Distance between intersections.
2. 95th percentile queue length in feet as reported by Synchro 6.0.

As Table 12 shows, during the AM and PM peak hour the queuing results are similar for future baseline and with-project conditions. Since the forecast project related traffic volumes are relatively low, the impacts of the proposed transfer station improvements to local queuing issues is expected to be negligible.

Concerns have been expressed with regard to added queuing from the transfer station further backing-up and inhibiting traffic on the southbound approach to S 188th Street at Orillia Road (transfer station exit). As noted in the analysis, this is an unsignalized approach to an arterial that operates at LOS F with average weekday peak hour delays in excess of 2 minutes, and will do so in the future with or without the growth increment added by the continued operation of the transfer facility. The minimal impact of this growth is reflected throughout the LOS and queuing analysis herein. The proposed action itself will result in no impact to these conditions, especially for outbound traffic, since the waste stream expected at the site is forecast to grow at approximately 2 percent annually with or without the project, and there are no plans to close the transfer station. Even with no transfer station and potential development to the north, delays would be very significant for any new development traffic.

Safety Impacts

As was illustrated in Table 9 (2011 Project Traffic Volume Impacts), this project is expected to increase the volumes by less than 1 percent during the weekday AM and PM

peak hours. As such, it is unlikely this project will impact safety conditions at the study intersections.

Year 2030 Planning Analysis

To support longer-range planning, a traffic analysis is also provided for the 2030 horizon year. This is consistent with the Master Plan for the Transfer Station. This section summarizes the traffic volumes for both baseline (without) and with-project conditions. Also, a future 2030 LOS analysis is provided of future baseline and with-project conditions.

Baseline Traffic Volumes

Forecast traffic volumes were established for year 2030 by increasing existing (2006) traffic volumes at an annual rate of 1 percent. This is based on information from the regional forecasting model. The 2030 baseline traffic volumes are provided in Figure 7.

Trip Generation

Based on waste tonnage forecasts provided by King County Solid Waste, year 2030 new project trips were estimated. Waste tonnage is forecast to increase from year 2006 to year 2030 at an annual rate of approximately 2 percent. It is assumed that traffic volumes accessing the site will increase at a linear rate. Thus, existing (2006) PM peak hour traffic volumes accessing the site were increased by 2 percent annually to estimate year 2030 net new project trips. Table 13 summarizes the estimated weekday PM peak hour net new project traffic volumes.

Table 13. Trip Generation Estimate Summary (Year 2030)

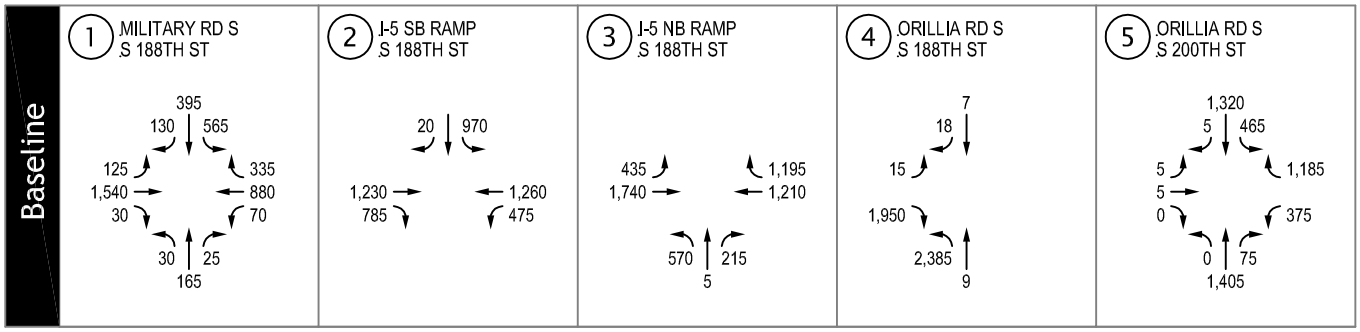
	PM Peak Hour		
Land Use	**Total**	**In**	**Out**
Existing Traffic Volumes[1]	44	19	25
Increased by 2.0% Annually[2]	71	31	40
Total Net New Project Trips	**27**	**12**	**15**

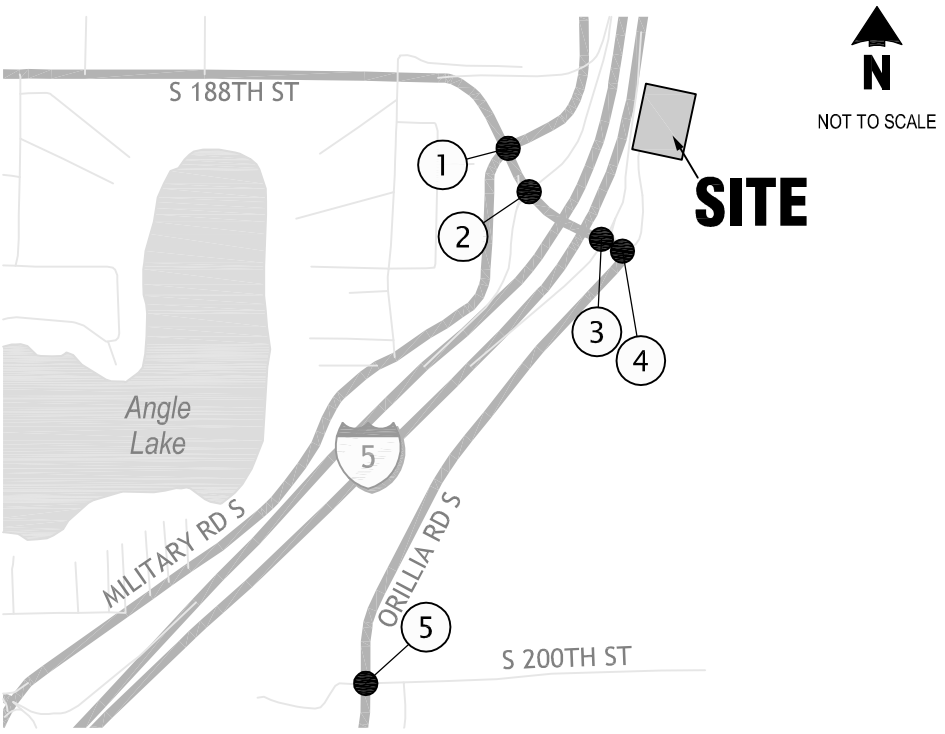
1. Based on existing year 2006 peak hour turning movement counts.
2. Growth rate based on County waste tonnage forecasts.

As Table 13 shows, by year 2030 the project is forecast to generate 27 net new weekday PM peak hour trips. As described in the analysis of 2011 conditions, these net new totals actually overstate the effect of project traffic, since there is no anticipated change in the waste stream arriving at Bow Lake Transfer/Recycling Station due to the proposal.

With-Project Traffic Volumes

The project-generated weekday PM peak hour traffic (Table 13) was added to the baseline traffic volumes to obtain the with-project volumes for the study intersections illustrated in Figure 7. These are the volumes used to estimate project impacts in the operations analysis under 2030 forecast conditions.





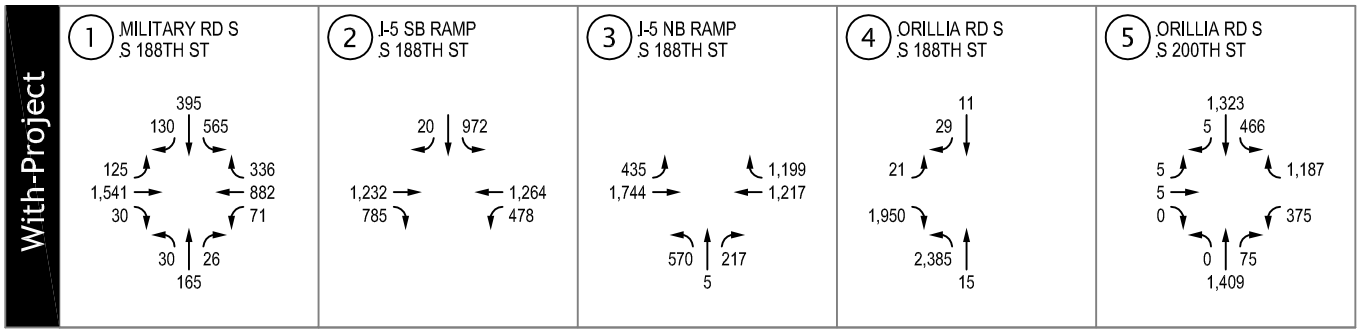


Figure 7
2030 Baseline and With-Project PM Peak Hour Traffic Volumes
Bow Lake Transfer/Recycling Station

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Traffic Operations

A LOS analysis was conducted for year 2030 to quantify forecast traffic operations for both baseline and with-project conditions. The LOS is based on the same HCM methodologies used in the previous analysis. Signal timing was optimized to account for the expected growth in traffic volumes. The optimized signal timing data used to estimate baseline conditions was held constant for the evaluation of with-project conditions to measure the degree of impact of project volumes on study intersections. Table 14 summarizes the baseline and with-project LOS for 2030. The detailed LOS worksheets are provided in Appendix B.

Table 14. 2030 With-Project and Baseline LOS Summary: Weekday PM Peak Hour

	PM Baseline (2030)			PM With-Project (2030)		
Intersection	**LOS[1]**	**Delay[2]**	**V/C[3] or WM[4]**	**LOS**	**Delay**	**V/C or WM**
S 188th St/Military Rd S	D	48.7	0.97	D	49.1	0.97
S 188th St/I-5 SB Ramps	E	56.5	1.12	E	58.5	1.13
S 188th St/I-5 NB Ramps	E	67.0	1.14	E	67.9	1.14
Orillia Rd S/S 200th St	D	49.2	0.97	D	49.5	D
Unsignalized						
S 188th St/Orillia Rd S	C	16.2	NA	D	25.4	NA
Worst Movement	*F*	*>120*	*SB*	*F*	*>120*	*SB*

1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.

As Table 14 shows, during the PM peak hour the overall operation of S 188th Street/Orillia Road S (site access) is expected to degrade from LOS C to LOS D. This change in LOS does not impact commuter traffic on S 188th Street. The change in LOS is due to the increased southbound delay at the site access, which results in increased delays for vehicles exiting the transfer station during the PM peak hour. Project traffic volumes have a negligible impact on all remaining study intersections under 2030 conditions. As noted above, even these negligible impacts are an overestimate of actual impacts. The approach taken was intentionally conservative and assures impacts are not underestimated.

Off-Site Traffic Queuing

Similar to previous queue calculation summaries, this section of the report summarizes the calculated queues between the study area intersections. Table 15 provides a summary of the forecast queuing under baseline conditions compared to the with-project conditions.

Table 15. Intersection Queue Summary: 2030 Baseline and With-Project

	PM Peak Hour		
		95th Percentile[2] Queue	
Direction/Intersection	Capacity[1] (ft)	2030 Baseline (ft)[3]	2030 With-Project (ft)
Westbound			
S 188th St /Military Rd S	205	315	315
S 188th St /I-5 SB Ramps	490	520	525
S 188th St /I-5 NB Ramps	65	1,105	1,115
Eastbound			
S 188th St/Orillia Rd S	65	325	330
S 188th St /I-5 NB Ramps	490	605	605
S 188th St /I-5 SB Ramps	205	800	805

1. Distance between intersections.
2. 95th percentile queue length in feet as reported by Synchro 6.0.
3. Baseline conditions include the volumes from the proposed Tukwila South Project.

As Table 15 shows, by year 2030 capacity between all intersections is expected to be exceeded assuming no capacity improvement projects occur. The addition of the Bow Lake with-project future traffic volume has a negligible impact on queuing along the S 188th Street corridor. Most of the forecast queuing is the result of background traffic volume unrelated to the project site. As previously described, these impacts are an overstatement of actual impacts.

Cumulative Analysis With Tukwila South Project

The purpose of this section is to analyze a future conditions scenario that includes the forecast traffic volumes from the proposed Tukwila South Project (La Pianta, LLC). Tukwila South is proposing development of up to approximately 14 million square feet in a large-scale, campus setting on approximately 498 contiguous acres. Proposed uses are office, research, commercial, retail, residential, hotel, and recreational. Tukwila South proposes three access points with the regional roadway system. The proposed access points are at S 180th Street/South Center Parkway, S 180th Street/Andover Park W, and S 200th Street/Frager Road S. Sixty percent of the Tukwila South traffic is forecast to access the site through the S 200th Street/Frager Road S intersection. From this location, 20 percent of the Tukwila South traffic is forecast to travel on Orillia Road S between S 200th Street and S 188th Street. Tukwila South evaluates the interim year of 2015 and the full-build out year of 2030.

This section of the report summarizes a baseline forecast condition that includes the Tukwila South traffic volumes. The project-generated traffic volumes are added to the baseline (with Tukwila South) volumes to estimate with-project impacts when Tukwila South volumes are included in the background traffic. The Tukwila South Project traffic volumes and data used in this analysis are derived from the Tukwila South Project DEIS (April 2005).

Baseline 2011 Volumes with Tukwila South

Baseline traffic volumes (without Bow Lake new trips) were developed that included the Tukwila South Alternative 1 year 2015 weekday PM peak hour volumes. During this time period, Tukwila South is forecast to generate a total of 3,727 (1,192 in/2,535 out) weekday PM peak hour trips. Of these PM peak hour trips, 745 (20%) are forecast to travel on Orillia Road S between S 188th Street and S 200th Street. These trips were assigned to the roadway network based on the distributions provided in the Tukwila South DEIS.

Only weekday PM peak hour is evaluated since this is typically the time period with highest adjacent street traffic volumes and it is the only time period that was analyzed by Tukwila South in its DEIS. Year 2011 future volumes were estimated by increasing the existing (2006) traffic volume by 1 percent annually and adding the Tukwila South weekday PM peak hour traffic volumes. The 2011 with baseline (with Tukwila South) weekday PM peak hour traffic volumes are summarized in Figure 8.

Tukwila South Planned Improvement Projects

The Tukwila South Project DEIS year 2015 analysis has no planned improvements for the Bow Lake Study intersections. Thus, there are roadway improvements assumed for the traffic operations analysis.

2011 With-Project Traffic Volumes

The project-generated weekday PM peak hour traffic (Table 8) was added to the baseline (with Tukwila South) traffic volumes to obtain the with-project volumes for the study intersections illustrated in Figure 8. These are the volumes used to estimate project impacts in the operations analysis when the Tukwila South project traffic volumes are assumed on the roadway system.

2011 Traffic Operation Impacts

This section of the report summarizes the baseline (with Tukwila South) and with-project (Bow Lake) traffic operations at the study intersections. The operations analysis section summarizes LOS calculations as well as off-site vehicle queuing.

Level of Service

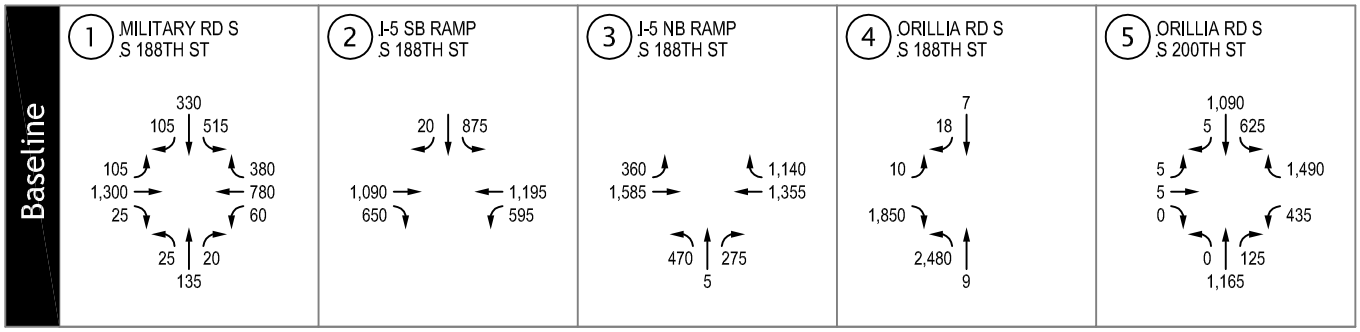
A LOS analysis was conducted for baseline (with Tukwila South) and with-project conditions in order to quantify traffic operations in the study area. For future baseline conditions, cycle lengths remained consistent with existing conditions; the splits were optimized within the max/min parameters on the existing timing plans. Signal timings were held consistent with those used in the evaluation of baseline conditions to measure the degree of impact of the proposed Bow Lake Project. Table 16 summarizes the baseline (with Tukwila South) and with-project (Bow Lake) conditions. The detailed LOS worksheets are provided in Appendix B.

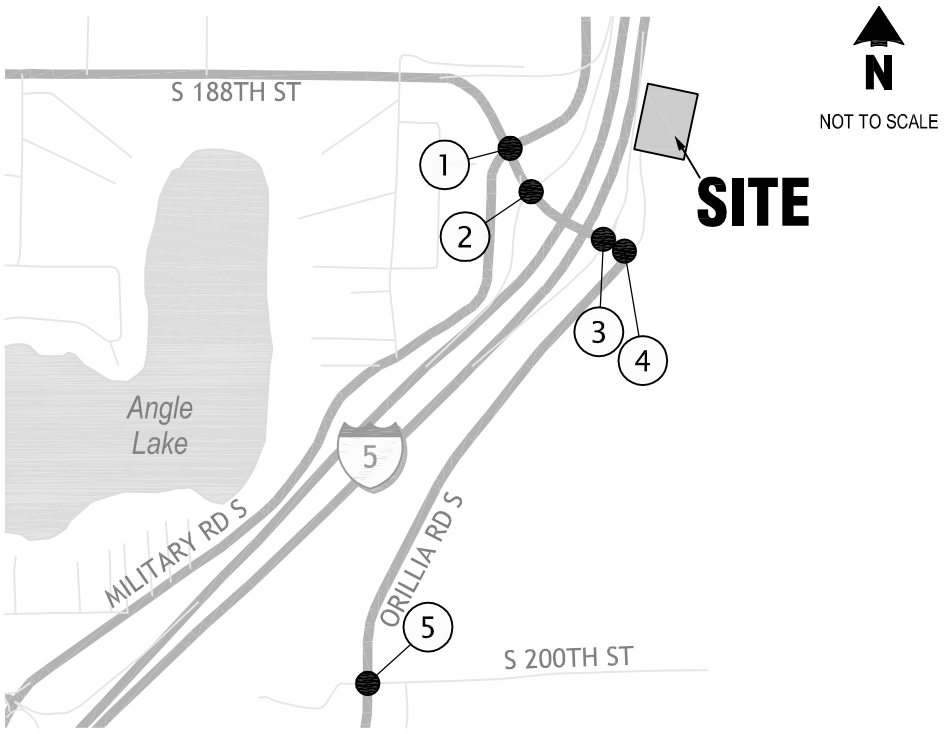
Table 16. 2011 With-Project and Baseline (Tukwila South) LOS Summary: PM Peak Hour

	2011 PM Baseline			2011 PM With-Project		
Intersection	**LOS[1]**	**Delay[2]**	**V/C[3] or WM[4]**	**LOS**	**Delay**	**V/C or WM**
S 188th St/Military Rd S	C	34.8	0.83	C	34.8	0.83
S 188th St/I-5 SB Ramps	E	61.8	1.13	E	62.0	1.13
S 188th St/I-5 NB Ramps	E	55.4	1.11	E	55.6	1.11
Orillia Rd S/S 200th St	F	90.1	1.06	F	90.3	1.06
Unsignalized						
S 188th St/Orillia Rd S	C	16.3	NA	C	18.6	NA
Worst Movement	*F*	*>120*	*SB*	*F*	*>120*	*SB*

1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.

As Table 16 shows, with the inclusion of the Tukwila South Project in the baseline traffic volumes, the Bow Lake project traffic volumes are expected to have an insignificant impact on calculated level of service. The roadways are expected to operate essentially the same with or without Bow Lake traffic volumes.





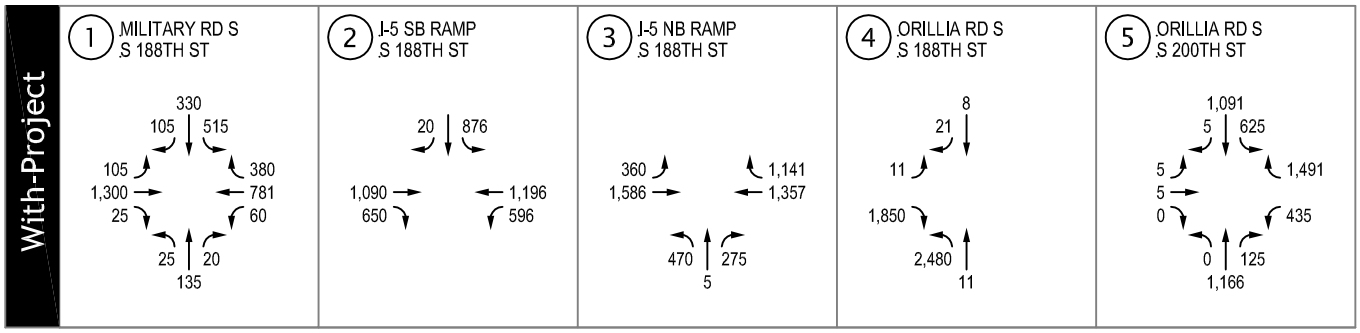


Figure 8

2011 With-Project and Baseline (with Tukwila south) PM Peak Hour Traffic Volumes

Bow Lake Transfer/Recycling Station

The Transpo Group

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Off-Site Traffic Queuing

Similar to previous queue calculation summaries, this section of the report summarizes the calculated queuing between the study area intersections. Table 17 provides a summary of the forecast queuing under baseline conditions that include the Tukwila South traffic volumes, compared with the with-project (Bow Lake) conditions.

Table 17. 2011 Intersection Queue Summary: Weekday PM Peak Hours

	PM Peak Hour		
		95th Percentile[2] Queue	
Direction/Intersection	Capacity[1] (ft)	Baseline (ft)[3]	With-Project (ft)
Westbound			
S 188th St /Military Rd S	205	260	260
S 188th St /I-5 SB Ramps	490	510	515
S 188th St /I-5 NB Ramps	65	865	865
Eastbound			
S 188th St/Orillia Rd S	65	255	255
S 188th St /I-5 NB Ramps	490	540	540
S 188th St /I-5 SB Ramps	205	550	550

1. Distance between intersections.
2. 95th percentile queue length in feet as reported by Synchro 6.0.
3. Baseline conditions include the volumes from the proposed Tukwila South Project.

As Table 17 shows, the addition of the Bow Lake with-project future traffic volume has a negligible impact on queuing along the S 188th Street corridor.

Baseline 2030 Volumes with Tukwila South

Baseline traffic volumes (without Bow Lake new trips) were developed that included the Tukwila South Alternative 1 year 2030 weekday PM peak hour volumes. During this time period Tukwila South is forecast to generate a total of 13,975 (4,304 in/9,671 out) weekday PM peak hour trips. Of these PM peak hour trips 2,795 (20%) are forecast to travel on Orillia Road S between S 188th Street and S 200th Street. These trips were assigned to the roadway network based on the distributions provided in the Tukwila South DEIS.

Only weekday PM peak hour is evaluated since this is typically the time period with highest adjacent street traffic volumes and it is the only time period analyzed by Tukwila South. Year 2030 future volumes were estimated by increasing the existing (2006) traffic volume by 1 percent annually and adding the Tukwila South weekday PM peak hour traffic volumes. The 2030 with baseline (with Tukwila South) weekday PM peak hour traffic volumes are summarized in Figure 9.

Tukwila South Planned Improvement Projects

The Tukwila South Project DEIS year 2030 analysis proposes improvement projects at three study intersections. The proposed improvements are as follows:

- **S 188th Street/I-5 SB Ramps:** Provide an additional westbound left-turn lane for dual lefts and an additional eastbound right-turn lane for dual rights. Rechannelize the southbound leg for dual left-turn lanes and a thru-right lane.
- **S 188th Street/I-5 NB Ramps:** Provide dual westbound right-turn lanes. Rechannelize the northbound leg for dual left-turn lanes, a thru-right lane and a right-turn lane.
- **Orillia Road S/S 200th Street:** Provide double westbound (WB) left-turn lanes, an additional northbound thru lane for three thru lanes, and a northbound right-turn only lane.

These projects were assumed as a baseline condition for the 2030 analysis.

2030 With-Project Traffic Volumes

The project-generated weekday PM peak hour traffic (Table 13) was added to the baseline (with Tukwila South) traffic volumes to obtain the with-project volumes for the study intersections illustrated in Figure 9. These are the volumes used to estimate project impacts in the operations analysis when the Tukwila South project traffic volumes are assumed on the roadway system.

2030 Traffic Operation Impacts

This section of the report summarizes the baseline (with Tukwila South) and with-project (Bow Lake) traffic operations at the study intersections. The operations analysis section summarizes LOS calculations as well as off-site vehicle queuing.

Level of Service

A LOS analysis was conducted for year 2030 to quantify forecast traffic operations for both baseline (with Tukwila South) and with-project (Bow Lake) conditions. The LOS is based on the same HCM methodologies used in the previous analysis. Signal timing was optimized to account for the expected growth in traffic volumes. Cycle lengths were limited to between 60 and 130 seconds for this planning analysis as a reasonable limit for optimization of the 2030 baseline conditions. The proposed intersections projects at the three study intersections were also coded into the model for both baseline and with-project conditions.

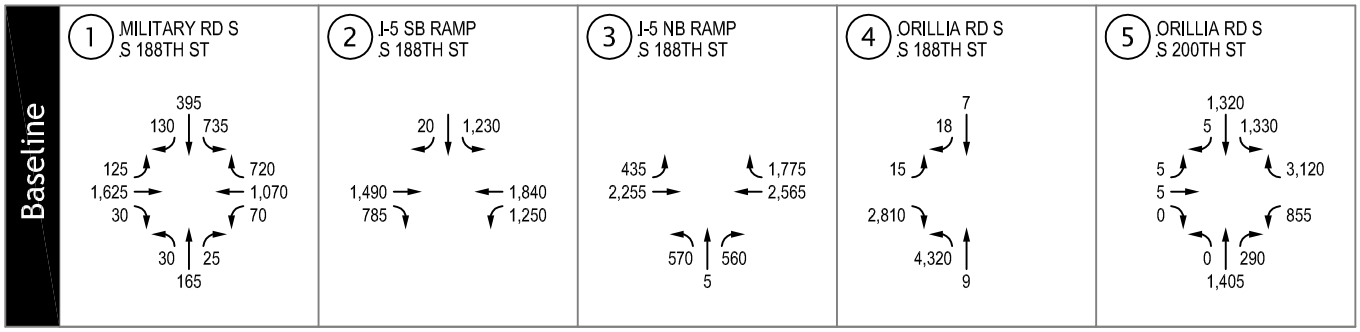
The optimized signal timing data used to estimate baseline conditions was held constant for the evaluation of with-project conditions to measure the degree of impact of project volumes on study intersections. Table 18 summarizes the baseline and with-project level of service for 2030, assuming the Tukwila South Project traffic volumes. The detailed LOS worksheets are provided in Appendix B.

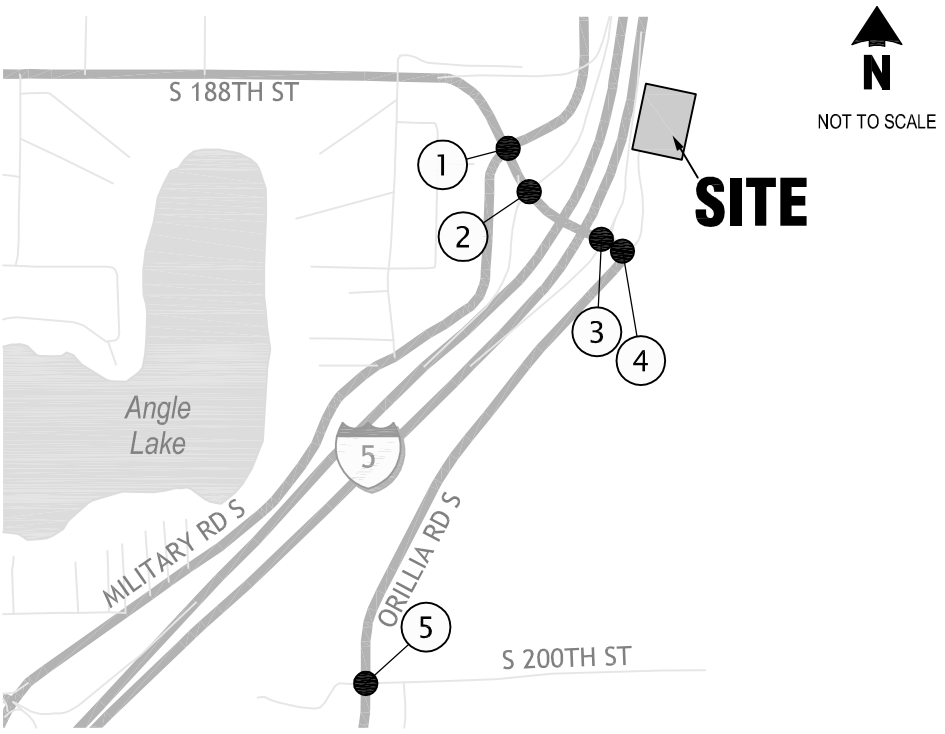
Table 18. 2030 With-Project and Baseline (Tukwila South) LOS Summary: PM Peak Hour

	PM Baseline (2030)			PM With-Project (2030)		
Intersection	**LOS[1]**	**Delay[2]**	**V/C[3] or WM[4]**	**LOS**	**Delay**	**V/C or WM**
S 188th St/Military Rd S	D	53.2	0.98	D	53.3	0.98
S 188th St/I-5 SB Ramps	F	>120	1.40	F	>120	1.41
S 188th St/I-5 NB Ramps	F	104.4	1.32	F	105.3	1.32
Orillia Rd S/S 200th St	F	>120	1.59	F	>120	1.59
Unsignalized						
S 188th St/Orillia Rd S	B	11.7	NA	C	20.1	NA
Worst Movement	*F*	*>120*	*SB*	*F*	*>120*	*SB*

1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Worst movement reported for unsignalized intersections.

As Table 18 shows, with the inclusion of the Tukwila South in the baseline traffic volumes, the Bow Lake project traffic volumes are expected to have an insignificant impact on calculated LOS. The roadways are expected to operate essentially the same with or without Bow Lake traffic volumes.





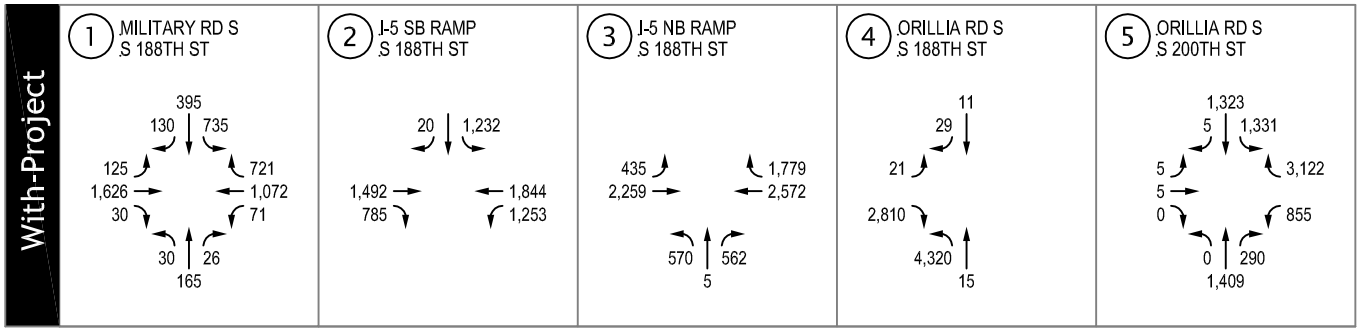


Figure 9

2030 With-Project and Baseline (with Tukwila south) PM Peak Hour Traffic Volumes

Bow Lake Transfer/Recycling Station

The Transpo Group

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Off-Site Traffic Queuing

Similar to previous queue calculation summaries, this section of the report summarizes the calculated queues between the study area intersections. Table 19 provides a summary of the forecast queuing under baseline conditions that include the Tukwila South traffic volumes, compared with the with-project (Bow Lake) conditions.

Table 19. 2030 Intersection Queue Summary: Weekday PM Peak Hours

	PM Peak Hour		
		95th Percentile[2] Queue	
Direction/Intersection	Capacity[1] (ft)	Baseline[3] (ft)	With-Project (ft)
Westbound			
S 188th St /Military Rd S	205	260	260
S 188th St /I-5 SB Ramps	490	450	450
S 188th St /I-5 NB Ramps	65	1680	1685
Eastbound			
S 188th St/Orillia Rd S	65	350	350
S 188th St /I-5 NB Ramps	490	865	870
S 188th St /I-5 SB Ramps	205	900	905

1. Distance between intersections.
2. 95th percentile queue length in feet as reported by Synchro 6.0.
3. Baseline conditions include the volumes from the proposed Tukwila South Project.

As Table 19 shows, the addition of the Bow Lake with-project future traffic volume has a negligible impact on queuing along the S 188th Street corridor. When compared to Table 17, the intersection of S 188th Street/I-5 SB Ramps shows shorter queue lengths under 2030 conditions when compared to the 2011 results. This is due to the proposed improvements at S 188th Street/I-5 SB Ramps under the 2030 analysis.

Mitigation Measures

Based on the identified negligible impacts, no mitigation measures were identified. The negligible impacts are a result of the low volume of new site-generated traffic volume when compared to the TEV of traffic at the study intersections. During the weekday AM peak hour, site-generated future new traffic volume impacts the study intersections total traffic volume with a range of 0.1 to 0.4 percent. During the weekday PM peak hour, site-generated future new traffic volume impacts the study intersections total traffic volume with a range of 0.1 to 0.2 percent. As these results show, during peak commuter travel times the future new site-generated trips comprise a very small part of the traffic stream. The transfer station generates the highest traffic volumes on a Saturday, which coincides with the lowest volume of traffic volumes on the adjacent streets. During the Saturday peak hour, site-generated future new traffic volume impacts the study intersections total traffic volume with a range of 0.2 to 2.3 percent; the 2.3 percent is at the site access. Traffic volumes typically fluctuate about plus or minus 5 percent from day-to-day depending on factors such as the day of the week, weather, and traffic conditions elsewhere in the roadway network. Based on these results, it is unlikely that the average motorist would notice the forecast impact of increased site-generated traffic volume. These conclusions are also verified through the LOS analysis. In addition, even the negligible increases due to the site are an overstatement of actual impacts, since there is no probable difference in site traffic demand anticipated between the proposal and "no action."

Under year 2011, four of the study intersections experienced no LOS change when comparing baseline to with-project conditions. Level of service calculations show that the calculated delay is expected to change by less than 0.1 seconds at the four intersections. Only the intersection of S 188th Street/Orillia Road S (site access) experienced changes in LOS during the PM peak hour. During the weekday AM peak hour, S 188th Street/Orillia Road S operates at LOS A under both baseline and with-project conditions. During the weekday PM peak hour, S 188th Street/Orillia Road S changes from LOS A under baseline conditions to LOS C under with-project conditions. The southbound approach operates at LOS F under both weekday AM and PM conditions. As noted in the foregoing analysis, S 188th Street/Orillia Road S is an unsignalized approach to an arterial that operates at LOS F with average weekday peak hour delays in excess of 2 minutes, and will do so in the future with or without the growth increment added by the continued operation of the transfer facility. The proposed action itself will result in no impact to these conditions, especially for outbound traffic, since the waste stream expected at the site is forecast to grow at approximately 2 percent annually with or without the project, and there are no plans to close the transfer station. Even without a transfer station and potential development to the north, delays would be very significant for any new development traffic.

Appendix A: Level Of Service Criteria

Highway Capacity Manual, 2000

Signalized intersection level of service (LOS) is defined in terms of the average total vehicle delay of all movements through an intersection. Vehicle delay is a method of quantifying several intangible factors, including driver discomfort, frustration, and lost travel time. Specifically, LOS criteria are stated in terms of average delay per vehicle during a specified time period (for example, the PM peak hour). Vehicle delay is a complex measure based on many variables, including signal phasing (i.e., progression of movements through the intersection), signal cycle length, and traffic volumes with respect to intersection capacity. Table 1 shows LOS criteria for signalized intersections, as described in the *Highway Capacity Manual* (Transportation Research Board, Special Report 209, 2000).

Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (sec/veh)	General Description (Signalized Intersections)
A	≤10	Free Flow
B	>10 - 20	Stable Flow (slight delays)
C	>20 - 35	Stable flow (acceptable delays)
D	>35 - 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 - 80	Unstable flow (intolerable delay)
F	>80	Forced flow (jammed)

Unsignalized intersection LOS criteria can be further reduced into two intersection types: all-way stop-controlled and two-way stop-controlled. All-way, stop-controlled intersection LOS is expressed in terms of the average vehicle delay of all of the movements, much like that of a signalized intersection. Two-way, stop-controlled intersection LOS is defined in terms of the average vehicle delay of an individual movement(s). This is because the performance of a two-way, stop-controlled intersection is more closely reflected in terms of its individual movements, rather than its performance overall. For this reason, LOS for a two-way, stop-controlled intersection is defined in terms of its individual movements. With this in mind, total average vehicle delay (i.e., average delay of all movements) for a two-way, stop-controlled intersection should be viewed with discretion. Table 2 shows LOS criteria for unsignalized intersections (both all-way and two-way, stop-controlled).

Table 2. Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (sec/veh)
A	0 - 10
B	>10 - 15
C	>15 - 25
D	>25 - 35
E	>35 - 50
F	>50

Appendix B: Level of Service Worksheets

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	117	783	2	12	879	374	68	460	337	243
v/c Ratio	0.69	0.52	0.00	0.08	0.80	0.57	0.41	1.43	0.65	0.80
Control Delay	57.3	18.5	12.0	46.5	25.4	9.5	41.8	237.7	37.6	44.3
Queue Delay	0.0	0.3	0.0	0.0	14.7	2.4	0.0	2.0	0.0	0.0
Total Delay	57.3	18.8	12.0	46.5	40.1	11.9	41.8	239.7	37.6	44.3
Queue Length 50th (ft)	58	133	0	5	170	52	33	~319	86	91
Queue Length 95th (ft)	#134	242	5	m12	261	64	72	#500	132	#219
Internal Link Dist (ft)		436			107		431			246
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	170	1516	679	169	1097	658	169	322	537	302
Starvation Cap Reductn	0	0	0	0	218	169	0	0	0	0
Spillback Cap Reductn	0	249	0	0	0	0	0	1	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.62	0.00	0.07	1.00	0.76	0.40	1.43	0.63	0.80

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.91	0.91	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.98	
Satd. Flow (prot)	1703	3406	1524	1687	3374	1509	1687	1509		3070	1448	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1703	3406	1524	1687	3374	1509	1687	1509		3070	1479	
Volume (vph)	105	705	2	11	791	337	61	335	79	303	95	123
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	117	783	2	12	879	374	68	372	88	337	106	137
RTOR Reduction (vph)	0	0	1	0	0	171	0	10	0	0	39	0
Lane Group Flow (vph)	117	783	1	12	879	203	68	450	0	337	204	0
Heavy Vehicles (%)	6%	6%	6%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	6.3	28.9	28.9	1.5	24.2	24.2	5.0	15.7		11.9	33.5	
Effective Green, g (s)	8.0	30.7	30.7	2.2	24.9	24.9	6.7	17.6		13.5	35.1	
Actuated g/C Ratio	0.10	0.38	0.38	0.03	0.31	0.31	0.08	0.22		0.17	0.44	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	170	1307	585	46	1050	470	141	332		518	645	
v/s Ratio Prot	c0.07	0.23		0.01	c0.26		0.04	c0.30		c0.11	0.05	
v/s Ratio Perm			0.00			0.13					0.09	
v/c Ratio	0.69	0.60	0.00	0.26	0.84	0.43	0.48	1.36		0.65	0.32	
Uniform Delay, d1	34.8	19.7	15.2	38.1	25.7	21.9	35.0	31.2		31.0	14.6	
Progression Factor	1.00	1.00	1.00	1.36	0.79	0.82	1.00	1.00		1.00	1.00	
Incremental Delay, d2	20.4	2.0	0.0	2.6	6.8	2.5	2.6	178.3		2.9	0.3	
Delay (s)	55.2	21.8	15.2	54.4	27.1	20.4	37.6	209.5		34.0	14.9	
Level of Service	E	C	B	D	C	C	D	F		C	B	
Approach Delay (s)		26.1			25.4		187.4				26.0	
Approach LOS		C			C		F				C	

Intersection Summary

HCM Average Control Delay	51.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	767	402	108	1154	383	346
v/c Ratio	0.48	0.43	0.32	0.57	0.77	0.69
Control Delay	16.4	4.0	14.9	11.1	36.1	31.3
Queue Delay	0.5	0.8	0.0	1.9	0.1	0.6
Total Delay	16.9	4.8	14.9	13.0	36.3	31.9
Queue Length 50th (ft)	154	16	22	133	184	156
Queue Length 95th (ft)	m160	m39	m38	198	247	215
Internal Link Dist (ft)	107			326		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1610	930	371	2021	665	664
Starvation Cap Reductn	432	268	0	176	0	0
Spillback Cap Reductn	0	0	0	668	23	97
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.61	0.29	0.85	0.60	0.61

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.98	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.96	
Satd. Flow (prot)		3374	1509	1656	3312					1715	1698	
Flt Permitted		1.00	1.00	0.25	1.00					0.95	0.96	
Satd. Flow (perm)		3374	1509	439	3312					1715	1698	
Volume (vph)	0	706	370	99	1062	0	0	0	0	632	0	39
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	767	402	108	1154	0	0	0	0	687	0	42
RTOR Reduction (vph)	0	0	216	0	0	0	0	0	0	0	7	0
Lane Group Flow (vph)	0	767	186	108	1154	0	0	0	0	383	339	0
Heavy Vehicles (%)	7%	7%	7%	9%	9%	9%	9%	9%	9%	0%	0%	0%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		36.1	36.1	47.8	47.8					22.2	22.2	
Effective Green, g (s)		37.1	37.1	48.8	48.8					23.2	23.2	
Actuated g/C Ratio		0.46	0.46	0.61	0.61					0.29	0.29	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1565	700	385	2020					497	492	
v/s Ratio Prot		0.23		0.03	c0.35							
v/s Ratio Perm			0.12	0.14						c0.22	0.20	
v/c Ratio		0.49	0.27	0.28	0.57					0.77	0.69	
Uniform Delay, d1		14.9	13.1	7.7	9.3					26.0	25.2	
Progression Factor		0.91	1.18	1.63	0.97					1.00	1.00	
Incremental Delay, d2		0.9	0.7	0.2	0.7					7.3	4.0	
Delay (s)		14.4	16.3	12.7	9.7					33.2	29.2	
Level of Service		B	B	B	A					C	C	
Approach Delay (s)		15.1			10.0			0.0			31.3	
Approach LOS		B			A			A			C	

Intersection Summary

HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	278	1349	880	673	413	385
v/c Ratio	0.66	0.67	0.79	0.73	0.83	0.79
Control Delay	25.0	14.4	33.2	8.0	39.7	34.8
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	25.0	14.6	33.2	8.0	39.7	34.8
Queue Length 50th (ft)	102	207	210	0	196	164
Queue Length 95th (ft)	m186	332	#367	92	283	249
Internal Link Dist (ft)		326	1			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	488	2013	1111	926	587	564
Starvation Cap Reductn	0	154	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.73	0.79	0.73	0.70	0.68

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.89	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.99	
Satd. Flow (prot)	1703	3406			3059	1369			1618	1492	
Flt Permitted	0.15	1.00			1.00	1.00			0.95	0.99	
Satd. Flow (perm)	270	3406			3059	1369			1618	1492	
Volume (vph)	245	1187	0	0	774	592	0	0	448	0	254
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	278	1349	0	0	880	673	0	0	509	0	289
RTOR Reduction (vph)	0	0	0	0	0	428	0	0	0	26	0
Lane Group Flow (vph)	278	1349	0	0	880	245	0	0	413	359	0
Heavy Vehicles (%)	6%	6%	6%	18%	18%	18%	0%	0%	6%	6%	6%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	46.3	46.3			28.1	28.1			23.7	23.7	
Effective Green, g (s)	47.3	47.3			29.1	29.1			24.7	24.7	
Actuated g/C Ratio	0.59	0.59			0.36	0.36			0.31	0.31	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	414	2014			1113	498			500	461	
v/s Ratio Prot	0.12	c0.40			c0.29				c0.26	0.24	
v/s Ratio Perm	0.28					0.18					
v/c Ratio	0.67	0.67			0.79	0.49			0.83	0.78	
Uniform Delay, d1	12.2	11.1			22.7	19.7			25.7	25.2	
Progression Factor	1.55	1.05			1.00	1.00			1.00	1.00	
Incremental Delay, d2	3.3	1.5			5.8	3.4			11.0	8.4	
Delay (s)	22.2	13.1			28.5	23.2			36.6	33.6	
Level of Service	C	B			C	C			D	C	
Approach Delay (s)		14.7			26.2		0.0			35.1	
Approach LOS		B			C		A			D	

Intersection Summary

HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1343	21	23	1417	9	20
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	1444	23	25	1524	10	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				74		
pX, platoon unblocked					0.73	
vC, conflicting volume			1467		2267	733
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1467		2364	733
tC, single (s)			4.3		8.4	8.5
tC, 2 stage (s)						
tF (s)			2.3		4.3	4.1
p0 queue free %			94		0	91
cM capacity (veh/h)			418		7	231

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	963	504	25	762	762	10	22
Volume Left	0	0	25	0	0	10	0
Volume Right	0	23	0	0	0	0	22
cSH	1700	1700	418	1700	1700	7	231
Volume to Capacity	0.57	0.30	0.06	0.45	0.45	1.37	0.09
Queue Length 95th (ft)	0	0	5	0	0	52	8
Control Delay (s)	0.0	0.0	14.1	0.0	0.0	1164.9	22.2
Lane LOS			B			F	C
Approach Delay (s)	0.0		0.2			376.8	
Approach LOS						F	

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	2	31	374	1207	662	849
v/c Ratio	0.01	0.19	0.45	0.66	0.99	0.29
Control Delay	30.0	32.8	6.7	14.4	61.8	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.0	32.8	6.7	14.4	61.8	3.0
Queue Length 50th (ft)	0	10	13	104	112	0
Queue Length 95th (ft)	7	40	51	#394	#333	132
Internal Link Dist (ft)	36			266		3370
Turn Bay Length (ft)						
Base Capacity (vph)	171	313	828	1827	672	2967
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.10	0.45	0.66	0.99	0.29

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88		0.95		0.97	0.95	
Frt		0.93		1.00		0.85		0.98		1.00	1.00	
Flt Protected		1.00		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1772		1410		2221		3196		3273	3373	
Flt Permitted		1.00		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1772		1410		2221		3196		3273	3373	
Volume (vph)	0	1	1	30	0	363	0	1036	135	642	822	2
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1	1	31	0	374	0	1068	139	662	847	2
RTOR Reduction (vph)	0	1	0	0	0	222	0	9	0	0	0	0
Lane Group Flow (vph)	0	1	0	31	0	152	0	1198	0	662	849	0
Heavy Vehicles (%)	0%	0%	0%	28%	28%	28%	11%	11%	11%	7%	7%	7%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.8		3.0		14.3		34.9		11.3	52.2	
Effective Green, g (s)		2.8		4.0		17.3		36.9		13.3	54.2	
Actuated g/C Ratio		0.04		0.05		0.24		0.51		0.18	0.74	
Clearance Time (s)		6.0		5.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		68		77		648		1616		596	2504	
v/s Ratio Prot		c0.00		c0.02		0.04		c0.37		c0.20	0.25	
v/s Ratio Perm						0.03						
v/c Ratio		0.02		0.40		0.23		0.74		1.11	0.34	
Uniform Delay, d1		33.8		33.3		22.5		14.3		29.8	3.2	
Progression Factor		1.00		1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.1		3.4		0.2		3.1		71.1	0.4	
Delay (s)		33.9		36.8		22.7		17.4		100.9	3.6	
Level of Service		C		D		C		B		F	A	
Approach Delay (s)		33.9			23.8			17.4			46.2	
Approach LOS		C			C			B			D	

Intersection Summary				
HCM Average Control Delay	32.2	HCM Level of Service		C
HCM Volume to Capacity ratio	0.77			
Actuated Cycle Length (s)	73.0	Sum of lost time (s)		16.0
Intersection Capacity Utilization	69.6%	ICU Level of Service		C
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	100	1238	22	56	706	269	22	149	453	422
v/c Ratio	0.33	0.85	0.03	0.37	0.66	0.45	0.17	0.61	0.67	0.70
Control Delay	42.5	36.4	13.8	40.3	28.0	12.6	46.1	48.2	41.9	34.2
Queue Delay	0.0	8.6	0.0	0.0	3.8	1.7	0.0	0.0	0.0	0.0
Total Delay	42.5	45.0	13.8	40.3	31.7	14.4	46.1	48.2	41.9	34.2
Queue Length 50th (ft)	57	386	3	26	174	51	13	85	139	200
Queue Length 95th (ft)	115	#624	21	m54	m244	m126	38	150	177	338
Internal Link Dist (ft)		436			126		426			253
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	307	1455	660	189	1066	597	139	270	884	619
Starvation Cap Reductn	0	0	0	0	268	187	0	0	0	0
Spillback Cap Reductn	0	197	0	0	0	0	0	0	14	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.98	0.03	0.30	0.88	0.66	0.16	0.55	0.52	0.68

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1712	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1712	
Volume (vph)	98	1213	22	55	692	264	22	128	18	444	312	102
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	100	1238	22	56	706	269	22	131	18	453	318	104
RTOR Reduction (vph)	0	0	9	0	0	126	0	5	0	0	12	0
Lane Group Flow (vph)	100	1238	13	56	706	143	22	144	0	453	410	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	4%	4%	4%	3%	3%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	16.0	35.8	35.8	7.0	26.9	26.9	2.5	17.0		18.2	32.9	
Effective Green, g (s)	17.7	37.6	37.6	7.7	27.6	27.6	4.2	18.9		19.8	34.5	
Actuated g/C Ratio	0.18	0.38	0.38	0.08	0.28	0.28	0.04	0.19		0.20	0.34	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	307	1305	584	132	949	424	73	294		673	591	
v/s Ratio Prot	0.06	c0.36		c0.03	0.21		0.01	0.09		c0.13	c0.24	
v/s Ratio Perm			0.01			0.09						
v/c Ratio	0.33	0.95	0.02	0.42	0.74	0.34	0.30	0.49		0.67	0.69	
Uniform Delay, d1	35.9	30.3	19.6	44.0	33.0	28.9	46.5	36.2		37.1	28.2	
Progression Factor	1.00	1.00	1.00	0.80	0.83	1.02	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.8	15.3	0.1	2.0	4.7	1.9	2.3	1.3		2.7	3.5	
Delay (s)	38.7	45.6	19.7	37.4	32.0	31.5	48.8	37.5		39.8	31.7	
Level of Service	D	D	B	D	C	C	D	D		D	C	
Approach Delay (s)		44.7			32.2		39.0				35.9	
Approach LOS		D			C		D				D	

Intersection Summary

HCM Average Control Delay	38.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	999	639	387	1022	425	382
v/c Ratio	0.78	0.66	0.83	0.46	1.08	0.97
Control Delay	24.2	6.4	47.6	10.1	105.1	76.4
Queue Delay	71.5	15.3	0.0	1.1	0.0	0.5
Total Delay	95.6	21.7	47.6	11.2	105.1	76.8
Queue Length 50th (ft)	257	48	235	141	~333	~264
Queue Length 95th (ft)	m216	m75	m316	m228	#530	#467
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1281	972	512	2248	394	394
Starvation Cap Reductn	414	324	0	468	0	0
Spillback Cap Reductn	0	0	0	909	0	1
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.15	0.99	0.76	0.76	1.08	0.97

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.99	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	
Satd. Flow (prot)		3406	1524	1703	3406					1441	1438	
Flt Permitted		1.00	1.00	0.11	1.00					0.95	0.95	
Satd. Flow (perm)		3406	1524	196	3406					1441	1438	
Volume (vph)	0	969	620	375	991	0	0	0	0	765	0	17
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	999	639	387	1022	0	0	0	0	789	0	18
RTOR Reduction (vph)	0	0	399	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	999	240	387	1022	0	0	0	0	425	381	0
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	0%	0%	0%	19%	19%	19%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		36.6	36.6	63.7	63.7					26.3	26.3	
Effective Green, g (s)		37.6	37.6	64.7	64.7					27.3	27.3	
Actuated g/C Ratio		0.38	0.38	0.65	0.65					0.27	0.27	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1281	573	475	2204					393	393	
v/s Ratio Prot		0.29		c0.19	0.30							
v/s Ratio Perm			0.16	c0.34						c0.29	0.26	
v/c Ratio		0.78	0.42	0.81	0.46					1.08	0.97	
Uniform Delay, d1		27.5	23.1	25.0	8.9					36.4	35.9	
Progression Factor		0.75	2.04	1.58	1.08					1.00	1.00	
Incremental Delay, d2		2.8	1.3	7.0	0.5					69.0	36.7	
Delay (s)		23.5	48.4	46.5	10.1					105.3	72.6	
Level of Service		C	D	D	B					F	E	
Approach Delay (s)		33.2			20.1			0.0			89.8	
Approach LOS		C			C			A			F	

Intersection Summary

HCM Average Control Delay	40.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	105.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	353	1412	982	971	319	321
v/c Ratio	0.79	0.63	0.69	0.95	0.86	0.81
Control Delay	36.0	12.7	28.7	30.7	58.8	46.2
Queue Delay	0.0	0.5	0.0	0.0	0.0	0.0
Total Delay	36.0	13.1	28.7	30.7	58.8	46.2
Queue Length 50th (ft)	214	271	285	265	200	164
Queue Length 95th (ft)	m250	m337	374	#602	#346	#304
Internal Link Dist (ft)		410	1			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	502	2224	1414	1017	398	419
Starvation Cap Reductn	0	351	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.75	0.69	0.95	0.80	0.77

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.92	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.98	
Satd. Flow (prot)	1641	3282			3406	1524			1531	1447	
Flt Permitted	0.14	1.00			1.00	1.00			0.95	0.98	
Satd. Flow (perm)	244	3282			3406	1524			1531	1447	
Volume (vph)	342	1370	0	0	953	942	0	0	449	3	169
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	353	1412	0	0	982	971	0	0	463	3	174
RTOR Reduction (vph)	0	0	0	0	0	384	0	0	0	44	0
Lane Group Flow (vph)	353	1412	0	0	982	587	0	0	319	277	0
Heavy Vehicles (%)	10%	10%	10%	6%	6%	6%	0%	0%	12%	12%	12%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	66.8	66.8			40.6	40.6			23.2	23.2	
Effective Green, g (s)	67.8	67.8			41.6	41.6			24.2	24.2	
Actuated g/C Ratio	0.68	0.68			0.42	0.42			0.24	0.24	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	476	2225			1417	634			371	350	
v/s Ratio Prot	c0.16	0.43			0.29				c0.21	0.19	
v/s Ratio Perm	0.34					c0.39					
v/c Ratio	0.74	0.63			0.69	0.93			0.86	0.79	
Uniform Delay, d1	19.6	9.1			24.0	27.7			36.3	35.5	
Progression Factor	1.39	1.24			1.00	1.00			1.00	1.00	
Incremental Delay, d2	2.6	0.6			2.8	21.6			18.1	11.9	
Delay (s)	29.8	11.9			26.8	49.4			54.3	47.4	
Level of Service	C	B			C	D			D	D	
Approach Delay (s)		15.5			38.0		0.0			50.9	
Approach LOS		B			D		A			D	

Intersection Summary			
HCM Average Control Delay	30.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	105.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1878	9	10	1535	7	18
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	2019	10	11	1651	8	19
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				66		
pX, platoon unblocked					0.76	
vC, conflicting volume			2029		2871	1015
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			2029		3153	1015
tC, single (s)			4.3		7.3	7.4
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.5
p0 queue free %			96		0	90
cM capacity (veh/h)			247		4	201

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1346	683	11	825	825	8	19
Volume Left	0	0	11	0	0	8	0
Volume Right	0	10	0	0	0	0	19
cSH	1700	1700	247	1700	1700	4	201
Volume to Capacity	0.79	0.40	0.04	0.49	0.49	1.87	0.10
Queue Length 95th (ft)	0	0	3	0	0	48	8
Control Delay (s)	0.0	0.0	20.2	0.0	0.0	1983.9	24.8
Lane LOS			C			F	C
Approach Delay (s)	0.0		0.1			573.4	
Approach LOS						F	

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	2	309	984	1229	387	1094
v/c Ratio	0.01	0.82	0.74	0.79	0.75	0.51
Control Delay	38.5	49.8	17.9	24.7	43.7	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.5	49.8	17.9	24.7	43.7	8.7
Queue Length 50th (ft)	1	143	155	256	94	120
Queue Length 95th (ft)	8	#320	294	#467	#186	242
Internal Link Dist (ft)	36			266		3373
Turn Bay Length (ft)						
Base Capacity (vph)	145	389	1337	1547	515	2166
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.79	0.74	0.79	0.75	0.51

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88		0.95		0.97	0.95	
Frt		1.00		1.00		0.85		0.99		1.00	1.00	
Flt Protected		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1854		1752		2760		3444		3183	3281	
Flt Permitted		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1854		1752		2760		3444		3183	3281	
Volume (vph)	1	1	0	294	0	935	0	1108	60	368	1038	1
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1	1	0	309	0	984	0	1166	63	387	1093	1
RTOR Reduction (vph)	0	0	0	0	0	177	0	4	0	0	0	0
Lane Group Flow (vph)	0	2	0	309	0	807	0	1225	0	387	1094	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	10%	10%	10%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.9		16.4		27.4		34.2		11.0	51.2	
Effective Green, g (s)		2.9		17.4		30.4		36.2		13.0	53.2	
Actuated g/C Ratio		0.03		0.20		0.36		0.42		0.15	0.62	
Clearance Time (s)		6.0		5.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		63		357		1110		1458		484	2042	
v/s Ratio Prot				c0.18		c0.11		c0.36		0.12	0.33	
v/s Ratio Perm		0.00				0.18						
v/c Ratio		0.03		0.87		0.73		0.84		0.80	0.54	
Uniform Delay, d1		39.9		32.9		23.9		22.1		35.0	9.2	
Progression Factor		1.00		1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.2		19.1		2.4		6.0		9.0	1.0	
Delay (s)		40.1		52.1		26.4		28.1		44.0	10.2	
Level of Service		D		D		C		C		D	B	
Approach Delay (s)		40.1			32.5			28.1			19.0	
Approach LOS		D			C			C			B	

Intersection Summary				
HCM Average Control Delay	26.1	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.77			
Actuated Cycle Length (s)	85.5	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	79.4%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	104	911	26	28	536	178	32	202	282	240
v/c Ratio	0.36	0.56	0.04	0.19	0.46	0.28	0.21	0.70	0.53	0.46
Control Delay	40.0	22.0	7.8	33.0	22.9	8.2	41.7	45.3	38.4	27.7
Queue Delay	0.0	0.0	0.0	0.0	2.2	0.8	0.0	0.0	0.0	0.0
Total Delay	40.0	22.0	7.8	33.0	25.0	9.0	41.7	45.3	38.4	27.7
Queue Length 50th (ft)	55	222	0	17	151	26	17	96	77	106
Queue Length 95th (ft)	107	305	17	m27	146	74	45	#192	111	176
Internal Link Dist (ft)		436			126		431			246
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	285	1624	741	212	1157	634	157	308	655	529
Starvation Cap Reductn	0	0	0	0	462	243	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.56	0.04	0.13	0.77	0.46	0.20	0.66	0.43	0.45

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1787	3574	1599	1736	3471	1553	1770	1583		3467	1746	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1787	3574	1599	1736	3471	1553	1770	1583		3467	1746	
Volume (vph)	99	865	25	27	509	169	30	142	50	268	172	56
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	911	26	28	536	178	32	149	53	282	181	59
RTOR Reduction (vph)	0	0	15	0	0	120	0	14	0	0	13	0
Lane Group Flow (vph)	104	911	11	28	536	58	32	188	0	282	227	0
Heavy Vehicles (%)	1%	1%	1%	4%	4%	4%	2%	2%	2%	1%	1%	1%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	12.7	34.9	34.9	4.7	27.0	27.0	3.8	16.1		12.3	24.8	
Effective Green, g (s)	14.4	36.7	36.7	5.4	27.7	27.7	5.5	18.0		13.9	26.4	
Actuated g/C Ratio	0.16	0.41	0.41	0.06	0.31	0.31	0.06	0.20		0.15	0.29	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	286	1457	652	104	1068	478	108	317		535	512	
v/s Ratio Prot	c0.06	c0.25		0.02	0.15		0.02	c0.12		c0.08	0.13	
v/s Ratio Perm			0.01			0.04						
v/c Ratio	0.36	0.63	0.02	0.27	0.50	0.12	0.30	0.59		0.53	0.44	
Uniform Delay, d1	33.7	21.2	15.9	40.4	25.5	22.4	40.4	32.7		35.0	25.8	
Progression Factor	1.00	1.00	1.00	0.80	0.90	1.80	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.6	2.0	0.0	1.4	1.6	0.5	1.5	3.0		0.9	0.6	
Delay (s)	37.3	23.2	15.9	33.6	24.6	40.9	41.9	35.7		36.0	26.5	
Level of Service	D	C	B	C	C	D	D	D		D	C	
Approach Delay (s)		24.4			28.8		36.5				31.6	
Approach LOS		C			C		D				C	

Intersection Summary

HCM Average Control Delay	28.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	617	585	100	689	112	108
v/c Ratio	0.27	0.47	0.20	0.25	0.53	0.45
Control Delay	6.5	2.9	4.6	5.1	44.4	28.0
Queue Delay	0.4	0.5	0.0	0.0	0.0	0.0
Total Delay	6.9	3.4	4.6	5.1	44.4	28.0
Queue Length 50th (ft)	55	16	13	100	63	35
Queue Length 95th (ft)	62	34	m33	140	112	83
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	2318	1239	671	2712	446	457
Starvation Cap Reductn	1096	292	0	0	0	0
Spillback Cap Reductn	0	0	0	513	0	5
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.62	0.15	0.31	0.25	0.24

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.94	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.97	
Satd. Flow (prot)		3539	1583	1752	3505					1545	1480	
Flt Permitted		1.00	1.00	0.37	1.00					0.95	0.97	
Satd. Flow (perm)		3539	1583	683	3505					1545	1480	
Volume (vph)	0	592	562	96	661	0	0	0	0	167	0	44
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	617	585	100	689	0	0	0	0	174	0	46
RTOR Reduction (vph)	0	0	209	0	0	0	0	0	0	0	36	0
Lane Group Flow (vph)	0	617	376	100	689	0	0	0	0	112	72	0
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	11%	11%	11%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		56.9	56.9	68.6	68.6					11.4	11.4	
Effective Green, g (s)		57.9	57.9	69.6	69.6					12.4	12.4	
Actuated g/C Ratio		0.64	0.64	0.77	0.77					0.14	0.14	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		2277	1018	620	2711					213	204	
v/s Ratio Prot		0.17		0.01	c0.20							
v/s Ratio Perm			c0.24	0.11						c0.07	0.05	
v/c Ratio		0.27	0.37	0.16	0.25					0.53	0.35	
Uniform Delay, d1		6.9	7.5	2.8	2.9					36.1	35.2	
Progression Factor		0.81	1.86	1.28	1.52					1.00	1.00	
Incremental Delay, d2		0.2	0.9	0.1	0.2					2.3	1.1	
Delay (s)		5.8	14.9	3.7	4.6					38.4	36.2	
Level of Service		A	B	A	A					D	D	
Approach Delay (s)		10.2			4.5			0.0			37.3	
Approach LOS		B			A			A			D	

Intersection Summary				
HCM Average Control Delay	10.9	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.39			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	56.1%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	313	523	388	277	257	245
v/c Ratio	0.51	0.22	0.22	0.30	0.71	0.64
Control Delay	10.4	5.6	14.0	3.2	42.7	33.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.4	5.6	14.0	3.2	42.7	33.9
Queue Length 50th (ft)	63	54	58	0	142	111
Queue Length 95th (ft)	124	87	113	48	210	177
Internal Link Dist (ft)		410	9			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	774	2381	1756	920	481	490
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.22	0.22	0.30	0.53	0.50

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.94	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.97	
Satd. Flow (prot)	1719	3438			3406	1524			1665	1596	
Flt Permitted	0.46	1.00			1.00	1.00			0.95	0.97	
Satd. Flow (perm)	841	3438			3406	1524			1665	1596	
Volume (vph)	291	486	0	0	361	258	0	0	371	1	95
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	313	523	0	0	388	277	0	0	399	1	102
RTOR Reduction (vph)	0	0	0	0	0	134	0	0	0	31	0
Lane Group Flow (vph)	313	523	0	0	388	143	0	0	257	214	0
Heavy Vehicles (%)	5%	5%	5%	6%	6%	6%	0%	0%	3%	3%	3%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	61.3	61.3			45.4	45.4			18.7	18.7	
Effective Green, g (s)	62.3	62.3			46.4	46.4			19.7	19.7	
Actuated g/C Ratio	0.69	0.69			0.52	0.52			0.22	0.22	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	698	2380			1756	786			364	349	
v/s Ratio Prot	c0.06	0.15			0.11				c0.15	0.13	
v/s Ratio Perm	c0.25					0.09					
v/c Ratio	0.45	0.22			0.22	0.18			0.71	0.61	
Uniform Delay, d1	5.5	5.0			11.9	11.7			32.5	31.7	
Progression Factor	1.23	0.96			1.00	1.00			1.00	1.00	
Incremental Delay, d2	0.3	0.2			0.3	0.5			6.3	3.3	
Delay (s)	7.0	5.0			12.2	12.2			38.8	35.0	
Level of Service	A	A			B	B			D	D	
Approach Delay (s)		5.8			12.2		0.0			37.0	
Approach LOS		A			B		A			D	

Intersection Summary			
HCM Average Control Delay	15.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	532	30	63	509	18	70
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	566	32	67	541	19	74
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				89		
pX, platoon unblocked					0.95	
vC, conflicting volume			598		987	299
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			598		936	299
tC, single (s)			4.2		6.9	7.0
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			93		92	89
cM capacity (veh/h)			941		227	685

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	377	221	67	271	271	19	74
Volume Left	0	0	67	0	0	19	0
Volume Right	0	32	0	0	0	0	74
cSH	1700	1700	941	1700	1700	227	685
Volume to Capacity	0.22	0.13	0.07	0.16	0.16	0.08	0.11
Queue Length 95th (ft)	0	0	6	0	0	7	9
Control Delay (s)	0.0	0.0	9.1	0.0	0.0	22.3	10.9
Lane LOS			A			C	B
Approach Delay (s)	0.0		1.0			13.2	
Approach LOS						B	

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	32.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	4	112	209	3	577	199	457
v/c Ratio	0.03	0.44	0.20	0.02	0.31	0.39	0.18
Control Delay	30.8	34.6	3.2	37.0	11.8	31.1	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.8	34.6	3.2	37.0	11.8	31.1	6.1
Queue Length 50th (ft)	1	44	0	1	67	40	24
Queue Length 95th (ft)	11	104	23	10	154	85	110
Internal Link Dist (ft)	36				266		3376
Turn Bay Length (ft)							
Base Capacity (vph)	156	390	1009	152	1848	582	2481
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.29	0.21	0.02	0.31	0.34	0.18

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88	1.00	0.95		0.97	0.95	
Frt		0.93		1.00		0.85	1.00	0.98		1.00	1.00	
Flt Protected		1.00		0.95		1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1772		1752		2760	1752	3423		3273	3374	
Flt Permitted		1.00		0.95		1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1772		1752		2760	1752	3423		3273	3374	
Volume (vph)	0	2	2	102	0	190	3	443	82	181	416	0
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	2	2	112	0	209	3	487	90	199	457	0
RTOR Reduction (vph)	0	2	0	0	0	157	0	13	0	0	0	0
Lane Group Flow (vph)	0	2	0	112	0	52	3	564	0	199	457	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	3%	3%	3%	7%	7%	7%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.8		8.5		17.6	0.8	41.7		9.1	50.0	
Effective Green, g (s)		2.8		9.5		20.6	2.8	43.7		11.1	52.0	
Actuated g/C Ratio		0.03		0.11		0.25	0.03	0.53		0.13	0.63	
Clearance Time (s)		6.0		5.0		6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		60		200		817	59	1800		437	2111	
v/s Ratio Prot		c0.00		c0.06		0.01	0.00	c0.16		c0.06	0.14	
v/s Ratio Perm						0.01						
v/c Ratio		0.03		0.56		0.06	0.05	0.31		0.46	0.22	
Uniform Delay, d1		38.8		34.8		23.9	38.9	11.2		33.2	6.7	
Progression Factor		1.00		1.00		1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2		3.6		0.0	0.4	0.5		0.8	0.2	
Delay (s)		39.1		38.4		23.9	39.2	11.6		34.0	7.0	
Level of Service		D		D		C	D	B		C	A	
Approach Delay (s)		39.1			29.0			11.8			15.2	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	83.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	42.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	122	822	6	11	922	394	72	483	356	255
v/c Ratio	0.85	0.62	0.01	0.09	0.97	0.66	0.39	1.00	0.95	1.08
Control Delay	83.7	23.2	11.4	50.5	49.9	16.0	39.5	70.3	72.0	109.9
Queue Delay	0.0	0.7	0.0	0.0	78.2	5.5	0.0	0.5	0.0	0.0
Total Delay	83.7	23.9	11.4	50.5	128.1	21.6	39.5	70.8	72.0	109.9
Queue Length 50th (ft)	61	161	0	6	248	82	34	~234	98	~124
Queue Length 95th (ft)	#157	#279	9	m10	#363	m85	74	#434	#185	#282
Internal Link Dist (ft)		436			107		431			246
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	143	1331	599	120	949	593	194	483	376	236
Starvation Cap Reductn	0	0	0	0	173	142	0	0	0	0
Spillback Cap Reductn	0	211	0	0	0	0	0	1	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.73	0.01	0.09	1.19	0.87	0.37	1.00	0.95	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.91	0.91	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.98	
Satd. Flow (prot)	1703	3406	1524	1687	3374	1509	1687	1509		3070	1448	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1703	3406	1524	1687	3374	1509	1687	1509		3070	1479	
Volume (vph)	110	740	5	10	830	355	65	350	85	320	100	130
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	122	822	6	11	922	394	72	389	94	356	111	144
RTOR Reduction (vph)	0	0	4	0	0	172	0	11	0	0	35	0
Lane Group Flow (vph)	122	822	2	11	922	222	72	472	0	356	220	0
Heavy Vehicles (%)	6%	6%	6%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	5.0	24.5	24.5	1.0	20.6	20.6	6.0	24.3		8.2	34.9	
Effective Green, g (s)	6.7	26.3	26.3	1.7	21.3	21.3	7.7	26.2		9.8	38.1	
Actuated g/C Ratio	0.08	0.33	0.33	0.02	0.27	0.27	0.10	0.33		0.12	0.48	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	143	1120	501	36	898	402	162	494		376	701	
v/s Ratio Prot	c0.07	0.24		0.01	c0.27		0.04	c0.31		c0.12	0.04	
v/s Ratio Perm			0.00			0.15					c0.11	
v/c Ratio	0.85	0.73	0.00	0.31	1.03	0.55	0.44	0.96		0.95	0.31	
Uniform Delay, d1	36.2	23.8	18.0	38.6	29.4	25.3	34.1	26.3		34.8	12.9	
Progression Factor	1.00	1.00	1.00	1.40	0.97	1.06	1.00	1.00		1.00	1.00	
Incremental Delay, d2	43.9	4.3	0.0	3.9	34.3	4.5	1.9	29.3		32.6	0.3	
Delay (s)	80.1	28.0	18.1	58.0	62.8	31.3	36.1	55.7		67.5	13.2	
Level of Service	F	C	B	E	E	C	D	E		E	B	
Approach Delay (s)		34.7			53.4		53.1				44.8	
Approach LOS		C			D		D				D	

Intersection Summary

HCM Average Control Delay	46.7	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	804	424	114	1212	402	364
v/c Ratio	0.50	0.45	0.34	0.61	0.79	0.72
Control Delay	11.7	2.7	11.2	11.3	37.4	32.1
Queue Delay	1.0	1.5	0.0	3.9	0.0	673.9
Total Delay	12.7	4.3	11.2	15.2	37.4	706.0
Queue Length 50th (ft)	153	11	23	160	192	164
Queue Length 95th (ft)	m82	m0	m39	m226	268	234
Internal Link Dist (ft)	107			326		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1611	942	344	2003	643	643
Starvation Cap Reductn	507	333	0	174	0	0
Spillback Cap Reductn	0	0	0	689	0	639
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.70	0.33	0.92	0.63	91.00

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰	↑↑					↰	↕	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.98	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.96	
Satd. Flow (prot)		3374	1509	1656	3312					1715	1698	
Flt Permitted		1.00	1.00	0.24	1.00					0.95	0.96	
Satd. Flow (perm)		3374	1509	413	3312					1715	1698	
Volume (vph)	0	740	390	105	1115	0	0	0	0	665	0	40
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	804	424	114	1212	0	0	0	0	723	0	43
RTOR Reduction (vph)	0	0	227	0	0	0	0	0	0	0	7	0
Lane Group Flow (vph)	0	804	197	114	1212	0	0	0	0	402	357	0
Heavy Vehicles (%)	7%	7%	7%	9%	9%	9%	9%	9%	9%	0%	0%	0%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		36.2	36.2	47.4	47.4					22.6	22.6	
Effective Green, g (s)		37.2	37.2	48.4	48.4					23.6	23.6	
Actuated g/C Ratio		0.46	0.46	0.60	0.60					0.30	0.30	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1569	702	362	2004					506	501	
v/s Ratio Prot		0.24		0.03	c0.37							
v/s Ratio Perm			0.13	0.16						c0.23	0.21	
v/c Ratio		0.51	0.28	0.31	0.60					0.79	0.71	
Uniform Delay, d1		15.0	13.2	8.0	9.8					26.0	25.2	
Progression Factor		0.65	0.80	1.17	0.94					1.00	1.00	
Incremental Delay, d2		0.8	0.7	0.3	0.8					8.4	4.8	
Delay (s)		10.6	11.2	9.7	10.0					34.4	29.9	
Level of Service		B	B	A	A					C	C	
Approach Delay (s)		10.8			10.0			0.0			32.3	
Approach LOS		B			A			A			C	

Intersection Summary				
HCM Average Control Delay	15.4	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.67			
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	101.3%	ICU Level of Service	G	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	290	1420	926	705	429	406
v/c Ratio	0.78	0.70	0.78	0.73	0.87	0.84
Control Delay	34.4	14.0	28.0	7.0	45.8	40.5
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	34.4	14.2	28.0	7.0	45.8	40.5
Queue Length 50th (ft)	116	232	218	0	205	174
Queue Length 95th (ft)	m#205	276	#288	70	#351	#315
Internal Link Dist (ft)		326	1			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	379	2027	1189	963	526	512
Starvation Cap Reductn	0	113	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.74	0.78	0.73	0.82	0.79

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.89	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.99	
Satd. Flow (prot)	1703	3406			3059	1369			1618	1494	
Flt Permitted	0.15	1.00			1.00	1.00			0.95	0.99	
Satd. Flow (perm)	267	3406			3059	1369			1618	1494	
Volume (vph)	255	1250	0	0	815	620	0	0	470	0	265
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	290	1420	0	0	926	705	0	0	534	0	301
RTOR Reduction (vph)	0	0	0	0	0	431	0	0	0	27	0
Lane Group Flow (vph)	290	1420	0	0	926	274	0	0	429	379	0
Heavy Vehicles (%)	6%	6%	6%	18%	18%	18%	0%	0%	6%	6%	6%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	46.6	46.6			30.1	30.1			23.4	23.4	
Effective Green, g (s)	47.6	47.6			31.1	31.1			24.4	24.4	
Actuated g/C Ratio	0.60	0.60			0.39	0.39			0.30	0.30	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	383	2027			1189	532			493	456	
v/s Ratio Prot	0.12	c0.42			0.30				c0.27	0.25	
v/s Ratio Perm	c0.33					0.20					
v/c Ratio	0.76	0.70			0.78	0.52			0.87	0.83	
Uniform Delay, d1	13.6	11.3			21.4	18.7			26.3	25.9	
Progression Factor	1.41	1.02			1.00	1.00			1.00	1.00	
Incremental Delay, d2	6.7	1.7			5.1	3.5			15.7	12.5	
Delay (s)	25.8	13.3			26.5	22.2			42.0	38.3	
Level of Service	C	B			C	C			D	D	
Approach Delay (s)		15.4			24.7		0.0			40.2	
Approach LOS		B			C		A			D	

Intersection Summary

HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	101.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1410	21	23	1490	9	20
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	1516	23	25	1602	10	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				74		
pX, platoon unblocked					0.71	
vC, conflicting volume			1539		2378	769
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1539		2532	769
tC, single (s)			4.3		8.4	8.5
tC, 2 stage (s)						
tF (s)			2.3		4.3	4.1
p0 queue free %			94		0	90
cM capacity (veh/h)			391		5	216

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1011	528	25	801	801	10	22
Volume Left	0	0	25	0	0	10	0
Volume Right	0	23	0	0	0	0	22
cSH	1700	1700	391	1700	1700	5	216
Volume to Capacity	0.59	0.31	0.06	0.47	0.47	1.98	0.10
Queue Length 95th (ft)	0	0	5	0	0	56	8
Control Delay (s)	0.0	0.0	14.8	0.0	0.0	1804.0	23.5
Lane LOS			B			F	C
Approach Delay (s)	0.0		0.2			576.1	
Approach LOS						F	

Intersection Summary			
Average Delay	5.7		
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	10	36	392	1268	696	897
v/c Ratio	0.07	0.34	0.42	0.75	0.79	0.30
Control Delay	30.8	46.5	7.3	19.5	35.4	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.8	46.5	7.3	19.5	35.4	2.3
Queue Length 50th (ft)	2	17	19	248	164	35
Queue Length 95th (ft)	19	51	62	#473	#302	112
Internal Link Dist (ft)	36			266		3370
Turn Bay Length (ft)						
Base Capacity (vph)	150	105	954	1697	899	2944
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.34	0.41	0.75	0.77	0.30

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88		0.95		0.97	0.95	
Frt		0.93		1.00		0.85		0.98		1.00	1.00	
Flt Protected		1.00		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1772		1410		2221		3197		3273	3371	
Flt Permitted		1.00		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1772		1410		2221		3197		3273	3371	
Volume (vph)	0	5	5	35	0	380	0	1090	140	675	865	5
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	5	5	36	0	392	0	1124	144	696	892	5
RTOR Reduction (vph)	0	5	0	0	0	198	0	10	0	0	0	0
Lane Group Flow (vph)	0	5	0	36	0	194	0	1258	0	696	897	0
Heavy Vehicles (%)	0%	0%	0%	28%	28%	28%	11%	11%	11%	7%	7%	7%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.9		2.8		21.4		38.6		18.6	63.2	
Effective Green, g (s)		2.9		3.8		24.4		40.6		20.6	65.2	
Actuated g/C Ratio		0.03		0.05		0.29		0.48		0.25	0.78	
Clearance Time (s)		6.0		5.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		61		64		752		1547		804	2620	
v/s Ratio Prot		c0.00		c0.03		0.06		c0.39		c0.21	0.27	
v/s Ratio Perm						0.02						
v/c Ratio		0.08		0.56		0.26		0.81		0.87	0.34	
Uniform Delay, d1		39.2		39.2		22.8		18.4		30.3	2.8	
Progression Factor		1.00		1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.6		10.8		0.2		4.8		9.7	0.4	
Delay (s)		39.8		50.1		23.0		23.2		40.0	3.2	
Level of Service		D		D		C		C		D	A	
Approach Delay (s)		39.8			25.3			23.2			19.3	
Approach LOS		D			C			C			B	

Intersection Summary			
HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	83.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	107	1301	26	61	740	281	26	158	474	444
v/c Ratio	0.40	0.81	0.04	0.54	0.61	0.42	0.22	0.62	0.82	0.83
Control Delay	44.7	29.4	8.4	71.4	18.3	7.7	49.2	48.1	53.0	46.5
Queue Delay	0.0	2.8	0.0	0.0	1.3	1.4	0.0	3.0	0.9	0.0
Total Delay	44.7	32.3	8.4	71.4	19.6	9.0	49.2	51.1	53.9	46.5
Queue Length 50th (ft)	64	393	2	34	169	73	16	88	151	260
Queue Length 95th (ft)	119	#507	17	m#79	m232	m135	43	155	#225	#439
Internal Link Dist (ft)		436			126		426			253
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	268	1612	733	113	1220	665	116	292	585	536
Starvation Cap Reductn	0	0	0	0	275	214	0	0	0	0
Spillback Cap Reductn	0	206	0	0	0	0	0	64	20	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.93	0.04	0.54	0.78	0.62	0.22	0.69	0.84	0.83

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1713	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1713	
Volume (vph)	105	1275	25	60	725	275	25	135	20	465	330	105
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	107	1301	26	61	740	281	26	138	20	474	337	107
RTOR Reduction (vph)	0	0	12	0	0	123	0	5	0	0	11	0
Lane Group Flow (vph)	107	1301	14	61	740	158	26	153	0	474	433	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	4%	4%	4%	3%	3%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	13.7	41.5	41.5	4.7	32.6	32.6	3.0	16.4		15.4	29.0	
Effective Green, g (s)	15.4	43.3	43.3	5.4	33.3	33.3	4.7	18.3		17.0	30.6	
Actuated g/C Ratio	0.15	0.43	0.43	0.05	0.33	0.33	0.05	0.18		0.17	0.31	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	267	1503	672	93	1145	512	82	284		578	524	
v/s Ratio Prot	0.06	c0.37		c0.04	0.22		0.01	0.10		c0.14	c0.25	
v/s Ratio Perm			0.01			0.10						
v/c Ratio	0.40	0.87	0.02	0.66	0.65	0.31	0.32	0.54		0.82	0.83	
Uniform Delay, d1	38.1	25.7	16.2	46.4	28.3	24.8	46.1	37.0		40.0	32.2	
Progression Factor	1.00	1.00	1.00	1.23	0.61	0.69	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.4	6.9	0.1	13.4	2.4	1.3	2.2	2.0		9.1	10.3	
Delay (s)	42.6	32.6	16.3	70.3	19.7	18.5	48.3	39.0		49.1	42.5	
Level of Service	D	C	B	E	B	B	D	D		D	D	
Approach Delay (s)		33.1			22.2		40.3				45.9	
Approach LOS		C			C		D				D	

Intersection Summary

HCM Average Control Delay	33.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	1052	670	407	1072	449	402
v/c Ratio	0.90	0.70	0.94	0.53	0.96	0.86
Control Delay	31.3	5.6	61.6	11.6	66.9	50.6
Queue Delay	103.2	21.3	0.0	0.8	0.0	0.1
Total Delay	134.6	27.0	61.6	12.4	66.9	50.7
Queue Length 50th (ft)	268	51	252	183	290	247
Queue Length 95th (ft)	#448	m72	m#366	m260	#497	#424
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1173	964	431	2028	476	476
Starvation Cap Reductn	318	303	0	303	0	0
Spillback Cap Reductn	0	0	0	589	0	1
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.23	1.01	0.94	0.74	0.94	0.85

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.99	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	
Satd. Flow (prot)		3406	1524	1703	3406					1441	1437	
Flt Permitted		1.00	1.00	0.10	1.00					0.95	0.95	
Satd. Flow (perm)		3406	1524	187	3406					1441	1437	
Volume (vph)	0	1020	650	395	1040	0	0	0	0	805	0	20
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1052	670	407	1072	0	0	0	0	830	0	21
RTOR Reduction (vph)	0	0	440	0	0	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	1052	230	407	1072	0	0	0	0	449	400	0
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	0%	0%	0%	19%	19%	19%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		33.4	33.4	58.5	58.5					31.5	31.5	
Effective Green, g (s)		34.4	34.4	59.5	59.5					32.5	32.5	
Actuated g/C Ratio		0.34	0.34	0.60	0.60					0.32	0.32	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1172	524	431	2027					468	467	
v/s Ratio Prot		0.31		c0.20	0.31							
v/s Ratio Perm			0.15	c0.36						c0.31	0.28	
v/c Ratio		0.90	0.44	0.94	0.53					0.96	0.86	
Uniform Delay, d1		31.1	25.4	29.1	12.0					33.1	31.6	
Progression Factor		0.76	1.44	1.41	0.89					1.00	1.00	
Incremental Delay, d2		6.6	1.5	22.8	0.7					31.0	14.3	
Delay (s)		30.4	37.9	63.8	11.4					64.1	45.9	
Level of Service		C	D	E	B					E	D	
Approach Delay (s)		33.3			25.8			0.0			55.5	
Approach LOS		C			C			A			E	

Intersection Summary

HCM Average Control Delay	35.2	HCM Level of Service		D	
HCM Volume to Capacity ratio	0.94				
Actuated Cycle Length (s)	100.0	Sum of lost time (s)		8.0	
Intersection Capacity Utilization	137.9%	ICU Level of Service		H	
Analysis Period (min)	15				

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	371	1485	1031	1021	335	341
v/c Ratio	0.91	0.66	0.63	0.93	0.93	0.88
Control Delay	43.7	11.9	21.5	23.4	70.5	55.9
Queue Delay	0.0	0.4	0.0	0.0	0.0	0.0
Total Delay	43.7	12.3	21.5	23.4	70.5	55.9
Queue Length 50th (ft)	188	238	248	219	218	187
Queue Length 95th (ft)	m#221	m263	316	#621	#393	#357
Internal Link Dist (ft)		410	1			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	409	2243	1640	1098	367	391
Starvation Cap Reductn	0	281	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.76	0.63	0.93	0.91	0.87

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.92	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.98	
Satd. Flow (prot)	1641	3282			3406	1524			1531	1447	
Flt Permitted	0.16	1.00			1.00	1.00			0.95	0.98	
Satd. Flow (perm)	274	3282			3406	1524			1531	1447	
Volume (vph)	360	1440	0	0	1000	990	0	0	470	5	180
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	371	1485	0	0	1031	1021	0	0	485	5	186
RTOR Reduction (vph)	0	0	0	0	0	365	0	0	0	43	0
Lane Group Flow (vph)	371	1485	0	0	1031	656	0	0	335	298	0
Heavy Vehicles (%)	10%	10%	10%	6%	6%	6%	0%	0%	12%	12%	12%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	67.3	67.3			47.1	47.1			22.7	22.7	
Effective Green, g (s)	68.3	68.3			48.1	48.1			23.7	23.7	
Actuated g/C Ratio	0.68	0.68			0.48	0.48			0.24	0.24	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	409	2242			1638	733			363	343	
v/s Ratio Prot	c0.15	0.45			0.30				c0.22	0.21	
v/s Ratio Perm	c0.47					0.43					
v/c Ratio	0.91	0.66			0.63	0.90			0.92	0.87	
Uniform Delay, d1	20.2	9.2			19.3	23.7			37.3	36.6	
Progression Factor	1.86	1.19			1.00	1.00			1.00	1.00	
Incremental Delay, d2	11.5	0.6			1.8	15.7			28.8	20.4	
Delay (s)	49.1	11.5			21.2	39.4			66.1	57.0	
Level of Service	D	B			C	D			E	E	
Approach Delay (s)		19.1			30.2		0.0			61.5	
Approach LOS		B			C		A			E	

Intersection Summary

HCM Average Control Delay	30.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	137.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1975	9	10	1615	7	18
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	2124	10	11	1737	8	19
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				66		
pX, platoon unblocked					0.74	
vC, conflicting volume			2133		3018	1067
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			2133		3384	1067
tC, single (s)			4.3		7.3	7.4
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.5
p0 queue free %			95		0	90
cM capacity (veh/h)			224		3	184

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1416	718	11	868	868	8	19
Volume Left	0	0	11	0	0	8	0
Volume Right	0	10	0	0	0	0	19
cSH	1700	1700	224	1700	1700	3	184
Volume to Capacity	0.83	0.42	0.05	0.51	0.51	2.89	0.10
Queue Length 95th (ft)	0	0	4	0	0	50	9
Control Delay (s)	0.0	0.0	21.9	0.0	0.0	3220.6	26.8
Lane LOS			C			F	D
Approach Delay (s)	0.0		0.1			921.1	
Approach LOS						F	

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	10	326	1037	1294	405	1152
v/c Ratio	0.07	0.84	0.80	0.82	0.86	0.54
Control Delay	39.8	52.3	21.6	25.2	53.6	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.8	52.3	21.6	25.2	53.6	9.1
Queue Length 50th (ft)	5	153	185	271	101	130
Queue Length 95th (ft)	21	#344	#377	#497	#209	261
Internal Link Dist (ft)	36			266		3373
Turn Bay Length (ft)						
Base Capacity (vph)	144	389	1301	1581	472	2151
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.84	0.80	0.82	0.86	0.54

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88		0.95		0.97	0.95	
Frt		1.00		1.00		0.85		0.99		1.00	1.00	
Flt Protected		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1854		1752		2760		3444		3183	3280	
Flt Permitted		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1854		1752		2760		3444		3183	3280	
Volume (vph)	5	5	0	310	0	985	0	1165	65	385	1090	5
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	5	0	326	0	1037	0	1226	68	405	1147	5
RTOR Reduction (vph)	0	0	0	0	0	163	0	5	0	0	0	0
Lane Group Flow (vph)	0	10	0	326	0	874	0	1289	0	405	1152	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	10%	10%	10%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.9		16.9		26.9		35.1		10.0	51.1	
Effective Green, g (s)		2.9		17.9		29.9		37.1		12.0	53.1	
Actuated g/C Ratio		0.03		0.21		0.35		0.43		0.14	0.62	
Clearance Time (s)		6.0		5.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		63		365		1089		1487		445	2028	
v/s Ratio Prot				c0.19		c0.11		c0.37		0.13	0.35	
v/s Ratio Perm		0.01				0.20						
v/c Ratio		0.16		0.89		0.80		0.87		0.91	0.57	
Uniform Delay, d1		40.3		33.1		25.3		22.2		36.4	9.6	
Progression Factor		1.00		1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		1.2		23.0		4.4		7.1		22.5	1.2	
Delay (s)		41.5		56.1		29.7		29.2		58.9	10.8	
Level of Service		D		E		C		C		E	B	
Approach Delay (s)		41.5			36.0			29.2			23.3	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM Average Control Delay	29.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	85.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	111	958	26	32	563	189	32	216	295	252
v/c Ratio	0.35	0.58	0.03	0.25	0.52	0.31	0.24	0.68	0.61	0.46
Control Delay	38.0	21.4	7.2	45.3	23.6	7.5	44.1	41.2	42.2	26.8
Queue Delay	0.0	0.0	0.0	0.0	3.1	0.9	0.0	0.0	0.0	0.0
Total Delay	38.0	21.4	7.2	45.3	26.7	8.4	44.1	41.2	42.2	26.8
Queue Length 50th (ft)	57	234	0	14	162	28	18	104	81	112
Queue Length 95th (ft)	112	309	16	m45	162	72	46	173	123	178
Internal Link Dist (ft)		436			126		431			246
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	318	1658	756	127	1084	602	132	380	501	559
Starvation Cap Reductn	0	0	0	0	405	213	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.58	0.03	0.25	0.83	0.49	0.24	0.57	0.59	0.45

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1787	3574	1599	1736	3471	1553	1770	1583		3467	1745	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1787	3574	1599	1736	3471	1553	1770	1583		3467	1745	
Volume (vph)	105	910	25	30	535	180	30	150	55	280	180	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	111	958	26	32	563	189	32	158	58	295	189	63
RTOR Reduction (vph)	0	0	15	0	0	122	0	15	0	0	13	0
Lane Group Flow (vph)	111	958	11	32	563	67	32	201	0	295	239	0
Heavy Vehicles (%)	1%	1%	1%	4%	4%	4%	2%	2%	2%	1%	1%	1%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	14.3	35.8	35.8	3.6	25.2	25.2	3.0	17.6		11.0	25.8	
Effective Green, g (s)	16.0	37.6	37.6	4.3	25.9	25.9	4.7	19.5		12.6	27.4	
Actuated g/C Ratio	0.18	0.42	0.42	0.05	0.29	0.29	0.05	0.22		0.14	0.30	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	318	1493	668	83	999	447	92	343		485	531	
v/s Ratio Prot	c0.06	c0.27		0.02	0.16		0.02	c0.13		c0.09	0.14	
v/s Ratio Perm			0.01			0.04						
v/c Ratio	0.35	0.64	0.02	0.39	0.56	0.15	0.35	0.59		0.61	0.45	
Uniform Delay, d1	32.4	20.8	15.4	41.6	27.2	23.9	41.2	31.6		36.4	25.2	
Progression Factor	1.00	1.00	1.00	1.01	0.85	1.21	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.0	2.1	0.0	2.9	2.2	0.7	2.3	2.6		2.2	0.6	
Delay (s)	35.4	23.0	15.4	45.1	25.4	29.6	43.4	34.2		38.5	25.8	
Level of Service	D	C	B	D	C	C	D	C		D	C	
Approach Delay (s)		24.1			27.2		35.4				32.7	
Approach LOS		C			C		D				C	

Intersection Summary				
HCM Average Control Delay	27.8	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.61			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	60.5%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	646	615	104	724	117	112
v/c Ratio	0.28	0.49	0.20	0.27	0.54	0.46
Control Delay	4.3	2.2	6.0	6.1	44.9	28.2
Queue Delay	0.3	0.5	0.0	0.0	0.0	0.0
Total Delay	4.6	2.7	6.0	6.1	44.9	28.2
Queue Length 50th (ft)	45	10	23	114	66	37
Queue Length 95th (ft)	17	20	m0	146	116	86
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	2313	1248	561	2707	498	506
Starvation Cap Reductn	1021	271	0	0	0	0
Spillback Cap Reductn	0	0	0	404	0	5
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.63	0.19	0.31	0.23	0.22

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.94	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.97	
Satd. Flow (prot)		3539	1583	1752	3505					1545	1481	
Flt Permitted		1.00	1.00	0.36	1.00					0.95	0.97	
Satd. Flow (perm)		3539	1583	659	3505					1545	1481	
Volume (vph)	0	620	590	100	695	0	0	0	0	175	0	45
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	646	615	104	724	0	0	0	0	182	0	47
RTOR Reduction (vph)	0	0	220	0	0	0	0	0	0	0	37	0
Lane Group Flow (vph)	0	646	395	104	724	0	0	0	0	117	75	0
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	11%	11%	11%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		56.8	56.8	68.5	68.5					11.5	11.5	
Effective Green, g (s)		57.8	57.8	69.5	69.5					12.5	12.5	
Actuated g/C Ratio		0.64	0.64	0.77	0.77					0.14	0.14	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		2273	1017	602	2707					215	206	
v/s Ratio Prot		0.18		0.01	c0.21							
v/s Ratio Perm			c0.25	0.12						c0.08	0.05	
v/c Ratio		0.28	0.39	0.17	0.27					0.54	0.36	
Uniform Delay, d1		7.0	7.7	2.8	2.9					36.1	35.1	
Progression Factor		0.50	1.14	1.74	1.79					1.00	1.00	
Incremental Delay, d2		0.3	0.9	0.1	0.2					2.8	1.1	
Delay (s)		3.8	9.7	5.1	5.5					38.9	36.2	
Level of Service		A	A	A	A					D	D	
Approach Delay (s)		6.7			5.4			0.0			37.6	
Approach LOS		A			A			A			D	

Intersection Summary				
HCM Average Control Delay	9.3	HCM Level of Service	A	
HCM Volume to Capacity ratio	0.41			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	58.3%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	328	548	409	290	273	259
v/c Ratio	0.57	0.23	0.24	0.32	0.72	0.65
Control Delay	13.9	5.8	15.7	3.6	42.2	33.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.9	5.8	15.7	3.6	42.2	33.3
Queue Length 50th (ft)	63	35	64	0	151	117
Queue Length 95th (ft)	183	110	131	53	216	182
Internal Link Dist (ft)		410	9			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	738	2345	1686	901	537	543
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.23	0.24	0.32	0.51	0.48

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.94	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.97	
Satd. Flow (prot)	1719	3438			3406	1524			1665	1596	
Flt Permitted	0.45	1.00			1.00	1.00			0.95	0.97	
Satd. Flow (perm)	809	3438			3406	1524			1665	1596	
Volume (vph)	305	510	0	0	380	270	0	0	390	5	100
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	328	548	0	0	409	290	0	0	419	5	108
RTOR Reduction (vph)	0	0	0	0	0	146	0	0	0	32	0
Lane Group Flow (vph)	328	548	0	0	409	144	0	0	273	227	0
Heavy Vehicles (%)	5%	5%	5%	6%	6%	6%	0%	0%	3%	3%	3%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	60.4	60.4			43.6	43.6			19.6	19.6	
Effective Green, g (s)	61.4	61.4			44.6	44.6			20.6	20.6	
Actuated g/C Ratio	0.68	0.68			0.50	0.50			0.23	0.23	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	681	2345			1688	755			381	365	
v/s Ratio Prot	c0.07	0.16			0.12				c0.16	0.14	
v/s Ratio Perm	c0.26					0.09					
v/c Ratio	0.48	0.23			0.24	0.19			0.72	0.62	
Uniform Delay, d1	5.9	5.4			13.0	12.6			32.0	31.2	
Progression Factor	1.49	0.90			1.00	1.00			1.00	1.00	
Incremental Delay, d2	0.4	0.2			0.3	0.6			6.5	3.4	
Delay (s)	9.2	5.1			13.4	13.2			38.5	34.6	
Level of Service	A	A			B	B			D	C	
Approach Delay (s)		6.7			13.3		0.0			36.6	
Approach LOS		A			B		A			D	

Intersection Summary				
HCM Average Control Delay	16.4	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.54			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	58.3%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	560	30	63	535	18	70
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	596	32	67	569	19	74
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				89		
pX, platoon unblocked					0.95	
vC, conflicting volume			628		1030	314
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			628		976	314
tC, single (s)			4.2		6.9	7.0
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			93		91	89
cM capacity (veh/h)			917		212	670

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	397	230	67	285	285	19	74
Volume Left	0	0	67	0	0	19	0
Volume Right	0	32	0	0	0	0	74
cSH	1700	1700	917	1700	1700	212	670
Volume to Capacity	0.23	0.14	0.07	0.17	0.17	0.09	0.11
Queue Length 95th (ft)	0	0	6	0	0	7	9
Control Delay (s)	0.0	0.0	9.2	0.0	0.0	23.7	11.0
Lane LOS			A			C	B
Approach Delay (s)	0.0		1.0			13.6	
Approach LOS						B	

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	10	121	220	5	604	209	478
v/c Ratio	0.06	0.47	0.21	0.03	0.33	0.41	0.19
Control Delay	28.6	35.9	3.3	36.4	12.3	31.5	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.6	35.9	3.3	36.4	12.3	31.5	6.7
Queue Length 50th (ft)	2	49	0	2	73	42	26
Queue Length 95th (ft)	18	114	25	13	165	90	122
Internal Link Dist (ft)	36				266		3376
Turn Bay Length (ft)							
Base Capacity (vph)	219	339	1047	212	1824	586	2459
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.36	0.21	0.02	0.33	0.36	0.19

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88	1.00	0.95		0.97	0.95	
Frt		0.93		1.00		0.85	1.00	0.98		1.00	1.00	
Flt Protected		1.00		0.95		1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1772		1752		2760	1752	3424		3273	3374	
Flt Permitted		1.00		0.95		1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1772		1752		2760	1752	3424		3273	3374	
Volume (vph)	0	5	5	110	0	200	5	465	85	190	435	0
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	5	5	121	0	220	5	511	93	209	478	0
RTOR Reduction (vph)	0	5	0	0	0	165	0	13	0	0	0	0
Lane Group Flow (vph)	0	5	0	121	0	55	5	591	0	209	478	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	3%	3%	3%	7%	7%	7%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		1.1		8.4		17.7	1.1	41.1		9.3	49.3	
Effective Green, g (s)		3.1		9.4		20.7	3.1	43.1		11.3	51.3	
Actuated g/C Ratio		0.04		0.11		0.25	0.04	0.52		0.14	0.62	
Clearance Time (s)		6.0		5.0		6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		66		199		822	66	1780		446	2088	
v/s Ratio Prot		c0.00		c0.07		0.01	0.00	c0.17		c0.06	0.14	
v/s Ratio Perm						0.01						
v/c Ratio		0.08		0.61		0.07	0.08	0.33		0.47	0.23	
Uniform Delay, d1		38.5		35.0		23.7	38.5	11.5		33.0	7.0	
Progression Factor		1.00		1.00		1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.5		5.2		0.0	0.5	0.5		0.8	0.3	
Delay (s)		39.0		40.2		23.8	39.0	12.0		33.8	7.3	
Level of Service		D		D		C	D	B		C	A	
Approach Delay (s)		39.0			29.6			12.3			15.3	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	82.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	43.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	122	823	6	11	922	394	72	483	356	255
v/c Ratio	0.85	0.62	0.01	0.09	0.97	0.66	0.39	1.00	0.95	1.08
Control Delay	83.7	23.2	11.4	50.5	49.8	16.0	39.5	70.3	72.0	109.9
Queue Delay	0.0	0.7	0.0	0.0	78.2	5.5	0.0	0.5	0.0	0.0
Total Delay	83.7	23.9	11.4	50.5	128.1	21.5	39.5	70.8	72.0	109.9
Queue Length 50th (ft)	61	162	0	6	248	80	34	~234	98	~124
Queue Length 95th (ft)	#157	#281	9	m10	#363	85	74	#434	#185	#282
Internal Link Dist (ft)		436			107		431			246
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	143	1331	599	120	949	593	194	483	376	236
Starvation Cap Reductn	0	0	0	0	173	142	0	0	0	0
Spillback Cap Reductn	0	215	0	0	0	0	0	1	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.74	0.01	0.09	1.19	0.87	0.37	1.00	0.95	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.91	0.91	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.98	
Satd. Flow (prot)	1703	3406	1524	1687	3374	1509	1687	1509		3070	1448	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1703	3406	1524	1687	3374	1509	1687	1509		3070	1479	
Volume (vph)	110	741	5	10	830	355	65	350	85	320	100	130
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	122	823	6	11	922	394	72	389	94	356	111	144
RTOR Reduction (vph)	0	0	4	0	0	172	0	11	0	0	35	0
Lane Group Flow (vph)	122	823	2	11	922	222	72	472	0	356	220	0
Heavy Vehicles (%)	6%	6%	6%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6			5	2		7	4	3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	5.0	24.5	24.5	1.0	20.6	20.6	6.0	24.3		8.2	34.9	
Effective Green, g (s)	6.7	26.3	26.3	1.7	21.3	21.3	7.7	26.2		9.8	38.1	
Actuated g/C Ratio	0.08	0.33	0.33	0.02	0.27	0.27	0.10	0.33		0.12	0.48	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	143	1120	501	36	898	402	162	494		376	701	
v/s Ratio Prot	c0.07	0.24		0.01	c0.27		0.04	c0.31		c0.12	0.04	
v/s Ratio Perm			0.00			0.15					c0.11	
v/c Ratio	0.85	0.73	0.00	0.31	1.03	0.55	0.44	0.96		0.95	0.31	
Uniform Delay, d1	36.2	23.8	18.0	38.6	29.4	25.3	34.1	26.3		34.8	12.9	
Progression Factor	1.00	1.00	1.00	1.40	0.97	1.06	1.00	1.00		1.00	1.00	
Incremental Delay, d2	43.9	4.3	0.0	3.9	34.3	4.5	1.9	29.3		32.6	0.3	
Delay (s)	80.1	28.1	18.1	58.0	62.8	31.3	36.1	55.7		67.5	13.2	
Level of Service	F	C	B	E	E	C	D	E		E	B	
Approach Delay (s)		34.7			53.4		53.1				44.8	
Approach LOS		C			D		D				D	

Intersection Summary

HCM Average Control Delay	46.6	HCM Level of Service		D	
HCM Volume to Capacity ratio	1.03				
Actuated Cycle Length (s)	80.0	Sum of lost time (s)		20.0	
Intersection Capacity Utilization	66.0%	ICU Level of Service		C	
Analysis Period (min)	15				

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	805	424	115	1212	403	364
v/c Ratio	0.50	0.45	0.34	0.61	0.79	0.71
Control Delay	11.7	2.7	11.3	11.3	37.3	32.0
Queue Delay	1.0	1.5	0.0	3.9	0.0	673.9
Total Delay	12.7	4.3	11.3	15.1	37.3	705.9
Queue Length 50th (ft)	155	13	23	160	192	164
Queue Length 95th (ft)	m81	m0	m40	m225	269	234
Internal Link Dist (ft)	107			326		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1608	941	342	2001	643	643
Starvation Cap Reductn	505	332	0	173	0	0
Spillback Cap Reductn	0	0	0	685	0	639
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.70	0.34	0.92	0.63	91.00

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.98	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.96	
Satd. Flow (prot)		3374	1509	1656	3312					1715	1698	
Flt Permitted		1.00	1.00	0.24	1.00					0.95	0.96	
Satd. Flow (perm)		3374	1509	411	3312					1715	1698	
Volume (vph)	0	741	390	106	1115	0	0	0	0	666	0	40
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	805	424	115	1212	0	0	0	0	724	0	43
RTOR Reduction (vph)	0	0	227	0	0	0	0	0	0	0	7	0
Lane Group Flow (vph)	0	805	197	115	1212	0	0	0	0	403	357	0
Heavy Vehicles (%)	7%	7%	7%	9%	9%	9%	9%	9%	9%	0%	0%	0%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		36.1	36.1	47.3	47.3					22.7	22.7	
Effective Green, g (s)		37.1	37.1	48.3	48.3					23.7	23.7	
Actuated g/C Ratio		0.46	0.46	0.60	0.60					0.30	0.30	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1565	700	360	2000					508	503	
v/s Ratio Prot		0.24		0.03	c0.37							
v/s Ratio Perm			0.13	0.16						c0.24	0.21	
v/c Ratio		0.51	0.28	0.32	0.61					0.79	0.71	
Uniform Delay, d1		15.1	13.2	8.1	9.9					25.9	25.1	
Progression Factor		0.65	0.81	1.18	0.94					1.00	1.00	
Incremental Delay, d2		0.8	0.7	0.3	0.8					8.3	4.6	
Delay (s)		10.7	11.3	9.8	10.0					34.2	29.6	
Level of Service		B	B	A	B					C	C	
Approach Delay (s)		10.9			10.0			0.0			32.0	
Approach LOS		B			B			A			C	

Intersection Summary

HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	101.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	290	1423	927	707	430	406
v/c Ratio	0.78	0.70	0.78	0.73	0.87	0.84
Control Delay	34.4	14.0	28.1	7.0	46.1	40.7
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	34.4	14.2	28.1	7.0	46.1	40.7
Queue Length 50th (ft)	116	233	218	0	205	174
Queue Length 95th (ft)	m#205	276	#288	70	#352	#316
Internal Link Dist (ft)		326	1			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	379	2027	1189	964	526	511
Starvation Cap Reductn	0	113	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.74	0.78	0.73	0.82	0.79

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.89	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.99	
Satd. Flow (prot)	1703	3406			3059	1369			1618	1494	
Flt Permitted	0.15	1.00			1.00	1.00			0.95	0.99	
Satd. Flow (perm)	266	3406			3059	1369			1618	1494	
Volume (vph)	255	1252	0	0	816	622	0	0	470	0	266
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	290	1423	0	0	927	707	0	0	534	0	302
RTOR Reduction (vph)	0	0	0	0	0	432	0	0	0	27	0
Lane Group Flow (vph)	290	1423	0	0	927	275	0	0	430	379	0
Heavy Vehicles (%)	6%	6%	6%	18%	18%	18%	0%	0%	6%	6%	6%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	46.6	46.6			30.1	30.1			23.4	23.4	
Effective Green, g (s)	47.6	47.6			31.1	31.1			24.4	24.4	
Actuated g/C Ratio	0.60	0.60			0.39	0.39			0.30	0.30	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	383	2027			1189	532			493	456	
v/s Ratio Prot	0.12	c0.42			0.30				c0.27	0.25	
v/s Ratio Perm	c0.33					0.20					
v/c Ratio	0.76	0.70			0.78	0.52			0.87	0.83	
Uniform Delay, d1	13.6	11.3			21.4	18.7			26.3	25.9	
Progression Factor	1.41	1.02			1.00	1.00			1.00	1.00	
Incremental Delay, d2	6.7	1.7			5.1	3.6			15.9	12.5	
Delay (s)	25.9	13.3			26.5	22.3			42.2	38.3	
Level of Service	C	B			C	C			D	D	
Approach Delay (s)		15.4			24.7		0.0			40.3	
Approach LOS		B			C		A			D	

Intersection Summary			
HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	101.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1410	25	26	1490	11	23
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	1516	27	28	1602	12	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				74		
pX, platoon unblocked					0.71	
vC, conflicting volume			1543		2387	772
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1543		2545	772
tC, single (s)			4.3		8.4	8.5
tC, 2 stage (s)						
tF (s)			2.3		4.3	4.1
p0 queue free %			93		0	88
cM capacity (veh/h)			390		5	215

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1011	532	28	801	801	12	25
Volume Left	0	0	28	0	0	12	0
Volume Right	0	27	0	0	0	0	25
cSH	1700	1700	390	1700	1700	5	215
Volume to Capacity	0.59	0.31	0.07	0.47	0.47	2.51	0.12
Queue Length 95th (ft)	0	0	6	0	0	65	10
Control Delay (s)	0.0	0.0	14.9	0.0	0.0	2099.5	23.9
Lane LOS			B			F	C
Approach Delay (s)	0.0		0.3			695.4	
Approach LOS						F	

Intersection Summary			
Average Delay	8.1		
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	10	36	392	1272	697	898
v/c Ratio	0.07	0.34	0.42	0.75	0.79	0.31
Control Delay	30.8	46.5	7.3	19.5	35.4	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.8	46.5	7.3	19.5	35.4	2.4
Queue Length 50th (ft)	2	17	19	250	164	35
Queue Length 95th (ft)	19	51	62	#476	#303	112
Internal Link Dist (ft)	36			266		3370
Turn Bay Length (ft)						
Base Capacity (vph)	150	105	954	1696	899	2944
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.34	0.41	0.75	0.78	0.31

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88		0.95		0.97	0.95	
Frt		0.93		1.00		0.85		0.98		1.00	1.00	
Flt Protected		1.00		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1772		1410		2221		3197		3273	3371	
Flt Permitted		1.00		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1772		1410		2221		3197		3273	3371	
Volume (vph)	0	5	5	35	0	380	0	1094	140	676	866	5
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	5	5	36	0	392	0	1128	144	697	893	5
RTOR Reduction (vph)	0	5	0	0	0	198	0	10	0	0	0	0
Lane Group Flow (vph)	0	5	0	36	0	194	0	1262	0	697	898	0
Heavy Vehicles (%)	0%	0%	0%	28%	28%	28%	11%	11%	11%	7%	7%	7%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.9		2.8		21.5		38.5		18.7	63.2	
Effective Green, g (s)		2.9		3.8		24.5		40.5		20.7	65.2	
Actuated g/C Ratio		0.03		0.05		0.29		0.48		0.25	0.78	
Clearance Time (s)		6.0		5.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		61		64		754		1543		808	2620	
v/s Ratio Prot		c0.00		c0.03		0.06		c0.39		c0.21	0.27	
v/s Ratio Perm						0.02						
v/c Ratio		0.08		0.56		0.26		0.82		0.86	0.34	
Uniform Delay, d1		39.2		39.2		22.7		18.5		30.2	2.8	
Progression Factor		1.00		1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.6		10.8		0.2		4.9		9.4	0.4	
Delay (s)		39.8		50.1		22.9		23.5		39.7	3.2	
Level of Service		D		D		C		C		D	A	
Approach Delay (s)		39.8			25.2			23.5			19.1	
Approach LOS		D			C			C			B	

Intersection Summary			
HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	83.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	107	1301	26	61	741	281	26	158	474	444
v/c Ratio	0.40	0.81	0.04	0.54	0.61	0.42	0.22	0.62	0.82	0.83
Control Delay	44.7	29.4	8.4	71.4	18.3	7.7	49.2	48.1	53.0	46.5
Queue Delay	0.0	2.8	0.0	0.0	1.4	1.4	0.0	3.0	0.9	0.0
Total Delay	44.7	32.3	8.4	71.4	19.7	9.0	49.2	51.1	53.9	46.5
Queue Length 50th (ft)	64	393	2	34	170	73	16	88	151	260
Queue Length 95th (ft)	119	#507	17	m#79	m232	m135	43	155	#225	#439
Internal Link Dist (ft)		436			126		426			253
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	268	1612	733	113	1220	665	116	292	585	536
Starvation Cap Reductn	0	0	0	0	275	214	0	0	0	0
Spillback Cap Reductn	0	206	0	0	0	0	0	64	20	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.93	0.04	0.54	0.78	0.62	0.22	0.69	0.84	0.83

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1713	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1713	
Volume (vph)	105	1275	25	60	726	275	25	135	20	465	330	105
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	107	1301	26	61	741	281	26	138	20	474	337	107
RTOR Reduction (vph)	0	0	12	0	0	123	0	5	0	0	11	0
Lane Group Flow (vph)	107	1301	14	61	741	158	26	153	0	474	433	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	4%	4%	4%	3%	3%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	13.7	41.5	41.5	4.7	32.6	32.6	3.0	16.4		15.4	29.0	
Effective Green, g (s)	15.4	43.3	43.3	5.4	33.3	33.3	4.7	18.3		17.0	30.6	
Actuated g/C Ratio	0.15	0.43	0.43	0.05	0.33	0.33	0.05	0.18		0.17	0.31	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	267	1503	672	93	1145	512	82	284		578	524	
v/s Ratio Prot	0.06	c0.37		c0.04	0.22		0.01	0.10		c0.14	c0.25	
v/s Ratio Perm			0.01			0.10						
v/c Ratio	0.40	0.87	0.02	0.66	0.65	0.31	0.32	0.54		0.82	0.83	
Uniform Delay, d1	38.1	25.7	16.2	46.4	28.4	24.8	46.1	37.0		40.0	32.2	
Progression Factor	1.00	1.00	1.00	1.23	0.61	0.69	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.4	6.9	0.1	13.3	2.4	1.3	2.2	2.0		9.1	10.3	
Delay (s)	42.6	32.6	16.3	70.3	19.7	18.5	48.3	39.0		49.1	42.5	
Level of Service	D	C	B	E	B	B	D	D		D	D	
Approach Delay (s)		33.1			22.3		40.3				45.9	
Approach LOS		C			C		D				D	

Intersection Summary

HCM Average Control Delay	33.5	HCM Level of Service		C	
HCM Volume to Capacity ratio	0.82				
Actuated Cycle Length (s)	100.0	Sum of lost time (s)		12.0	
Intersection Capacity Utilization	81.6%	ICU Level of Service		D	
Analysis Period (min)	15				

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	1052	670	408	1073	449	403
v/c Ratio	0.90	0.70	0.94	0.53	0.96	0.86
Control Delay	31.4	5.6	61.8	11.6	66.9	50.8
Queue Delay	103.9	21.3	0.0	0.8	0.0	0.1
Total Delay	135.2	27.0	61.8	12.4	66.9	50.9
Queue Length 50th (ft)	268	51	253	183	290	248
Queue Length 95th (ft)	#448	m72	m#367	m260	#497	#425
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1172	964	432	2028	476	476
Starvation Cap Reductn	318	303	0	303	0	0
Spillback Cap Reductn	0	0	0	588	0	1
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.23	1.01	0.94	0.75	0.94	0.85

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.99	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	
Satd. Flow (prot)		3406	1524	1703	3406					1441	1437	
Flt Permitted		1.00	1.00	0.10	1.00					0.95	0.95	
Satd. Flow (perm)		3406	1524	187	3406					1441	1437	
Volume (vph)	0	1020	650	396	1041	0	0	0	0	806	0	20
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1052	670	408	1073	0	0	0	0	831	0	21
RTOR Reduction (vph)	0	0	440	0	0	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	1052	230	408	1073	0	0	0	0	449	401	0
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	0%	0%	0%	19%	19%	19%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		33.4	33.4	58.5	58.5					31.5	31.5	
Effective Green, g (s)		34.4	34.4	59.5	59.5					32.5	32.5	
Actuated g/C Ratio		0.34	0.34	0.60	0.60					0.32	0.32	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1172	524	431	2027					468	467	
v/s Ratio Prot		0.31		c0.20	0.32							
v/s Ratio Perm			0.15	c0.36						c0.31	0.28	
v/c Ratio		0.90	0.44	0.95	0.53					0.96	0.86	
Uniform Delay, d1		31.1	25.4	29.1	12.0					33.1	31.6	
Progression Factor		0.76	1.44	1.41	0.89					1.00	1.00	
Incremental Delay, d2		6.6	1.5	23.1	0.7					31.0	14.5	
Delay (s)		30.4	38.0	64.2	11.4					64.1	46.1	
Level of Service		C	D	E	B					E	D	
Approach Delay (s)		33.3			25.9			0.0			55.6	
Approach LOS		C			C			A			E	

Intersection Summary

HCM Average Control Delay	35.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	138.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	371	1486	1033	1022	335	341
v/c Ratio	0.91	0.66	0.63	0.93	0.93	0.88
Control Delay	44.0	11.9	21.5	23.7	70.5	55.9
Queue Delay	0.0	0.4	0.0	0.0	0.0	0.0
Total Delay	44.0	12.3	21.5	23.7	70.5	55.9
Queue Length 50th (ft)	188	238	249	222	218	187
Queue Length 95th (ft)	m#221	m263	317	#624	#393	#357
Internal Link Dist (ft)		410	1			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	408	2243	1638	1098	367	391
Starvation Cap Reductn	0	281	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.76	0.63	0.93	0.91	0.87

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.92	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.98	
Satd. Flow (prot)	1641	3282			3406	1524			1531	1447	
Flt Permitted	0.16	1.00			1.00	1.00			0.95	0.98	
Satd. Flow (perm)	272	3282			3406	1524			1531	1447	
Volume (vph)	360	1441	0	0	1002	991	0	0	470	5	180
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	371	1486	0	0	1033	1022	0	0	485	5	186
RTOR Reduction (vph)	0	0	0	0	0	365	0	0	0	43	0
Lane Group Flow (vph)	371	1486	0	0	1033	657	0	0	335	298	0
Heavy Vehicles (%)	10%	10%	10%	6%	6%	6%	0%	0%	12%	12%	12%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	67.3	67.3			47.0	47.0			22.7	22.7	
Effective Green, g (s)	68.3	68.3			48.0	48.0			23.7	23.7	
Actuated g/C Ratio	0.68	0.68			0.48	0.48			0.24	0.24	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	409	2242			1635	732			363	343	
v/s Ratio Prot	c0.15	0.45			0.30				c0.22	0.21	
v/s Ratio Perm	c0.47					0.43					
v/c Ratio	0.91	0.66			0.63	0.90			0.92	0.87	
Uniform Delay, d1	20.4	9.2			19.4	23.8			37.3	36.6	
Progression Factor	1.85	1.19			1.00	1.00			1.00	1.00	
Incremental Delay, d2	11.5	0.6			1.9	16.0			28.8	20.4	
Delay (s)	49.2	11.6			21.3	39.7			66.1	57.0	
Level of Service	D	B			C	D			E	E	
Approach Delay (s)		19.1			30.5		0.0			61.5	
Approach LOS		B			C		A			E	

Intersection Summary

HCM Average Control Delay	30.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	138.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1975	11	11	1615	8	21
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	2124	12	12	1737	9	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				66		
pX, platoon unblocked					0.74	
vC, conflicting volume			2135		3022	1068
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			2135		3389	1068
tC, single (s)			4.3		7.3	7.4
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.5
p0 queue free %			95		0	88
cM capacity (veh/h)			224		3	184

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1416	720	12	868	868	9	23
Volume Left	0	0	12	0	0	9	0
Volume Right	0	12	0	0	0	0	23
cSH	1700	1700	224	1700	1700	3	184
Volume to Capacity	0.83	0.42	0.05	0.51	0.51	3.35	0.12
Queue Length 95th (ft)	0	0	4	0	0	Err	10
Control Delay (s)	0.0	0.0	22.0	0.0	0.0	Err	27.3
Lane LOS			C			F	D
Approach Delay (s)	0.0		0.1			2778.1	
Approach LOS						F	

Intersection Summary			
Average Delay	22.2		
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	10	326	1038	1295	405	1153
v/c Ratio	0.07	0.84	0.80	0.82	0.86	0.54
Control Delay	39.8	52.3	21.7	25.2	53.6	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.8	52.3	21.7	25.2	53.6	9.1
Queue Length 50th (ft)	5	153	184	271	101	130
Queue Length 95th (ft)	21	#344	#377	#497	#209	261
Internal Link Dist (ft)	36			266		3373
Turn Bay Length (ft)						
Base Capacity (vph)	144	389	1301	1581	472	2151
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.84	0.80	0.82	0.86	0.54

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88		0.95		0.97	0.95	
Frt		1.00		1.00		0.85		0.99		1.00	1.00	
Flt Protected		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1854		1752		2760		3444		3183	3280	
Flt Permitted		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1854		1752		2760		3444		3183	3280	
Volume (vph)	5	5	0	310	0	986	0	1166	65	385	1091	5
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	5	0	326	0	1038	0	1227	68	405	1148	5
RTOR Reduction (vph)	0	0	0	0	0	163	0	5	0	0	0	0
Lane Group Flow (vph)	0	10	0	326	0	875	0	1290	0	405	1153	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	10%	10%	10%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.9		16.9		26.9		35.1		10.0	51.1	
Effective Green, g (s)		2.9		17.9		29.9		37.1		12.0	53.1	
Actuated g/C Ratio		0.03		0.21		0.35		0.43		0.14	0.62	
Clearance Time (s)		6.0		5.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		63		365		1089		1487		445	2028	
v/s Ratio Prot				c0.19		c0.11		c0.37		0.13	0.35	
v/s Ratio Perm		0.01				0.20						
v/c Ratio		0.16		0.89		0.80		0.87		0.91	0.57	
Uniform Delay, d1		40.3		33.1		25.3		22.2		36.4	9.7	
Progression Factor		1.00		1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		1.2		23.0		4.4		7.1		22.5	1.2	
Delay (s)		41.5		56.1		29.7		29.3		58.9	10.8	
Level of Service		D		E		C		C		E	B	
Approach Delay (s)		41.5			36.0			29.3			23.3	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM Average Control Delay	29.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	85.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	111	960	26	33	564	191	32	216	295	252
v/c Ratio	0.35	0.58	0.03	0.26	0.52	0.32	0.24	0.68	0.61	0.46
Control Delay	38.0	21.4	7.2	45.8	23.7	7.5	44.1	41.2	42.2	26.8
Queue Delay	0.0	0.0	0.0	0.0	3.1	0.9	0.0	0.0	0.0	0.0
Total Delay	38.0	21.4	7.2	45.8	26.8	8.4	44.1	41.2	42.2	26.8
Queue Length 50th (ft)	57	234	0	14	162	28	18	104	81	112
Queue Length 95th (ft)	112	310	16	m46	165	72	46	173	123	178
Internal Link Dist (ft)		436			126		431			246
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	318	1658	756	127	1084	603	132	380	501	559
Starvation Cap Reductn	0	0	0	0	403	212	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.58	0.03	0.26	0.83	0.49	0.24	0.57	0.59	0.45

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1787	3574	1599	1736	3471	1553	1770	1583		3467	1745	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1787	3574	1599	1736	3471	1553	1770	1583		3467	1745	
Volume (vph)	105	912	25	31	536	181	30	150	55	280	180	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	111	960	26	33	564	191	32	158	58	295	189	63
RTOR Reduction (vph)	0	0	15	0	0	123	0	15	0	0	13	0
Lane Group Flow (vph)	111	960	11	33	564	68	32	201	0	295	239	0
Heavy Vehicles (%)	1%	1%	1%	4%	4%	4%	2%	2%	2%	1%	1%	1%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	14.3	35.8	35.8	3.6	25.2	25.2	3.0	17.6		11.0	25.8	
Effective Green, g (s)	16.0	37.6	37.6	4.3	25.9	25.9	4.7	19.5		12.6	27.4	
Actuated g/C Ratio	0.18	0.42	0.42	0.05	0.29	0.29	0.05	0.22		0.14	0.30	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	318	1493	668	83	999	447	92	343		485	531	
v/s Ratio Prot	c0.06	c0.27		0.02	0.16		0.02	c0.13		c0.09	0.14	
v/s Ratio Perm			0.01			0.04						
v/c Ratio	0.35	0.64	0.02	0.40	0.56	0.15	0.35	0.59		0.61	0.45	
Uniform Delay, d1	32.4	20.9	15.4	41.6	27.3	23.9	41.2	31.6		36.4	25.2	
Progression Factor	1.00	1.00	1.00	1.02	0.85	1.20	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.0	2.1	0.0	3.0	2.3	0.7	2.3	2.6		2.2	0.6	
Delay (s)	35.4	23.0	15.4	45.5	25.5	29.3	43.4	34.2		38.5	25.8	
Level of Service	D	C	B	D	C	C	D	C		D	C	
Approach Delay (s)		24.1			27.2		35.4				32.7	
Approach LOS		C			C		D				C	

Intersection Summary				
HCM Average Control Delay	27.8	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.61			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	60.5%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	648	615	107	727	121	114
v/c Ratio	0.28	0.49	0.20	0.27	0.55	0.47
Control Delay	4.3	2.2	6.2	6.2	44.9	28.8
Queue Delay	0.3	0.5	0.0	0.0	0.0	0.0
Total Delay	4.6	2.8	6.2	6.2	44.9	28.8
Queue Length 50th (ft)	45	10	24	113	68	40
Queue Length 95th (ft)	17	21	m0	146	118	89
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	2300	1244	559	2697	498	505
Starvation Cap Reductn	1006	270	0	0	0	0
Spillback Cap Reductn	0	0	0	398	0	5
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.63	0.19	0.32	0.24	0.23

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.94	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.97	
Satd. Flow (prot)		3539	1583	1752	3505					1545	1482	
Flt Permitted		1.00	1.00	0.36	1.00					0.95	0.97	
Satd. Flow (perm)		3539	1583	656	3505					1545	1482	
Volume (vph)	0	622	590	103	698	0	0	0	0	180	0	45
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	648	615	107	727	0	0	0	0	188	0	47
RTOR Reduction (vph)	0	0	222	0	0	0	0	0	0	0	35	0
Lane Group Flow (vph)	0	648	393	107	727	0	0	0	0	121	79	0
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	11%	11%	11%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		56.5	56.5	68.3	68.3					11.7	11.7	
Effective Green, g (s)		57.5	57.5	69.3	69.3					12.7	12.7	
Actuated g/C Ratio		0.64	0.64	0.77	0.77					0.14	0.14	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		2261	1011	600	2699					218	209	
v/s Ratio Prot		0.18		0.02	c0.21							
v/s Ratio Perm			c0.25	0.12						c0.08	0.05	
v/c Ratio		0.29	0.39	0.18	0.27					0.56	0.38	
Uniform Delay, d1		7.2	7.8	2.9	3.0					36.0	35.1	
Progression Factor		0.50	1.12	1.73	1.76					1.00	1.00	
Incremental Delay, d2		0.3	0.9	0.1	0.2					3.0	1.1	
Delay (s)		3.8	9.6	5.2	5.5					39.1	36.2	
Level of Service		A	A	A	A					D	D	
Approach Delay (s)		6.7			5.5			0.0			37.7	
Approach LOS		A			A			A			D	

Intersection Summary				
HCM Average Control Delay	9.4	HCM Level of Service	A	
HCM Volume to Capacity ratio	0.41			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	58.6%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	328	556	415	295	274	261
v/c Ratio	0.57	0.24	0.25	0.33	0.72	0.65
Control Delay	14.1	5.8	15.9	3.7	42.1	33.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.1	5.8	15.9	3.7	42.1	33.0
Queue Length 50th (ft)	65	38	66	0	151	117
Queue Length 95th (ft)	187	112	134	55	216	182
Internal Link Dist (ft)		410	9			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	734	2342	1677	900	537	543
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.24	0.25	0.33	0.51	0.48

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.94	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.97	
Satd. Flow (prot)	1719	3438			3406	1524			1665	1595	
Flt Permitted	0.44	1.00			1.00	1.00			0.95	0.97	
Satd. Flow (perm)	801	3438			3406	1524			1665	1595	
Volume (vph)	305	517	0	0	386	274	0	0	390	5	103
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	328	556	0	0	415	295	0	0	419	5	111
RTOR Reduction (vph)	0	0	0	0	0	150	0	0	0	34	0
Lane Group Flow (vph)	328	556	0	0	415	145	0	0	274	227	0
Heavy Vehicles (%)	5%	5%	5%	6%	6%	6%	0%	0%	3%	3%	3%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	60.3	60.3			43.3	43.3			19.7	19.7	
Effective Green, g (s)	61.3	61.3			44.3	44.3			20.7	20.7	
Actuated g/C Ratio	0.68	0.68			0.49	0.49			0.23	0.23	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	678	2342			1677	750			383	367	
v/s Ratio Prot	c0.07	0.16			0.12				c0.16	0.14	
v/s Ratio Perm	c0.26					0.10					
v/c Ratio	0.48	0.24			0.25	0.19			0.72	0.62	
Uniform Delay, d1	6.0	5.5			13.2	12.8			31.9	31.1	
Progression Factor	1.51	0.90			1.00	1.00			1.00	1.00	
Incremental Delay, d2	0.4	0.2			0.4	0.6			6.5	3.3	
Delay (s)	9.4	5.2			13.6	13.4			38.4	34.4	
Level of Service	A	A			B	B			D	C	
Approach Delay (s)		6.8			13.5		0.0			36.4	
Approach LOS		A			B		A			D	

Intersection Summary			
HCM Average Control Delay	16.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	560	35	73	535	22	80
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	596	37	78	569	23	85
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				89		
pX, platoon unblocked					0.95	
vC, conflicting volume			633		1054	316
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			633		1001	316
tC, single (s)			4.2		6.9	7.0
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			91		88	87
cM capacity (veh/h)			913		201	668

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	397	236	78	285	285	23	85
Volume Left	0	0	78	0	0	23	0
Volume Right	0	37	0	0	0	0	85
cSH	1700	1700	913	1700	1700	201	668
Volume to Capacity	0.23	0.14	0.09	0.17	0.17	0.12	0.13
Queue Length 95th (ft)	0	0	7	0	0	10	11
Control Delay (s)	0.0	0.0	9.3	0.0	0.0	25.2	11.2
Lane LOS			A			D	B
Approach Delay (s)	0.0		1.1			14.2	
Approach LOS						B	

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	34.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	10	121	222	5	607	210	481
v/c Ratio	0.06	0.47	0.21	0.03	0.33	0.41	0.20
Control Delay	28.6	35.9	3.3	36.4	12.3	31.5	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.6	35.9	3.3	36.4	12.3	31.5	6.7
Queue Length 50th (ft)	2	49	0	2	74	42	26
Queue Length 95th (ft)	18	114	25	13	166	90	122
Internal Link Dist (ft)	36				266		3376
Turn Bay Length (ft)							
Base Capacity (vph)	219	339	1049	212	1822	587	2459
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.36	0.21	0.02	0.33	0.36	0.20

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88	1.00	0.95		0.97	0.95	
Frt		0.93		1.00		0.85	1.00	0.98		1.00	1.00	
Flt Protected		1.00		0.95		1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1772		1752		2760	1752	3424		3273	3374	
Flt Permitted		1.00		0.95		1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1772		1752		2760	1752	3424		3273	3374	
Volume (vph)	0	5	5	110	0	202	5	468	85	191	438	0
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	5	5	121	0	222	5	514	93	210	481	0
RTOR Reduction (vph)	0	5	0	0	0	167	0	13	0	0	0	0
Lane Group Flow (vph)	0	5	0	121	0	55	5	594	0	210	481	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	3%	3%	3%	7%	7%	7%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		1.1		8.4		17.7	1.1	41.1		9.3	49.3	
Effective Green, g (s)		3.1		9.4		20.7	3.1	43.1		11.3	51.3	
Actuated g/C Ratio		0.04		0.11		0.25	0.04	0.52		0.14	0.62	
Clearance Time (s)		6.0		5.0		6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		66		199		822	66	1780		446	2088	
v/s Ratio Prot		c0.00		c0.07		0.01	0.00	c0.17		c0.06	0.14	
v/s Ratio Perm						0.01						
v/c Ratio		0.08		0.61		0.07	0.08	0.33		0.47	0.23	
Uniform Delay, d1		38.5		35.0		23.7	38.5	11.6		33.0	7.0	
Progression Factor		1.00		1.00		1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.5		5.2		0.0	0.5	0.5		0.8	0.3	
Delay (s)		39.0		40.2		23.8	39.0	12.1		33.8	7.3	
Level of Service		D		D		C	D	B		C	A	
Approach Delay (s)		39.0			29.6			12.3			15.3	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	82.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	128	1571	31	71	898	342	31	194	577	536
v/c Ratio	0.51	0.99	0.04	0.78	0.72	0.52	0.32	0.80	0.83	0.91
Control Delay	56.1	54.0	10.6	111.4	17.2	7.8	63.6	70.6	57.3	59.0
Queue Delay	0.0	19.4	0.0	0.0	6.4	3.2	0.0	0.0	42.4	0.0
Total Delay	56.1	73.4	10.6	111.4	23.5	11.0	63.6	70.6	99.6	59.0
Queue Length 50th (ft)	94	622	5	52	181	83	24	141	223	406
Queue Length 95th (ft)	159	#802	24	m#110	m314	m139	57	#252	#308	#644
Internal Link Dist (ft)		436			126		426			253
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	249	1581	717	91	1255	661	97	257	695	589
Starvation Cap Reductn	0	0	0	0	304	220	0	0	0	0
Spillback Cap Reductn	0	92	0	0	0	0	0	0	160	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	1.06	0.04	0.78	0.94	0.78	0.32	0.75	1.08	0.91

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1712	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1712	
Volume (vph)	125	1540	30	70	880	335	30	165	25	565	395	130
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	128	1571	31	71	898	342	31	168	26	577	403	133
RTOR Reduction (vph)	0	0	10	0	0	103	0	5	0	0	9	0
Lane Group Flow (vph)	128	1571	21	71	898	239	31	189	0	577	527	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	4%	4%	4%	3%	3%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	15.5	50.6	50.6	5.6	40.8	40.8	3.0	16.6		25.2	39.0	
Effective Green, g (s)	17.2	52.4	52.4	6.3	41.5	41.5	4.7	18.5		26.8	40.6	
Actuated g/C Ratio	0.14	0.44	0.44	0.05	0.35	0.35	0.04	0.15		0.22	0.34	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	249	1516	678	90	1189	532	68	239		759	579	
v/s Ratio Prot	0.07	c0.45		c0.04	0.26		0.02	c0.12		0.17	c0.31	
v/s Ratio Perm			0.01			0.16						
v/c Ratio	0.51	1.04	0.03	0.79	0.76	0.45	0.46	0.79		0.76	0.91	
Uniform Delay, d1	47.5	33.8	19.3	56.2	34.8	30.4	56.4	48.9		43.6	37.9	
Progression Factor	1.00	1.00	1.00	1.32	0.44	0.35	1.00	1.00		1.00	1.00	
Incremental Delay, d2	7.4	33.1	0.1	28.6	3.5	2.1	4.8	16.2		4.5	18.2	
Delay (s)	54.9	66.9	19.4	102.7	18.6	12.9	61.2	65.0		48.1	56.1	
Level of Service	D	E	B	F	B	B	E	E		D	E	
Approach Delay (s)		65.1			21.7		64.5				52.0	
Approach LOS		E			C		E				D	

Intersection Summary				
HCM Average Control Delay	48.7	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.97			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	94.1%	ICU Level of Service	F	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	1268	809	490	1299	538	483
v/c Ratio	1.06	0.87	1.14	0.64	1.12	1.01
Control Delay	59.9	12.2	118.7	5.7	116.3	82.9
Queue Delay	201.1	84.3	0.0	1.8	0.0	0.0
Total Delay	261.0	96.4	118.7	7.5	116.3	82.9
Queue Length 50th (ft)	~560	104	~400	80	~505	~395
Queue Length 95th (ft)	m#603	m259	m#522	m132	#732	#634
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1192	934	429	2044	480	480
Starvation Cap Reductn	358	251	0	314	0	0
Spillback Cap Reductn	0	0	0	543	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.52	1.18	1.14	0.87	1.12	1.01

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.99	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	
Satd. Flow (prot)		3406	1524	1703	3406					1441	1438	
Flt Permitted		1.00	1.00	0.09	1.00					0.95	0.95	
Satd. Flow (perm)		3406	1524	156	3406					1441	1438	
Volume (vph)	0	1230	785	475	1260	0	0	0	0	970	0	20
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1268	809	490	1299	0	0	0	0	1000	0	21
RTOR Reduction (vph)	0	0	400	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	1268	409	490	1299	0	0	0	0	538	482	0
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	0%	0%	0%	19%	19%	19%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		41.0	41.0	71.0	71.0					39.0	39.0	
Effective Green, g (s)		42.0	42.0	72.0	72.0					40.0	40.0	
Actuated g/C Ratio		0.35	0.35	0.60	0.60					0.33	0.33	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1192	533	429	2044					480	479	
v/s Ratio Prot		0.37		c0.25	0.38							
v/s Ratio Perm			0.27	c0.44						c0.37	0.33	
v/c Ratio		1.06	0.77	1.14	0.64					1.12	1.01	
Uniform Delay, d1		39.0	34.6	38.5	15.5					40.0	40.0	
Progression Factor		0.59	0.92	1.31	0.32					1.00	1.00	
Incremental Delay, d2		35.4	3.5	77.0	0.7					78.5	42.5	
Delay (s)		58.4	35.3	127.6	5.6					118.5	82.5	
Level of Service		E	D	F	A					F	F	
Approach Delay (s)		49.4			39.1			0.0			101.5	
Approach LOS		D			D			A			F	

Intersection Summary

HCM Average Control Delay	56.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	167.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	448	1794	1247	1232	415	400
v/c Ratio	1.16	0.79	0.76	1.14	1.12	1.07
Control Delay	108.0	10.1	29.0	92.5	126.1	106.5
Queue Delay	0.0	3.9	0.0	0.0	0.0	0.0
Total Delay	108.0	14.0	29.0	92.5	126.1	106.5
Queue Length 50th (ft)	~326	234	403	~841	~390	~340
Queue Length 95th (ft)	m#284	m220	492	#1105	#601	#550
Internal Link Dist (ft)		410	1			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	385	2270	1646	1076	370	374
Starvation Cap Reductn	0	389	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.16	0.95	0.76	1.14	1.12	1.07

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.92	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.98	
Satd. Flow (prot)	1641	3282			3406	1524			1531	1445	
Flt Permitted	0.11	1.00			1.00	1.00			0.95	0.98	
Satd. Flow (perm)	190	3282			3406	1524			1531	1445	
Volume (vph)	435	1740	0	0	1210	1195	0	0	570	5	215
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	448	1794	0	0	1247	1232	0	0	588	5	222
RTOR Reduction (vph)	0	0	0	0	0	339	0	0	0	25	0
Lane Group Flow (vph)	448	1794	0	0	1247	893	0	0	415	375	0
Heavy Vehicles (%)	10%	10%	10%	6%	6%	6%	0%	0%	12%	12%	12%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	82.0	82.0			57.0	57.0			28.0	28.0	
Effective Green, g (s)	83.0	83.0			58.0	58.0			29.0	29.0	
Actuated g/C Ratio	0.69	0.69			0.48	0.48			0.24	0.24	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	385	2270			1646	737			370	349	
v/s Ratio Prot	c0.20	0.55			0.37				c0.27	0.26	
v/s Ratio Perm	0.60					c0.59					
v/c Ratio	1.16	0.79			0.76	1.21			1.12	1.07	
Uniform Delay, d1	34.4	12.6			25.3	31.0			45.5	45.5	
Progression Factor	0.83	0.75			1.00	1.00			1.00	1.00	
Incremental Delay, d2	76.5	0.3			3.3	107.7			84.0	69.4	
Delay (s)	105.0	9.7			28.6	138.7			129.5	114.9	
Level of Service	F	A			C	F			F	F	
Approach Delay (s)		28.8			83.3		0.0			122.3	
Approach LOS		C			F		A			F	

Intersection Summary

HCM Average Control Delay	67.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	167.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations	↑↑↱		↰	↑↑	↰	↱
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	2385	9	15	1950	7	18
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	2565	10	16	2097	8	19
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				66		
pX, platoon unblocked					0.62	
vC, conflicting volume			2574		3650	1287
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			2574		4657	1287
tC, single (s)			4.3		7.3	7.4
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.5
p0 queue free %			89		0	85
cM capacity (veh/h)			147		0	128

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1710	865	16	1048	1048	8	19
Volume Left	0	0	16	0	0	8	0
Volume Right	0	10	0	0	0	0	19
cSH	1700	1700	147	1700	1700	0	128
Volume to Capacity	1.01	0.51	0.11	0.62	0.62	35.66	0.15
Queue Length 95th (ft)	0	0	9	0	0	Err	13
Control Delay (s)	0.0	0.0	32.4	0.0	0.0	Err	38.0
Lane LOS			D			F	E
Approach Delay (s)	0.0		0.2			2827.1	
Approach LOS						F	

Intersection Summary			
Average Delay	16.2		
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	10	395	1247	1558	489	1394
v/c Ratio	0.10	0.98	0.95	0.96	0.85	0.62
Control Delay	60.9	85.8	43.4	46.0	62.7	12.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.9	85.8	43.4	46.0	62.7	12.4
Queue Length 50th (ft)	7	301	455	580	188	266
Queue Length 95th (ft)	27	#563	#728	#880	#309	437
Internal Link Dist (ft)	36			266		3373
Turn Bay Length (ft)						
Base Capacity (vph)	100	405	1319	1624	578	2248
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.98	0.95	0.96	0.85	0.62

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88		0.95		0.97	0.95	
Frt		1.00		1.00		0.85		0.99		1.00	1.00	
Flt Protected		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1854		1752		2760		3445		3183	3280	
Flt Permitted		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1854		1752		2760		3445		3183	3280	
Volume (vph)	5	5	0	375	0	1185	0	1405	75	465	1320	5
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	5	0	395	0	1247	0	1479	79	489	1389	5
RTOR Reduction (vph)	0	0	0	0	0	96	0	3	0	0	0	0
Lane Group Flow (vph)	0	10	0	395	0	1151	0	1555	0	489	1394	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	10%	10%	10%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.9		27.0		47.0		55.1		20.0	81.1	
Effective Green, g (s)		2.9		28.0		50.0		57.1		22.0	83.1	
Actuated g/C Ratio		0.02		0.22		0.40		0.45		0.17	0.66	
Clearance Time (s)		6.0		5.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		43		389		1183		1561		556	2163	
v/s Ratio Prot				0.23		c0.17		c0.45		0.15	0.42	
v/s Ratio Perm		0.01				0.25						
v/c Ratio		0.23		1.02		0.97		1.00		0.88	0.64	
Uniform Delay, d1		60.5		49.0		37.3		34.3		50.7	12.7	
Progression Factor		1.00		1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		2.8		49.6		19.8		21.9		14.7	1.5	
Delay (s)		63.2		98.6		57.2		56.3		65.4	14.2	
Level of Service		E		F		E		E		E	B	
Approach Delay (s)		63.2			67.1			56.3			27.5	
Approach LOS		E			E			E			C	

Intersection Summary			
HCM Average Control Delay	49.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	126.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	128	1572	31	72	900	343	31	195	577	536
v/c Ratio	0.51	1.00	0.04	0.78	0.72	0.52	0.32	0.80	0.83	0.91
Control Delay	56.1	54.6	10.7	111.0	17.3	7.8	63.6	70.8	57.4	59.0
Queue Delay	0.0	19.7	0.0	0.0	6.5	3.2	0.0	0.0	44.7	0.0
Total Delay	56.1	74.3	10.7	111.0	23.8	11.0	63.6	70.8	102.0	59.0
Queue Length 50th (ft)	94	624	5	53	182	83	24	142	223	406
Queue Length 95th (ft)	159	#804	24	m#111	m315	m140	57	#255	#308	#644
Internal Link Dist (ft)		436			126		426			253
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	249	1578	716	92	1255	661	97	257	694	589
Starvation Cap Reductn	0	0	0	0	304	220	0	0	0	0
Spillback Cap Reductn	0	91	0	0	0	0	0	0	162	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	1.06	0.04	0.78	0.95	0.78	0.32	0.76	1.08	0.91

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1712	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1712	
Volume (vph)	125	1541	30	71	882	336	30	165	26	565	395	130
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	128	1572	31	72	900	343	31	168	27	577	403	133
RTOR Reduction (vph)	0	0	10	0	0	103	0	5	0	0	9	0
Lane Group Flow (vph)	128	1572	21	72	900	240	31	190	0	577	527	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	4%	4%	4%	3%	3%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	15.5	50.5	50.5	5.7	40.8	40.8	3.0	16.6		25.2	39.0	
Effective Green, g (s)	17.2	52.3	52.3	6.4	41.5	41.5	4.7	18.5		26.8	40.6	
Actuated g/C Ratio	0.14	0.44	0.44	0.05	0.35	0.35	0.04	0.15		0.22	0.34	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	249	1513	677	92	1189	532	68	239		759	579	
v/s Ratio Prot	0.07	c0.45		c0.04	0.26		0.02	c0.12		0.17	c0.31	
v/s Ratio Perm			0.01			0.16						
v/c Ratio	0.51	1.04	0.03	0.78	0.76	0.45	0.46	0.79		0.76	0.91	
Uniform Delay, d1	47.5	33.8	19.4	56.1	34.8	30.4	56.4	48.9		43.6	37.9	
Progression Factor	1.00	1.00	1.00	1.32	0.44	0.35	1.00	1.00		1.00	1.00	
Incremental Delay, d2	7.4	33.9	0.1	27.3	3.5	2.1	4.8	16.5		4.5	18.2	
Delay (s)	54.9	67.8	19.4	101.2	18.7	12.9	61.2	65.4		48.1	56.1	
Level of Service	D	E	B	F	B	B	E	E		D	E	
Approach Delay (s)		66.0			21.7		64.8				52.0	
Approach LOS		E			C		E				D	

Intersection Summary				
HCM Average Control Delay	49.1	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.97			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	94.1%	ICU Level of Service	F	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	1270	809	493	1303	539	484
v/c Ratio	1.07	0.87	1.15	0.64	1.12	1.01
Control Delay	60.5	12.1	121.1	5.8	117.0	83.4
Queue Delay	201.6	85.0	0.0	1.9	0.0	0.0
Total Delay	262.0	97.1	121.1	7.6	117.0	83.4
Queue Length 50th (ft)	~561	97	~405	81	~507	~397
Queue Length 95th (ft)	m#603	m247	m#527	m135	#734	#636
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1192	933	429	2044	480	480
Starvation Cap Reductn	358	251	0	315	0	0
Spillback Cap Reductn	0	0	0	546	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.52	1.19	1.15	0.87	1.12	1.01

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰	↑↑					↰	↕	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.99	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	
Satd. Flow (prot)		3406	1524	1703	3406					1441	1438	
Flt Permitted		1.00	1.00	0.09	1.00					0.95	0.95	
Satd. Flow (perm)		3406	1524	156	3406					1441	1438	
Volume (vph)	0	1232	785	478	1264	0	0	0	0	972	0	20
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1270	809	493	1303	0	0	0	0	1002	0	21
RTOR Reduction (vph)	0	0	400	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	1270	409	493	1303	0	0	0	0	539	483	0
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	0%	0%	0%	19%	19%	19%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		41.0	41.0	71.0	71.0					39.0	39.0	
Effective Green, g (s)		42.0	42.0	72.0	72.0					40.0	40.0	
Actuated g/C Ratio		0.35	0.35	0.60	0.60					0.33	0.33	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1192	533	429	2044					480	479	
v/s Ratio Prot		0.37		c0.25	0.38							
v/s Ratio Perm			0.27	c0.44						c0.37	0.34	
v/c Ratio		1.07	0.77	1.15	0.64					1.12	1.01	
Uniform Delay, d1		39.0	34.7	49.2	15.5					40.0	40.0	
Progression Factor		0.59	0.91	1.31	0.32					1.00	1.00	
Incremental Delay, d2		36.0	3.5	79.7	0.7					79.2	43.0	
Delay (s)		59.0	35.1	144.4	5.7					119.2	83.0	
Level of Service		E	D	F	A					F	F	
Approach Delay (s)		49.7			43.8			0.0			102.1	
Approach LOS		D			D			A			F	

Intersection Summary

HCM Average Control Delay	58.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	167.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	448	1798	1255	1236	416	401
v/c Ratio	1.17	0.79	0.76	1.15	1.12	1.07
Control Delay	109.4	10.1	29.2	94.5	127.0	107.3
Queue Delay	0.0	4.0	0.0	0.0	0.0	0.0
Total Delay	109.4	14.1	29.2	94.5	127.0	107.3
Queue Length 50th (ft)	~329	235	406	~848	~391	~342
Queue Length 95th (ft)	m#285	m220	496	#1114	#602	#552
Internal Link Dist (ft)		410	1			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	384	2270	1646	1075	370	374
Starvation Cap Reductn	0	388	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.17	0.96	0.76	1.15	1.12	1.07

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.92	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.98	
Satd. Flow (prot)	1641	3282			3406	1524			1531	1445	
Flt Permitted	0.11	1.00			1.00	1.00			0.95	0.98	
Satd. Flow (perm)	186	3282			3406	1524			1531	1445	
Volume (vph)	435	1744	0	0	1217	1199	0	0	570	5	217
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	448	1798	0	0	1255	1236	0	0	588	5	224
RTOR Reduction (vph)	0	0	0	0	0	338	0	0	0	25	0
Lane Group Flow (vph)	448	1798	0	0	1255	898	0	0	416	376	0
Heavy Vehicles (%)	10%	10%	10%	6%	6%	6%	0%	0%	12%	12%	12%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	82.0	82.0			57.0	57.0			28.0	28.0	
Effective Green, g (s)	83.0	83.0			58.0	58.0			29.0	29.0	
Actuated g/C Ratio	0.69	0.69			0.48	0.48			0.24	0.24	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	383	2270			1646	737			370	349	
v/s Ratio Prot	c0.20	0.55			0.37				c0.27	0.26	
v/s Ratio Perm	0.60					c0.59					
v/c Ratio	1.17	0.79			0.76	1.22			1.12	1.08	
Uniform Delay, d1	34.6	12.6			25.4	31.0			45.5	45.5	
Progression Factor	0.83	0.75			1.00	1.00			1.00	1.00	
Incremental Delay, d2	79.2	0.3			3.4	110.2			84.9	70.3	
Delay (s)	107.8	9.8			28.8	141.2			130.4	115.8	
Level of Service	F	A			C	F			F	F	
Approach Delay (s)		29.3			84.6		0.0			123.3	
Approach LOS		C			F		A			F	

Intersection Summary

HCM Average Control Delay	67.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	167.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations	↑↑↳		↰	↑↑	↰	↱
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	2385	15	21	1950	11	29
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	2565	16	23	2097	12	31
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				66		
pX, platoon unblocked					0.62	
vC, conflicting volume			2581		3666	1290
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			2581		4690	1290
tC, single (s)			4.3		7.3	7.4
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.5
p0 queue free %			85		0	76
cM capacity (veh/h)			146		0	127

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1710	871	23	1048	1048	12	31
Volume Left	0	0	23	0	0	12	0
Volume Right	0	16	0	0	0	0	31
cSH	1700	1700	146	1700	1700	0	127
Volume to Capacity	1.01	0.51	0.15	0.62	0.62	62.84	0.24
Queue Length 95th (ft)	0	0	13	0	0	Err	23
Control Delay (s)	0.0	0.0	34.0	0.0	0.0	Err	42.2
Lane LOS			D			F	E
Approach Delay (s)	0.0		0.4			2780.3	
Approach LOS						F	

Intersection Summary			
Average Delay	25.4		
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	10	395	1249	1562	491	1398
v/c Ratio	0.10	0.98	0.95	0.96	0.85	0.62
Control Delay	60.9	85.8	43.6	46.4	63.0	12.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.9	85.8	43.6	46.4	63.0	12.4
Queue Length 50th (ft)	7	301	456	583	189	267
Queue Length 95th (ft)	27	#563	#731	#884	#311	441
Internal Link Dist (ft)	36			266		3373
Turn Bay Length (ft)						
Base Capacity (vph)	100	405	1319	1624	578	2248
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.98	0.95	0.96	0.85	0.62

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88		0.95		0.97	0.95	
Frt		1.00		1.00		0.85		0.99		1.00	1.00	
Flt Protected		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1854		1752		2760		3445		3183	3280	
Flt Permitted		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1854		1752		2760		3445		3183	3280	
Volume (vph)	5	5	0	375	0	1187	0	1409	75	466	1323	5
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	5	0	395	0	1249	0	1483	79	491	1393	5
RTOR Reduction (vph)	0	0	0	0	0	96	0	3	0	0	0	0
Lane Group Flow (vph)	0	10	0	395	0	1153	0	1559	0	491	1398	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	10%	10%	10%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.9		27.0		47.0		55.1		20.0	81.1	
Effective Green, g (s)		2.9		28.0		50.0		57.1		22.0	83.1	
Actuated g/C Ratio		0.02		0.22		0.40		0.45		0.17	0.66	
Clearance Time (s)		6.0		5.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		43		389		1183		1561		556	2163	
v/s Ratio Prot				0.23		c0.17		c0.45		0.15	0.43	
v/s Ratio Perm		0.01				0.25						
v/c Ratio		0.23		1.02		0.97		1.00		0.88	0.65	
Uniform Delay, d1		60.5		49.0		37.4		34.4		50.7	12.7	
Progression Factor		1.00		1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		2.8		49.6		20.2		22.5		15.3	1.5	
Delay (s)		63.2		98.6		57.5		56.9		66.1	14.2	
Level of Service		E		F		E		E		E	B	
Approach Delay (s)		63.2			67.4			56.9			27.7	
Approach LOS		E			E			E			C	

Intersection Summary			
HCM Average Control Delay	49.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	126.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	107	1327	26	61	796	388	26	158	526	444
v/c Ratio	0.41	0.83	0.04	0.54	0.65	0.55	0.22	0.66	0.83	0.81
Control Delay	45.5	31.0	8.8	64.5	19.6	11.5	49.2	51.9	51.9	44.9
Queue Delay	0.0	0.1	0.0	0.0	3.1	2.2	0.0	333.4	7.5	0.0
Total Delay	45.5	31.0	8.8	64.5	22.6	13.8	49.2	385.3	59.4	44.9
Queue Length 50th (ft)	64	406	2	31	203	131	16	90	167	260
Queue Length 95th (ft)	119	#550	18	m#62	m260	m205	43	159	#244	#439
Internal Link Dist (ft)		436			126		426			253
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	258	1592	723	113	1220	700	116	266	643	546
Starvation Cap Reductn	0	0	0	0	311	188	0	0	0	0
Spillback Cap Reductn	0	9	0	0	0	0	0	174	85	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.84	0.04	0.54	0.88	0.76	0.22	1.72	0.94	0.81

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1713	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1713	
Volume (vph)	105	1300	25	60	780	380	25	135	20	515	330	105
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	107	1327	26	61	796	388	26	138	20	526	337	107
RTOR Reduction (vph)	0	0	11	0	0	159	0	5	0	0	11	0
Lane Group Flow (vph)	107	1327	15	61	796	229	26	153	0	526	433	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	4%	4%	4%	3%	3%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	13.2	40.9	40.9	4.7	32.5	32.5	3.0	15.4		17.0	29.6	
Effective Green, g (s)	14.9	42.7	42.7	5.4	33.2	33.2	4.7	17.3		18.6	31.2	
Actuated g/C Ratio	0.15	0.43	0.43	0.05	0.33	0.33	0.05	0.17		0.19	0.31	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	259	1482	663	93	1141	511	82	269		632	534	
v/s Ratio Prot	0.06	c0.38		c0.04	0.23		0.01	0.10		c0.15	c0.25	
v/s Ratio Perm			0.01			0.15						
v/c Ratio	0.41	0.90	0.02	0.66	0.70	0.45	0.32	0.57		0.83	0.81	
Uniform Delay, d1	38.6	26.6	16.6	46.4	29.0	26.2	46.1	37.9		39.2	31.7	
Progression Factor	1.00	1.00	1.00	1.08	0.63	0.92	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.8	8.8	0.1	12.7	2.9	2.3	2.2	2.8		9.2	9.1	
Delay (s)	43.4	35.3	16.6	63.0	21.2	26.4	48.3	40.7		48.4	40.8	
Level of Service	D	D	B	E	C	C	D	D		D	D	
Approach Delay (s)		35.6			24.9		41.8				44.9	
Approach LOS		D			C		D				D	

Intersection Summary

HCM Average Control Delay	34.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	1124	670	613	1232	486	437
v/c Ratio	1.06	0.75	1.15	0.58	1.12	1.01
Control Delay	69.0	7.3	112.6	16.9	116.2	81.2
Queue Delay	158.3	44.5	0.0	2.0	0.0	0.6
Total Delay	227.3	51.8	112.6	18.9	116.2	81.8
Queue Length 50th (ft)	~406	61	~433	286	~378	~295
Queue Length 95th (ft)	#540	m90	m#512	m336	#586	#511
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1056	895	531	2112	432	434
Starvation Cap Reductn	268	276	0	512	0	0
Spillback Cap Reductn	0	0	0	689	0	1
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.43	1.08	1.15	0.87	1.13	1.01

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.99	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	
Satd. Flow (prot)		3406	1524	1703	3406					1441	1437	
Flt Permitted		1.00	1.00	0.11	1.00					0.95	0.95	
Satd. Flow (perm)		3406	1524	205	3406					1441	1437	
Volume (vph)	0	1090	650	595	1195	0	0	0	0	875	0	20
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1124	670	613	1232	0	0	0	0	902	0	21
RTOR Reduction (vph)	0	0	423	0	0	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	1124	247	613	1232	0	0	0	0	486	435	0
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	0%	0%	0%	19%	19%	19%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		30.0	30.0	61.0	61.0					29.0	29.0	
Effective Green, g (s)		31.0	31.0	62.0	62.0					30.0	30.0	
Actuated g/C Ratio		0.31	0.31	0.62	0.62					0.30	0.30	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1056	472	532	2112					432	431	
v/s Ratio Prot		0.33		c0.31	0.36							
v/s Ratio Perm			0.16	c0.40						c0.34	0.30	
v/c Ratio		1.06	0.52	1.15	0.58					1.12	1.01	
Uniform Delay, d1		34.5	28.4	29.5	11.3					35.0	35.0	
Progression Factor		0.82	1.03	1.35	1.43					1.00	1.00	
Incremental Delay, d2		39.8	2.2	77.1	0.5					82.0	45.6	
Delay (s)		68.0	31.6	117.1	16.6					117.0	80.6	
Level of Service		E	C	F	B					F	F	
Approach Delay (s)		54.4			50.0			0.0			99.8	
Approach LOS		D			D			A			F	

Intersection Summary

HCM Average Control Delay	61.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	152.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	371	1634	1397	1175	390	384
v/c Ratio	1.07	0.73	0.87	1.10	1.06	1.03
Control Delay	74.2	12.9	31.3	71.2	102.6	90.0
Queue Delay	0.0	0.8	0.0	0.0	0.0	0.0
Total Delay	74.2	13.7	31.3	71.2	102.6	90.0
Queue Length 50th (ft)	~227	257	407	~608	~289	~254
Queue Length 95th (ft)	m208	m241	512	#863	#482	#448
Internal Link Dist (ft)		410	1			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	348	2232	1601	1072	367	372
Starvation Cap Reductn	0	299	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.07	0.85	0.87	1.10	1.06	1.03

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.89	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.99	
Satd. Flow (prot)	1641	3282			3406	1524			1531	1414	
Flt Permitted	0.08	1.00			1.00	1.00			0.95	0.99	
Satd. Flow (perm)	135	3282			3406	1524			1531	1414	
Volume (vph)	360	1585	0	0	1355	1140	0	0	470	5	275
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	371	1634	0	0	1397	1175	0	0	485	5	284
RTOR Reduction (vph)	0	0	0	0	0	356	0	0	0	33	0
Lane Group Flow (vph)	371	1634	0	0	1397	819	0	0	390	351	0
Heavy Vehicles (%)	10%	10%	10%	6%	6%	6%	0%	0%	12%	12%	12%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	67.0	67.0			46.0	46.0			23.0	23.0	
Effective Green, g (s)	68.0	68.0			47.0	47.0			24.0	24.0	
Actuated g/C Ratio	0.68	0.68			0.47	0.47			0.24	0.24	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	348	2232			1601	716			367	339	
v/s Ratio Prot	c0.18	0.50			0.41				c0.25	0.25	
v/s Ratio Perm	0.54					c0.54					
v/c Ratio	1.07	0.73			0.87	1.14			1.06	1.04	
Uniform Delay, d1	32.0	10.2			23.8	26.5			38.0	38.0	
Progression Factor	1.41	1.20			1.00	1.00			1.00	1.00	
Incremental Delay, d2	36.0	0.2			6.9	81.0			64.5	58.6	
Delay (s)	81.1	12.5			30.7	107.5			102.5	96.6	
Level of Service	F	B			C	F			F	F	
Approach Delay (s)		25.2			65.8		0.0			99.6	
Approach LOS		C			E		A			F	

Intersection Summary

HCM Average Control Delay	55.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	152.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	2480	9	10	1850	7	18
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	2667	10	11	1989	8	19
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				66		
pX, platoon unblocked					0.68	
vC, conflicting volume			2676		3688	1338
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			2676		4489	1338
tC, single (s)			4.3		7.3	7.4
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.5
p0 queue free %			92		0	84
cM capacity (veh/h)			134		0	118

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1778	899	11	995	995	8	19
Volume Left	0	0	11	0	0	8	0
Volume Right	0	10	0	0	0	0	19
cSH	1700	1700	134	1700	1700	0	118
Volume to Capacity	1.05	0.53	0.08	0.59	0.59	23.35	0.16
Queue Length 95th (ft)	0	0	6	0	0	Err	14
Control Delay (s)	0.0	0.0	34.3	0.0	0.0	Err	41.5
Lane LOS			D			F	E
Approach Delay (s)	0.0		0.2			2829.6	
Approach LOS						F	

Intersection Summary			
Average Delay	16.3		
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	10	458	1568	1358	658	1152
v/c Ratio	0.07	1.18	1.15	0.91	1.20	0.54
Control Delay	39.8	134.8	95.5	33.1	137.2	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.8	134.8	95.5	33.1	137.2	9.2
Queue Length 50th (ft)	5	~269	~474	308	~202	130
Queue Length 95th (ft)	21	#523	#736	#564	#360	261
Internal Link Dist (ft)	36			266		3373
Turn Bay Length (ft)						
Base Capacity (vph)	144	389	1369	1486	550	2146
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	1.18	1.15	0.91	1.20	0.54

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88		0.95		0.97	0.95	
Frt		1.00		1.00		0.85		0.99		1.00	1.00	
Flt Protected		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1854		1752		2760		3421		3183	3280	
Flt Permitted		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1854		1752		2760		3421		3183	3280	
Volume (vph)	5	5	0	435	0	1490	0	1165	125	625	1090	5
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	5	0	458	0	1568	0	1226	132	658	1147	5
RTOR Reduction (vph)	0	0	0	0	0	160	0	9	0	0	0	0
Lane Group Flow (vph)	0	10	0	458	0	1408	0	1349	0	658	1152	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	10%	10%	10%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.9		17.0		29.0		33.1		12.0	51.1	
Effective Green, g (s)		2.9		18.0		32.0		35.1		14.0	53.1	
Actuated g/C Ratio		0.03		0.21		0.37		0.41		0.16	0.62	
Clearance Time (s)		6.0		5.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		63		367		1155		1396		518	2025	
v/s Ratio Prot				0.26		c0.20		c0.39		0.21	0.35	
v/s Ratio Perm		0.01				0.31						
v/c Ratio		0.16		1.25		1.22		0.97		1.27	0.57	
Uniform Delay, d1		40.4		34.0		27.0		24.9		36.0	9.7	
Progression Factor		1.00		1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		1.2		132.4		106.5		17.3		136.2	1.2	
Delay (s)		41.5		166.4		133.5		42.2		172.2	10.9	
Level of Service		D		F		F		D		F	B	
Approach Delay (s)		41.5			141.0			42.2			69.5	
Approach LOS		D			F			D			E	

Intersection Summary			
HCM Average Control Delay	90.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	107	1327	26	61	797	388	26	158	526	444
v/c Ratio	0.41	0.83	0.04	0.54	0.65	0.55	0.22	0.66	0.83	0.81
Control Delay	45.5	31.0	8.8	64.5	19.6	11.5	49.2	51.9	51.9	44.9
Queue Delay	0.0	0.1	0.0	0.0	3.1	2.2	0.0	333.4	7.5	0.0
Total Delay	45.5	31.0	8.8	64.5	22.7	13.8	49.2	385.3	59.4	44.9
Queue Length 50th (ft)	64	406	2	31	204	131	16	90	167	260
Queue Length 95th (ft)	119	#550	18	m#62	m260	m205	43	159	#244	#439
Internal Link Dist (ft)		436			126		426			253
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	258	1592	723	113	1220	700	116	266	643	546
Starvation Cap Reductn	0	0	0	0	311	188	0	0	0	0
Spillback Cap Reductn	0	9	0	0	0	0	0	174	85	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.84	0.04	0.54	0.88	0.76	0.22	1.72	0.94	0.81

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1713	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1713	
Volume (vph)	105	1300	25	60	781	380	25	135	20	515	330	105
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	107	1327	26	61	797	388	26	138	20	526	337	107
RTOR Reduction (vph)	0	0	11	0	0	159	0	5	0	0	11	0
Lane Group Flow (vph)	107	1327	15	61	797	229	26	153	0	526	433	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	4%	4%	4%	3%	3%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	13.2	40.9	40.9	4.7	32.5	32.5	3.0	15.4		17.0	29.6	
Effective Green, g (s)	14.9	42.7	42.7	5.4	33.2	33.2	4.7	17.3		18.6	31.2	
Actuated g/C Ratio	0.15	0.43	0.43	0.05	0.33	0.33	0.05	0.17		0.19	0.31	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	259	1482	663	93	1141	511	82	269		632	534	
v/s Ratio Prot	0.06	c0.38		c0.04	0.23		0.01	0.10		c0.15	c0.25	
v/s Ratio Perm			0.01			0.15						
v/c Ratio	0.41	0.90	0.02	0.66	0.70	0.45	0.32	0.57		0.83	0.81	
Uniform Delay, d1	38.6	26.6	16.6	46.4	29.0	26.2	46.1	37.9		39.2	31.7	
Progression Factor	1.00	1.00	1.00	1.08	0.63	0.92	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.8	8.8	0.1	12.7	2.9	2.3	2.2	2.8		9.2	9.1	
Delay (s)	43.4	35.3	16.6	63.0	21.3	26.4	48.3	40.7		48.4	40.8	
Level of Service	D	D	B	E	C	C	D	D		D	D	
Approach Delay (s)		35.6			24.9		41.8				44.9	
Approach LOS		D			C		D				D	

Intersection Summary				
HCM Average Control Delay	34.8	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.83			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	82.3%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	1124	670	614	1233	486	438
v/c Ratio	1.06	0.75	1.16	0.58	1.12	1.01
Control Delay	69.0	7.3	113.3	17.0	116.2	81.8
Queue Delay	158.3	44.5	0.0	2.0	0.0	0.6
Total Delay	227.3	51.8	113.3	18.9	116.2	82.4
Queue Length 50th (ft)	~406	61	~435	287	~378	~297
Queue Length 95th (ft)	#540	m90	m#515	m336	#586	#514
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1056	895	531	2112	432	434
Starvation Cap Reductn	268	276	0	512	0	0
Spillback Cap Reductn	0	0	0	686	0	1
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.43	1.08	1.16	0.86	1.13	1.01

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.95	0.95	
Frt		1.00	0.85	1.00	1.00					1.00	0.99	
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	
Satd. Flow (prot)		3406	1524	1703	3406					1441	1437	
Flt Permitted		1.00	1.00	0.11	1.00					0.95	0.95	
Satd. Flow (perm)		3406	1524	205	3406					1441	1437	
Volume (vph)	0	1090	650	596	1196	0	0	0	0	876	0	20
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1124	670	614	1233	0	0	0	0	903	0	21
RTOR Reduction (vph)	0	0	423	0	0	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	1124	247	614	1233	0	0	0	0	486	436	0
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	0%	0%	0%	19%	19%	19%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		30.0	30.0	61.0	61.0					29.0	29.0	
Effective Green, g (s)		31.0	31.0	62.0	62.0					30.0	30.0	
Actuated g/C Ratio		0.31	0.31	0.62	0.62					0.30	0.30	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1056	472	532	2112					432	431	
v/s Ratio Prot		0.33		c0.31	0.36							
v/s Ratio Perm			0.16	c0.40						c0.34	0.30	
v/c Ratio		1.06	0.52	1.15	0.58					1.12	1.01	
Uniform Delay, d1		34.5	28.4	29.5	11.3					35.0	35.0	
Progression Factor		0.82	1.03	1.35	1.43					1.00	1.00	
Incremental Delay, d2		39.8	2.2	77.9	0.4					82.0	46.2	
Delay (s)		68.0	31.6	117.8	16.6					117.0	81.2	
Level of Service		E	C	F	B					F	F	
Approach Delay (s)		54.4			50.3			0.0			100.0	
Approach LOS		D			D			A			F	

Intersection Summary

HCM Average Control Delay	62.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	152.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL
Lane Group Flow (vph)	371	1635	1399	1176	390	384
v/c Ratio	1.07	0.73	0.87	1.10	1.06	1.03
Control Delay	74.2	12.9	31.4	71.6	102.6	90.0
Queue Delay	0.0	0.8	0.0	0.0	0.0	0.0
Total Delay	74.2	13.7	31.4	71.6	102.6	90.0
Queue Length 50th (ft)	~226	257	408	~610	~289	~254
Queue Length 95th (ft)	m208	m242	513	#864	#482	#448
Internal Link Dist (ft)		410	1			232
Turn Bay Length (ft)	170					
Base Capacity (vph)	348	2232	1601	1072	367	372
Starvation Cap Reductn	0	299	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.07	0.85	0.87	1.10	1.06	1.03

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			0.95	0.95	
Frt	1.00	1.00			1.00	0.85			1.00	0.89	
Flt Protected	0.95	1.00			1.00	1.00			0.95	0.99	
Satd. Flow (prot)	1641	3282			3406	1524			1531	1414	
Flt Permitted	0.08	1.00			1.00	1.00			0.95	0.99	
Satd. Flow (perm)	135	3282			3406	1524			1531	1414	
Volume (vph)	360	1586	0	0	1357	1141	0	0	470	5	275
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	371	1635	0	0	1399	1176	0	0	485	5	284
RTOR Reduction (vph)	0	0	0	0	0	356	0	0	0	33	0
Lane Group Flow (vph)	371	1635	0	0	1399	820	0	0	390	351	0
Heavy Vehicles (%)	10%	10%	10%	6%	6%	6%	0%	0%	12%	12%	12%
Turn Type	pm+pt					Perm			Split		
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					
Actuated Green, G (s)	67.0	67.0			46.0	46.0			23.0	23.0	
Effective Green, g (s)	68.0	68.0			47.0	47.0			24.0	24.0	
Actuated g/C Ratio	0.68	0.68			0.47	0.47			0.24	0.24	
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	
Lane Grp Cap (vph)	348	2232			1601	716			367	339	
v/s Ratio Prot	c0.18	0.50			0.41				c0.25	0.25	
v/s Ratio Perm	0.54					c0.54					
v/c Ratio	1.07	0.73			0.87	1.15			1.06	1.04	
Uniform Delay, d1	32.0	10.2			23.8	26.5			38.0	38.0	
Progression Factor	1.41	1.20			1.00	1.00			1.00	1.00	
Incremental Delay, d2	36.0	0.2			6.9	81.5			64.5	58.6	
Delay (s)	81.0	12.5			30.8	108.0			102.5	96.6	
Level of Service	F	B			C	F			F	F	
Approach Delay (s)		25.1			66.0		0.0			99.6	
Approach LOS		C			E		A			F	

Intersection Summary

HCM Average Control Delay	55.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	152.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	2480	11	11	1850	8	21
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	2667	12	12	1989	9	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				66		
pX, platoon unblocked					0.68	
vC, conflicting volume			2678		3691	1339
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			2678		4496	1339
tC, single (s)			4.3		7.3	7.4
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.5
p0 queue free %			91		0	81
cM capacity (veh/h)			133		0	117

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1778	901	12	995	995	9	23
Volume Left	0	0	12	0	0	9	0
Volume Right	0	12	0	0	0	0	23
cSH	1700	1700	133	1700	1700	0	117
Volume to Capacity	1.05	0.53	0.09	0.59	0.59	27.25	0.19
Queue Length 95th (ft)	0	0	7	0	0	Err	17
Control Delay (s)	0.0	0.0	34.6	0.0	0.0	Err	42.8
Lane LOS			D			F	E
Approach Delay (s)	0.0		0.2			2789.3	
Approach LOS						F	

Intersection Summary			
Average Delay	18.6		
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	10	458	1569	1359	658	1153
v/c Ratio	0.07	1.18	1.15	0.91	1.20	0.54
Control Delay	39.8	134.8	95.8	33.2	137.2	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.8	134.8	95.8	33.2	137.2	9.2
Queue Length 50th (ft)	5	~269	~475	310	~202	130
Queue Length 95th (ft)	21	#523	#738	#566	#360	261
Internal Link Dist (ft)	36			266		3373
Turn Bay Length (ft)						
Base Capacity (vph)	144	389	1369	1486	550	2146
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	1.18	1.15	0.91	1.20	0.54

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00		0.88		0.95		0.97	0.95	
Frt		1.00		1.00		0.85		0.99		1.00	1.00	
Flt Protected		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1854		1752		2760		3421		3183	3280	
Flt Permitted		0.98		0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1854		1752		2760		3421		3183	3280	
Volume (vph)	5	5	0	435	0	1491	0	1166	125	625	1091	5
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	5	0	458	0	1569	0	1227	132	658	1148	5
RTOR Reduction (vph)	0	0	0	0	0	160	0	9	0	0	0	0
Lane Group Flow (vph)	0	10	0	458	0	1409	0	1350	0	658	1153	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	10%	10%	10%
Turn Type	Perm			Prot		custom	Prot			Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4						
Actuated Green, G (s)		0.9		17.0		29.0		33.1		12.0	51.1	
Effective Green, g (s)		2.9		18.0		32.0		35.1		14.0	53.1	
Actuated g/C Ratio		0.03		0.21		0.37		0.41		0.16	0.62	
Clearance Time (s)		6.0		5.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		63		367		1155		1396		518	2025	
v/s Ratio Prot				0.26		c0.20		c0.39		0.21	0.35	
v/s Ratio Perm		0.01				0.31						
v/c Ratio		0.16		1.25		1.22		0.97		1.27	0.57	
Uniform Delay, d1		40.4		34.0		27.0		24.9		36.0	9.7	
Progression Factor		1.00		1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		1.2		132.4		106.9		17.4		136.2	1.2	
Delay (s)		41.5		166.4		133.9		42.3		172.2	10.9	
Level of Service		D		F		F		D		F	B	
Approach Delay (s)		41.5			141.3			42.3			69.5	
Approach LOS		D			F			D			E	

Intersection Summary			
HCM Average Control Delay	90.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	128	1658	31	71	1092	735	31	194	750	536
v/c Ratio	0.90	1.00	0.04	0.88	0.72	0.87	0.35	0.91	1.02	0.93
Control Delay	112.0	55.6	11.1	117.2	19.8	14.2	70.6	96.3	87.4	64.9
Queue Delay	0.0	28.0	0.0	0.0	49.8	44.2	0.0	0.0	173.9	0.0
Total Delay	112.0	83.7	11.1	117.2	69.6	58.4	70.6	96.3	261.3	64.9
Queue Length 50th (ft)	109	717	7	59	194	114	26	160	~343	~473
Queue Length 95th (ft)	#232	#901	25	m65	m263	m153	60	#308	#468	#697
Internal Link Dist (ft)		436			126		426			253
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	142	1661	751	81	1526	846	89	213	738	579
Starvation Cap Reductn	0	0	0	0	534	171	0	0	0	0
Spillback Cap Reductn	0	124	0	0	0	0	0	0	213	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.90	1.08	0.04	0.88	1.10	1.09	0.35	0.91	1.43	0.93

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1712	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1712	
Volume (vph)	125	1625	30	70	1070	720	30	165	25	735	395	130
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	128	1658	31	71	1092	735	31	168	26	750	403	133
RTOR Reduction (vph)	0	0	9	0	0	168	0	4	0	0	9	0
Lane Group Flow (vph)	128	1658	22	71	1092	567	31	190	0	750	527	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	4%	4%	4%	3%	3%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	8.9	58.1	58.1	5.4	54.7	54.7	3.0	15.6		28.9	41.7	
Effective Green, g (s)	10.6	59.9	59.9	6.1	55.4	55.4	4.7	17.5		30.5	43.3	
Actuated g/C Ratio	0.08	0.46	0.46	0.05	0.43	0.43	0.04	0.13		0.23	0.33	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	142	1599	716	81	1465	655	63	209		798	570	
v/s Ratio Prot	0.07	c0.48		0.04	0.32		0.02	c0.12		0.22	c0.31	
v/s Ratio Perm			0.01			c0.37						
v/c Ratio	0.90	1.04	0.03	0.88	0.75	0.87	0.49	0.91		0.94	0.93	
Uniform Delay, d1	59.2	35.0	19.2	61.6	31.4	33.9	61.5	55.5		48.8	41.8	
Progression Factor	1.00	1.00	1.00	1.35	0.63	0.42	1.00	1.00		1.00	1.00	
Incremental Delay, d2	52.9	32.7	0.1	31.9	1.4	6.4	5.9	37.4		18.6	21.0	
Delay (s)	112.1	67.7	19.3	115.3	21.0	20.7	67.4	92.8		67.4	62.8	
Level of Service	F	E	B	F	C	C	E	F		E	E	
Approach Delay (s)		70.0			24.4		89.3				65.5	
Approach LOS		E			C		F				E	

Intersection Summary

HCM Average Control Delay	53.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	1536	809	1289	1897	1268	21
v/c Ratio	1.30	0.66	1.48	0.92	1.30	0.05
Control Delay	164.8	9.7	252.9	13.4	180.3	16.2
Queue Delay	217.9	52.0	0.0	87.6	4.2	0.0
Total Delay	382.7	61.7	252.9	101.0	184.5	16.2
Queue Length 50th (ft)	~866	107	~718	316	~705	3
Queue Length 95th (ft)	m#863	m106	m#448	m212	#840	23
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1179	1233	870	2070	973	459
Starvation Cap Reductn	320	499	0	484	0	0
Spillback Cap Reductn	0	0	0	302	7	151
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.79	1.10	1.48	1.20	1.31	0.07

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	0.88	0.97	0.95					0.97	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.85	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3406	2682	3303	3406					2943	1357	
Flt Permitted		1.00	1.00	0.08	1.00					0.95	1.00	
Satd. Flow (perm)		3406	2682	284	3406					2943	1357	
Volume (vph)	0	1490	785	1250	1840	0	0	0	0	1230	0	20
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1536	809	1289	1897	0	0	0	0	1268	0	21
RTOR Reduction (vph)	0	0	305	0	0	0	0	0	0	0	10	0
Lane Group Flow (vph)	0	1536	504	1289	1897	0	0	0	0	1268	11	0
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	0%	0%	0%	19%	19%	19%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		44.0	44.0	78.0	78.0					42.0	42.0	
Effective Green, g (s)		45.0	45.0	79.0	79.0					43.0	43.0	
Actuated g/C Ratio		0.35	0.35	0.61	0.61					0.33	0.33	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1179	928	869	2070					973	449	
v/s Ratio Prot		0.45		c0.34	0.56						0.01	
v/s Ratio Perm			0.19	c0.56						c0.43		
v/c Ratio		1.30	0.54	1.48	0.92					1.30	0.02	
Uniform Delay, d1		42.5	34.2	52.2	22.6					43.5	29.3	
Progression Factor		0.69	0.66	1.27	0.53					1.00	1.00	
Incremental Delay, d2		136.8	0.2	218.1	0.8					144.0	0.0	
Delay (s)		166.1	22.7	284.3	12.7					187.5	29.4	
Level of Service		F	C	F	B					F	C	
Approach Delay (s)		116.6			122.6			0.0			184.9	
Approach LOS		F			F			A			F	

Intersection Summary				
HCM Average Control Delay	132.3	HCM Level of Service	F	
HCM Volume to Capacity ratio	1.40			
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	165.1%	ICU Level of Service	H	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL	NER
Lane Group Flow (vph)	448	2325	2644	1830	588	293	289
v/c Ratio	1.41	0.94	1.38	0.96	1.02	1.05	1.09
Control Delay	218.1	14.6	202.2	26.9	94.3	114.6	126.7
Queue Delay	0.0	45.0	18.0	0.0	0.0	0.0	0.0
Total Delay	218.1	59.5	220.2	26.9	94.3	114.6	126.7
Queue Length 50th (ft)	~456	350	~1555	514	~270	~256	~275
Queue Length 95th (ft)	m#271	m259	#1680	#817	#387	#441	#468
Internal Link Dist (ft)		410	1			232	
Turn Bay Length (ft)	170						
Base Capacity (vph)	318	2474	1913	1906	577	280	266
Starvation Cap Reductn	0	362	0	0	0	0	0
Spillback Cap Reductn	0	0	54	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.41	1.10	1.42	0.96	1.02	1.05	1.09

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	0.88			0.97	1.00	0.95
Frt	1.00	1.00			1.00	0.85			1.00	0.85	0.85
Flt Protected	0.95	1.00			1.00	1.00			0.95	1.00	1.00
Satd. Flow (prot)	1641	3282			3406	2682			3127	1445	1370
Flt Permitted	0.05	1.00			1.00	1.00			0.95	1.00	1.00
Satd. Flow (perm)	90	3282			3406	2682			3127	1445	1370
Volume (vph)	435	2255	0	0	2565	1775	0	0	570	5	560
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	448	2325	0	0	2644	1830	0	0	588	5	577
RTOR Reduction (vph)	0	0	0	0	0	400	0	0	0	13	13
Lane Group Flow (vph)	448	2325	0	0	2644	1430	0	0	588	280	276
Heavy Vehicles (%)	10%	10%	10%	6%	6%	6%	0%	0%	12%	12%	12%
Turn Type	pm+pt					Perm			Split		Perm
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					4
Actuated Green, G (s)	97.0	97.0			72.0	72.0			23.0	23.0	23.0
Effective Green, g (s)	98.0	98.0			73.0	73.0			24.0	24.0	24.0
Actuated g/C Ratio	0.75	0.75			0.56	0.56			0.18	0.18	0.18
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	5.0
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	3.5
Lane Grp Cap (vph)	318	2474			1913	1506			577	267	253
v/s Ratio Prot	c0.23	0.71			0.78				0.19	0.19	
v/s Ratio Perm	c0.84					0.53					c0.20
v/c Ratio	1.41	0.94			1.38	0.95			1.02	1.05	1.09
Uniform Delay, d1	51.1	13.5			28.5	26.8			53.0	53.0	53.0
Progression Factor	0.86	0.95			1.00	1.00			1.00	1.00	1.00
Incremental Delay, d2	185.7	1.0			175.3	13.9			42.4	68.4	82.9
Delay (s)	229.5	13.8			203.8	40.7			95.4	121.4	135.9
Level of Service	F	B			F	D			F	F	F
Approach Delay (s)		48.6			137.1		0.0			111.9	
Approach LOS		D			F		A			F	

Intersection Summary

HCM Average Control Delay	104.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	165.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	4320	9	15	2810	7	18
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	4645	10	16	3022	8	19
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				66		
pX, platoon unblocked					0.25	
vC, conflicting volume			4655		6193	2327
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			4655		18654	2327
tC, single (s)			4.3		7.3	7.4
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.5
p0 queue free %			15		0	12
cM capacity (veh/h)			19		0	22

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	3097	1558	16	1511	1511	8	19
Volume Left	0	0	16	0	0	8	0
Volume Right	0	10	0	0	0	0	19
cSH	1700	1700	19	1700	1700	0	22
Volume to Capacity	1.82	0.92	0.85	0.89	0.89	Err	0.88
Queue Length 95th (ft)	0	0	57	0	0	Err	63
Control Delay (s)	0.0	0.0	435.6	0.0	0.0	Err	399.2
Lane LOS			F			F	F
Approach Delay (s)	0.0		2.3			3087.2	
Approach LOS						F	

Intersection Summary			
Average Delay	11.7		
Intersection Capacity Utilization	129.7%	ICU Level of Service	H
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	10	900	3284	1479	305	1400	1394
v/c Ratio	0.11	1.65	1.78	1.09	0.54	0.97	0.56
Control Delay	71.6	336.1	375.4	100.5	19.1	55.7	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.6	336.1	375.4	100.5	19.1	55.7	9.1
Queue Length 50th (ft)	9	~598	~2475	~535	74	609	222
Queue Length 95th (ft)	31	#802	#2844	#714	185	#880	375
Internal Link Dist (ft)	36			266			3373
Turn Bay Length (ft)							
Base Capacity (vph)	87	546	1844	1359	569	1444	2473
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	1.65	1.78	1.09	0.54	0.97	0.56

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00		0.97		0.88		0.91	1.00	0.97	0.95	
Frt		1.00		1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected		0.98		0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1854		3400		2760		4988	1553	3183	3280	
Flt Permitted		0.98		0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1854		3400		2760		4988	1553	3183	3280	
Volume (vph)	5	5	0	855	0	3120	0	1405	290	1330	1320	5
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	5	0	900	0	3284	0	1479	305	1400	1389	5
RTOR Reduction (vph)	0	0	0	0	0	80	0	0	148	0	0	0
Lane Group Flow (vph)	0	10	0	900	0	3204	0	1479	157	1400	1394	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	10%	10%	10%
Turn Type	Perm			Prot		custom	Prot		Perm	Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4			2			
Actuated Green, G (s)		1.9		22.0		85.1		37.1	37.1	63.1	106.2	
Effective Green, g (s)		3.9		23.0		88.1		39.1	39.1	65.1	108.2	
Actuated g/C Ratio		0.03		0.16		0.60		0.27	0.27	0.44	0.74	
Clearance Time (s)		6.0		5.0		6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		49		532		1728		1326	413	1409	2413	
v/s Ratio Prot				0.26		c0.82		c0.30		0.44	0.42	
v/s Ratio Perm		0.01				0.34			0.10			
v/c Ratio		0.20		1.69		1.85		1.12	0.38	0.99	0.58	
Uniform Delay, d1		70.1		62.0		29.5		54.0	44.1	40.8	8.9	
Progression Factor		1.00		1.00		1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.1		319.3		386.6		62.8	2.7	22.3	1.0	
Delay (s)		72.1		381.4		416.1		116.8	46.8	63.1	10.0	
Level of Service		E		F		F		F	D	E	A	
Approach Delay (s)		72.1			408.6			104.8			36.6	
Approach LOS		E			F			F			D	

Intersection Summary			
HCM Average Control Delay	227.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.59		
Actuated Cycle Length (s)	147.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	150.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL
Lane Group Flow (vph)	128	1659	31	72	1094	736	31	195	750	536
v/c Ratio	0.90	1.00	0.04	0.89	0.72	0.87	0.35	0.92	1.02	0.93
Control Delay	112.0	55.8	11.1	118.7	19.9	14.3	70.6	97.2	87.4	64.9
Queue Delay	0.0	28.2	0.0	0.0	50.6	45.4	0.0	0.0	173.9	0.0
Total Delay	112.0	83.9	11.1	118.7	70.5	59.7	70.6	97.2	261.3	64.9
Queue Length 50th (ft)	109	718	7	60	195	115	26	161	~343	~473
Queue Length 95th (ft)	#232	#903	25	m66	m262	m153	60	#308	#468	#697
Internal Link Dist (ft)		436			126		426			253
Turn Bay Length (ft)	319		192	122		90				
Base Capacity (vph)	142	1661	751	81	1526	846	89	213	738	579
Starvation Cap Reductn	0	0	0	0	534	172	0	0	0	0
Spillback Cap Reductn	0	124	0	0	0	0	0	0	213	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.90	1.08	0.04	0.89	1.10	1.09	0.35	0.92	1.43	0.93

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	NBR2	SWL2	SWL	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1712	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1736	3471	1553	1719	3438	1538	1736	1553		3400	1712	
Volume (vph)	125	1626	30	71	1072	721	30	165	26	735	395	130
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	128	1659	31	72	1094	736	31	168	27	750	403	133
RTOR Reduction (vph)	0	0	9	0	0	168	0	4	0	0	9	0
Lane Group Flow (vph)	128	1659	22	72	1094	568	31	191	0	750	527	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	4%	4%	4%	3%	3%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	8.9	58.1	58.1	5.4	54.7	54.7	3.0	15.6		28.9	41.7	
Effective Green, g (s)	10.6	59.9	59.9	6.1	55.4	55.4	4.7	17.5		30.5	43.3	
Actuated g/C Ratio	0.08	0.46	0.46	0.05	0.43	0.43	0.04	0.13		0.23	0.33	
Clearance Time (s)	5.7	5.8	5.8	4.7	4.7	4.7	5.7	5.9		5.6	5.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	142	1599	716	81	1465	655	63	209		798	570	
v/s Ratio Prot	0.07	c0.48		0.04	0.32		0.02	c0.12		0.22	c0.31	
v/s Ratio Perm			0.01			c0.37						
v/c Ratio	0.90	1.04	0.03	0.89	0.75	0.87	0.49	0.91		0.94	0.93	
Uniform Delay, d1	59.2	35.0	19.2	61.6	31.4	33.9	61.5	55.5		48.8	41.8	
Progression Factor	1.00	1.00	1.00	1.35	0.63	0.42	1.00	1.00		1.00	1.00	
Incremental Delay, d2	52.9	32.9	0.1	34.1	1.4	6.4	5.9	38.7		18.6	21.0	
Delay (s)	112.1	67.9	19.3	117.2	21.1	20.8	67.4	94.2		67.4	62.8	
Level of Service	F	E	B	F	C	C	E	F		E	E	
Approach Delay (s)		70.2			24.6		90.5				65.5	
Approach LOS		E			C		F				E	

Intersection Summary

HCM Average Control Delay	53.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	1538	809	1292	1901	1270	21
v/c Ratio	1.30	0.66	1.49	0.92	1.31	0.05
Control Delay	165.6	9.7	254.4	13.4	181.1	16.2
Queue Delay	218.2	52.0	0.0	88.7	6.0	0.0
Total Delay	383.7	61.7	254.4	102.1	187.2	16.2
Queue Length 50th (ft)	~868	107	~721	316	~706	3
Queue Length 95th (ft)	m#865	m106	m#448	m212	#842	23
Internal Link Dist (ft)	126			410		462
Turn Bay Length (ft)			152			
Base Capacity (vph)	1179	1233	870	2070	973	459
Starvation Cap Reductn	320	499	0	484	0	0
Spillback Cap Reductn	0	0	0	302	10	151
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.79	1.10	1.49	1.20	1.32	0.07

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	0.88	0.97	0.95					0.97	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.85	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3406	2682	3303	3406					2943	1357	
Flt Permitted		1.00	1.00	0.08	1.00					0.95	1.00	
Satd. Flow (perm)		3406	2682	284	3406					2943	1357	
Volume (vph)	0	1492	785	1253	1844	0	0	0	0	1232	0	20
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1538	809	1292	1901	0	0	0	0	1270	0	21
RTOR Reduction (vph)	0	0	305	0	0	0	0	0	0	0	10	0
Lane Group Flow (vph)	0	1538	504	1292	1901	0	0	0	0	1270	11	0
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	0%	0%	0%	19%	19%	19%
Turn Type			Perm	pm+pt						Perm		
Protected Phases		2		1	6						8	
Permitted Phases			2	6						8		
Actuated Green, G (s)		44.0	44.0	78.0	78.0					42.0	42.0	
Effective Green, g (s)		45.0	45.0	79.0	79.0					43.0	43.0	
Actuated g/C Ratio		0.35	0.35	0.61	0.61					0.33	0.33	
Clearance Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
Vehicle Extension (s)		4.0	4.0	3.0	4.0					3.0	3.0	
Lane Grp Cap (vph)		1179	928	869	2070					973	449	
v/s Ratio Prot		0.45		c0.34	0.56						0.01	
v/s Ratio Perm			0.19	c0.56						c0.43		
v/c Ratio		1.30	0.54	1.49	0.92					1.31	0.02	
Uniform Delay, d1		42.5	34.2	52.2	22.6					43.5	29.3	
Progression Factor		0.69	0.66	1.27	0.53					1.00	1.00	
Incremental Delay, d2		137.6	0.2	219.6	0.9					144.9	0.0	
Delay (s)		166.9	22.6	285.9	12.8					188.4	29.4	
Level of Service		F	C	F	B					F	C	
Approach Delay (s)		117.2			123.3			0.0			185.8	
Approach LOS		F			F			A			F	

Intersection Summary

HCM Average Control Delay	133.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.41		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	165.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NEL2	NEL	NER
Lane Group Flow (vph)	448	2329	2652	1834	588	294	290
v/c Ratio	1.41	0.94	1.39	0.96	1.02	1.05	1.09
Control Delay	218.1	14.7	204.0	27.3	94.3	115.5	127.8
Queue Delay	0.0	45.5	18.4	0.0	0.0	0.0	0.0
Total Delay	218.1	60.1	222.5	27.3	94.3	115.5	127.8
Queue Length 50th (ft)	~457	352	~1562	519	~270	~258	~277
Queue Length 95th (ft)	m#271	m259	#1687	#822	#387	#443	#470
Internal Link Dist (ft)		410	1			232	
Turn Bay Length (ft)	170						
Base Capacity (vph)	318	2474	1913	1906	577	280	266
Starvation Cap Reductn	0	361	0	0	0	0	0
Spillback Cap Reductn	0	0	55	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.41	1.10	1.43	0.96	1.02	1.05	1.09

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR	NEL2	NEL	NER
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0	4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	0.88			0.97	1.00	0.95
Frt	1.00	1.00			1.00	0.85			1.00	0.85	0.85
Flt Protected	0.95	1.00			1.00	1.00			0.95	1.00	1.00
Satd. Flow (prot)	1641	3282			3406	2682			3127	1445	1370
Flt Permitted	0.05	1.00			1.00	1.00			0.95	1.00	1.00
Satd. Flow (perm)	90	3282			3406	2682			3127	1445	1370
Volume (vph)	435	2259	0	0	2572	1779	0	0	570	5	562
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	448	2329	0	0	2652	1834	0	0	588	5	579
RTOR Reduction (vph)	0	0	0	0	0	400	0	0	0	13	13
Lane Group Flow (vph)	448	2329	0	0	2652	1434	0	0	588	281	277
Heavy Vehicles (%)	10%	10%	10%	6%	6%	6%	0%	0%	12%	12%	12%
Turn Type	pm+pt					Perm			Split		Perm
Protected Phases	5	2			6				4	4	
Permitted Phases	2					6					4
Actuated Green, G (s)	97.0	97.0			72.0	72.0			23.0	23.0	23.0
Effective Green, g (s)	98.0	98.0			73.0	73.0			24.0	24.0	24.0
Actuated g/C Ratio	0.75	0.75			0.56	0.56			0.18	0.18	0.18
Clearance Time (s)	5.0	5.0			5.0	5.0			5.0	5.0	5.0
Vehicle Extension (s)	2.5	4.0			5.0	5.0			3.5	3.5	3.5
Lane Grp Cap (vph)	318	2474			1913	1506			577	267	253
v/s Ratio Prot	c0.23	0.71			0.78				0.19	0.19	
v/s Ratio Perm	c0.84					0.53					c0.20
v/c Ratio	1.41	0.94			1.39	0.95			1.02	1.05	1.09
Uniform Delay, d1	51.1	13.6			28.5	26.8			53.0	53.0	53.0
Progression Factor	0.86	0.95			1.00	1.00			1.00	1.00	1.00
Incremental Delay, d2	185.7	1.0			177.2	14.3			42.4	69.5	84.2
Delay (s)	229.6	13.9			205.7	41.1			95.4	122.5	137.2
Level of Service	F	B			F	D			F	F	F
Approach Delay (s)		48.7			138.4		0.0			112.5	
Approach LOS		D			F		A			F	

Intersection Summary

HCM Average Control Delay	105.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	165.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	4320	15	21	2810	11	29
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	4645	16	23	3022	12	31
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				66		
pX, platoon unblocked					0.25	
vC, conflicting volume			4661		6209	2331
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			4661		18716	2331
tC, single (s)			4.3		7.3	7.4
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.5
p0 queue free %			0		0	0
cM capacity (veh/h)			19		0	22

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	3097	1565	23	1511	1511	12	31
Volume Left	0	0	23	0	0	12	0
Volume Right	0	16	0	0	0	0	31
cSH	1700	1700	19	1700	1700	0	22
Volume to Capacity	1.82	0.92	1.20	0.89	0.89	Err	1.43
Queue Length 95th (ft)	0	0	79	0	0	Err	101
Control Delay (s)	0.0	0.0	568.4	0.0	0.0	Err	606.4
Lane LOS			F			F	F
Approach Delay (s)	0.0		4.2			Err	
Approach LOS						F	

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	129.9%	ICU Level of Service	H
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	10	900	3286	1483	305	1401	1398
v/c Ratio	0.11	1.65	1.78	1.09	0.54	0.97	0.57
Control Delay	71.6	336.1	375.9	101.5	19.2	55.9	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.6	336.1	375.9	101.5	19.2	55.9	9.1
Queue Length 50th (ft)	9	~598	~2477	~538	75	609	223
Queue Length 95th (ft)	31	#802	#2846	#717	186	#881	376
Internal Link Dist (ft)	36			266			3373
Turn Bay Length (ft)							
Base Capacity (vph)	87	546	1844	1359	569	1444	2473
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	1.65	1.78	1.09	0.54	0.97	0.57

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00		0.97		0.88		0.91	1.00	0.97	0.95	
Frt		1.00		1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected		0.98		0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1854		3400		2760		4988	1553	3183	3280	
Flt Permitted		0.98		0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1854		3400		2760		4988	1553	3183	3280	
Volume (vph)	5	5	0	855	0	3122	0	1409	290	1331	1323	5
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	5	0	900	0	3286	0	1483	305	1401	1393	5
RTOR Reduction (vph)	0	0	0	0	0	80	0	0	147	0	0	0
Lane Group Flow (vph)	0	10	0	900	0	3206	0	1483	158	1401	1398	0
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	10%	10%	10%
Turn Type	Perm			Prot		custom	Prot		Perm	Prot		
Protected Phases		3		4		1	5	2		1	6	
Permitted Phases	3					4			2			
Actuated Green, G (s)		1.9		22.0		85.1		37.1	37.1	63.1	106.2	
Effective Green, g (s)		3.9		23.0		88.1		39.1	39.1	65.1	108.2	
Actuated g/C Ratio		0.03		0.16		0.60		0.27	0.27	0.44	0.74	
Clearance Time (s)		6.0		5.0		6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0		3.0		3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		49		532		1728		1326	413	1409	2413	
v/s Ratio Prot				0.26		c0.82		c0.30		0.44	0.43	
v/s Ratio Perm		0.01				0.34			0.10			
v/c Ratio		0.20		1.69		1.86		1.12	0.38	0.99	0.58	
Uniform Delay, d1		70.1		62.0		29.5		54.0	44.1	40.8	9.0	
Progression Factor		1.00		1.00		1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.1		319.3		387.1		64.0	2.7	22.5	1.0	
Delay (s)		72.1		381.4		416.6		118.0	46.8	63.3	10.0	
Level of Service		E		F		F		F	D	E	A	
Approach Delay (s)		72.1			409.0			105.8			36.7	
Approach LOS		E			F			F			D	

Intersection Summary			
HCM Average Control Delay	228.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.59		
Actuated Cycle Length (s)	147.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	150.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

October 4, 2006

Technical Memorandum

From: Karl Hufnagel, P.E.

To: Steve Bingham, ESA Adolfson

Subject: Bow Lake Transfer/Recycling Station Facility Master Plan Update and Implementation – Summary of Preliminary Inbound Customer Queuing Evaluation

Background

The purpose of this memorandum is to summarize the preliminary customer traffic queuing assessment that is discussed in Section 4.3 of the July 2006 Draft Facility Master Plan Update to demonstrate that there should be no back up of customer traffic onto the Orillia Road intersection. This discussion is focused on self-haul customer traffic as these are the vehicles that arrive in large numbers on weekends and historically have produced the longest traffic queues at the County's eight transfer stations including the Bow Lake station. The information presented in this memorandum is taken primarily from Section 4 of the updated Facility Master Plan. In addition, the County provided the following peak hour self-haul traffic forecasts for the period through 2020 and then through 2030:

Year 2020 peak weekday hour self-haul traffic: 136
Year 2030 peak weekday hour self-haul traffic: 158
Year 2020 peak weekend hour self-haul traffic: 163
Year 2030 peak weekend hour self-haul traffic: 190

On weekdays self-haul customers will use the south scale facility which at full build out will include four scales three of which can be operated as inbound scales. On weekends, when self-haul customer traffic is at its peak, self-haul customers will be allowed to use the north scale facility in addition to the south scale facility. For this discussion, we have assumed that fourth scale at the south scale facility will be added in the year 2021 (10 years after the initial reconstruction of the station) when customer traffic may increase to the point of needing the fourth scale.

The south scale facility has approximately 440 feet of inbound pre-scale queuing length. The north scale facility has approximately 1,250 feet of inbound pre-scale queuing length. There is an additional queuing length of approximately 240 feet between the site entrance gate and the point at which incoming trailer traffic and customer traffic diverge.

Weekday Assessment:

The peak hour weekday traffic forecast is 136 vehicles up to the year 2021 when it is assumed the fourth scale might become operational at the south scale facility. With two inbound scales processing customers at an average rate of 40 seconds per vehicle, the scale facility will be able to process around 180 vehicles per hour, which means that there should be no queue in the peak traffic hour. The capacity of the two scales provides over a 30% margin for error in the traffic forecast and in the transaction time estimate.

When the fourth scale is added, three inbound scale will be able to process 270 vehicles per hour. The peak hour weekday traffic forecast in 2030 is 158 vehicles, which means that there should be no queue in the peak traffic hour. The capacity of the three scales provides about a 70% margin for error in the traffic forecast and in the transaction time estimate.

Weekend Assessment:

The peak hour weekend traffic forecast is 163 vehicles up to the year 2021 when it is assumed the fourth scale may become operational at the south scale facility. With three inbound scales (two at the south scale facility and one at the north) processing customers at an average rate of 40 seconds per vehicle, the scale facilities will be able to process around 270 vehicles per hour, which means that there should be no queue in the peak traffic hour. The capacity of the three scales provides over a 65% margin for error in the traffic forecast and in the transaction time estimate.

When the fourth scale is added, four inbound scale will be able to process 360 vehicles per hour. The peak hour weekday traffic forecast in 2030 is 190 vehicles, which means that there should be no queue in the peak hour even if all traffic is routed to the south scale facility. The capacity of the three scales at the south scale facility provide over a 40% margin for error in the traffic forecast and in the transaction time estimate.

Therefore, in all cases there should be no backup of queued incoming traffic into the intersection at Orillia Road. However, it should be noted that traffic will not arrive at the transfer station at a uniform rate. Clumps of vehicles can arrive over a fraction of an hour. In these instances, which will happen on a daily basis and not just in the peak hour, there will be short periods where traffic queues begin to form and then dissipate at the scale facilities. Therefore it is good practice to have a significant margin of error in the assessment and more importantly to have generous traffic queuing provisions which this station will have.

October 16, 2006

Technical Memorandum

From: Karl Hufnagel, P.E.

To: Steve Bingham, ESA Adolfson
Kurt Gahnberg, The Transpo Group

Subject: Bow Lake Transfer/Recycling Station Facility Master Plan Update and Implementation – Construction Traffic Forecast

Background

The purpose of this memorandum is to provide an estimate of the construction traffic traveling to and from the project site during the approximately three years that construction will be in progress at the site. This estimate is based on the attached preliminary project schedule dated August 28, 2006. As currently envisioned and shown in this schedule, the site construction will take place under two consecutive contracts: a site preparation contract schedule to run from April 1st through October 30, 2008, and a site facilities contract scheduled to run from April 1, 2009 through July 7, 2011.

Site Preparation Contract

This is primarily an earthworks contract with some retaining wall and stormwater system construction. At the completion of this construction the site will be "winterized" to protect it from stormwater erosion during the winter months of 2008/2009.

Soil Removal:

Based on preliminary estimates there is expected to be around 148,000 cubic yards of material excavated and removed from site. At 20 cubic yards per dump truck and pup trailer, this material will require around 7,400 round trip truck trips to/from the site over an estimated five month period. Assuming that the work is carried out only on weekdays, this would be 108 hauling days or an average of 68 truck trips per day.

Imported Materials:

It is estimated that there will be around 20,000 of earthwork material brought in to the site over a period of a month. At 20 cubic yards per dump truck and pup trailer, this material will require about 1,000 round trip truck trips. Assuming the work is carried out on weekdays, this would be around 22 hauling days or an average of 45 truck trips per day. These trips are expected to coincide with the soil removal trips.

Concrete:

It is estimated that there will be around 1,000 cubic yards of concrete brought to the site during the site preparation work, primarily for retaining walls. At 10 cubic yards per truck, this would require 100 truck trips. It is expected that concrete will be delivered and placed at an average rate of around 100 cubic yards per day, which equates to 10 truck trips per day. These trips are expected to coincide with the soil removal and soil import trips.

Workers:

The average workforce during the site preparation work is expected to be around 30 with a peak work force of 50. These workers are expected to park on site and to make an average of 1.5 round trips to the site each day. The peak workforce days are expected to coincide with the soil removal, import material and the concrete delivery trips.

Other:

It is expected that there will be other miscellaneous materials deliveries, vendor visits, labor union visits, contractor home office visits and County and consultant daily visits or between 25 and 30 per day though out the life of the construction.

Total:

The average daily traffic is expected to be around 223 trips through five of the seven months of this contract when soil is being hauled off site, and drop to around 155 trips for the remaining two months.

Site Facilities Contract

This is primarily a building, pavement and utilities contract with some additional earthwork, and site retaining wall construction.

Material Removal:

An estimated 20,000 cubic yards of rubble from the demolition of the existing transfer building and pavements will be removed during Phase 2 of this contract. At an average load of 20 cubic yards, this equates to 1,000 truck trips over a two month period, or around 25 trips per day.

Imported Materials:

The estimated material types, quantities, load size and number trips are provided in the following table:

Material Type	Estimated Quantity	Average Load Size	Number of Trips
Concrete	7,700 CY	10 CY	770
Road Aggregates	7,100 CY	20 CY	355
Structural Fill, Drain Rock	2,000 CY	20 CY	100
Hot Mix Asphalt	3,700 CY	20 CY	185
Roadway Appurtenances	---	---	20
Topsoil & Amendments	1,500 CY	20 CY	75
4" and larger Utility Pipe	15,000 LF	2,000 LF	8
Manholes/CBs	80 EA	6 EA	14
Metal Building	---	---	50
Electrical Equipment	---	---	50
Plumbing Pipe & Fixtures	---	---	20
Compactors	---	---	10
Industrial Wastewater Treatment System	---	---	20
Miscellaneous	---	---	1000
Total			**2677**

These material delivery trips are expected to occur on weekday over the full 27 month construction period (585 weekdays). The average daily trips would therefore be around 5. It is estimated that a peak day for this category could be 30 trips.

Workers:

The average workforce during the site facilities work is expected to be around 50 with a peak work force of 150. These workers are expected to park on site and to make an average of 1.5 round trips to the site each day.

Other:

It is expected that there will be other miscellaneous materials deliveries, vendor visits, labor union visits, contractor home office visits and County and consultant daily visits or between 30 and 40 per day though out the life of the construction.

Total:

Disregarding the two months when soil is being removed from site, the average daily traffic is expected to be around 110 trips. The peak daily traffic is expected to be around 295 trips.

MEETING MINUTES
Bow Lake Transfer Station
Facility Master Plan Update and Implementation
Phase 1 – FMP Update
WSDOT Property Acquisition Meeting
March 31, 2006
WSDOT Urban Corridors Office

Attendees:

Susan Everett, Engineering Manager WSDOT
Paul Johnson, Project Engineer, WSDOT
Andrew Lau, Property Manager, WSDOT
Neil Fujii, Managing Engineer, King Co.
Dwin Ugwoaba, Project Manager King Co.
Tim Hedges, Senior Transportation Engineer, The Transpo Group
Harold McNelly, Facilities Management, King Co.
Lillian Holley, Facilities Management, King Co.
Karl Hufnagel, Project Manager, R. W. Beck

1. The purpose of the meeting was to review preliminary layout prepared for WSDOT for future possible north bound I-5 on ramp improvements at the South 188th Street, and to identify whether there would be any conflicts stemming from the County's proposed Bow Lake Transfer Station redevelopment project that would impact WSDOT's future improvement plans.

2. Neil and Karl first reviewed the latest project site plan layout and site cross sections (attached). WSDOT staff noted that the north access road no longer suggests a future northward extension, which is consistent with WSDOT's preferences as expressed at a previous meeting. Karl made the point that the site plan does not accurately reflect where retaining walls may be needed along the west side of the proposed north access road, whereas the cross sections (B and C) do indicate that the intention is to have retaining walls along a major part of this road so as not to infringe on WSDOT property. Average daily and peak daily and hourly customer traffic numbers at the transfer station in 2030 were briefly reviewed.

3. Susan said that King County should keep in mind that retaining walls adjoining I-5 will need to be designed to accommodate appropriate loading from future vehicular traffic.

4. Susan indicated that WSDOT would be amenable to granting a construction easement so that earth embankment on the WSDOT side of the retaining walls discussed in 2 could be removed down to freeway elevation, thereby reducing the overall height of the wall required.

5. Tim Hedges reviewed the preliminary layout drawing of the on ramp improvements. During the ensuing discussion, WSDOT staff indicated flexibility in the alignment of the ramp lanes such that the apparent conflict or near conflict in the vicinity of the existing cell phone towers might be avoided. It was suggested that the stop bar and control point be moved further north to achieve 1000 feet of queuing length if possible. Paul and Susan discussed the possibility of moving the off and on ramp intersection point further west to enlarge the left turn pocket for customers entering the transfer station.

6. Based on the preliminary layout, WSDOT staff indicated that there appeared to be adequate room for WSDOT's planned future improvements, including an additional travel lane on the main line, and the County's project. WSDOT staff indicated that their favorable recommendation on the sale of the property to WSDOT headquarters would be conditioned on maintaining limited access on the proposed north access road.

7. Susan discussed the possibility of impact fees or payment of mitigation costs based on the results of the traffic study that will accompany the SEPA environmental review process.

8. It was agreed that the next step was for the County to submit an updated drawing (pdf) showing the latest proposed site arrangement coupled with the on ramp improvements revised as discussed above.

Attachments

Distribution: Attendees, Greg Harry, KPG, Ian Sutton, R. W. Beck, Steve Bingham, Adolfson

File: 11-00839-10000/2003

The Transpo Group

MEMORANDUM

Date: February 7, 2006 **TG:** 02150.00

To:

From:

cc:

Subject: Impacts of I 5/SR 509 Project on the Bow Lake Transfer Station

This memorandum discusses the I-5/SR 509 Freight and Congestion Relief project in southwest King County and the impacts that may be incurred near the Bow Lake Transfer Station.

Project Description/Need

The I-5/SR 509 Freight and Congestion Relief project will extend SR 509 from its existing termination point at South 188th Street /12th Place South to a connection with Interstate 5 at South 200th Street. In addition to this connection I-5 south will be widened from Military Road to South 320th Street. This connection will serve current and future transportation needs by enhancing the southern access to Sea-Tac Airport.

Existing/Future Conditions

Currently SR 509 terminates at South 188th Street / 12th Place South and does not connect to the regional transportation highway system, causing congestion along 188th Street, SR 99, and I-5 during peak hours. Increases in future traffic volumes caused by economic growth and increased airport activity will result in continued congestion along 188th Street, SR 99, and I-5.

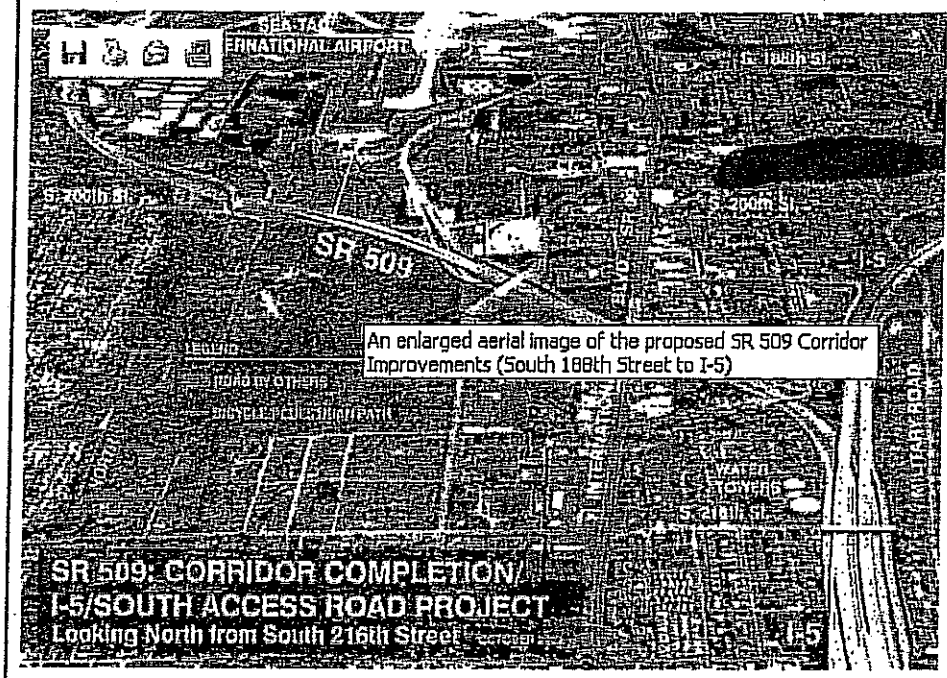
Future Circulation With-Project

The implementation of the SR 509 extension to I-5 will provide a direct connection to Sea-Tac Airport and shift traffic from existing travel routes enabling better circulation on SR 99, I-5, and 188th Street corridor. The addition of travel lanes along I-5 will also reduce congestion in the area. Motorists currently traveling on I-5 to access SR 509 via South 188th Street will be removed from this interchange and shifted to the new connection provided at South 200th Street

Impacts to Bow Lake Transfer Station

The SR 509 project should have little to no impacts on the area near the Bow Lake Transfer Station. Physically no changes to the interchange will affect right-of-way or access to Bow Lake Transfer Station. Additional lanes added to Interstate 5 will occur south of the site. Traffic volumes adjacent to the transfer station currently travel to/from the east via Orillia Road. Future circulation with the implementation of the SR 509 extension will not re-route the majority of these travelers. 2020 PM

peak hour level of service on Orillia Road is not expected to change with or without the project.



An enlarged aerial image of the proposed SR 509 Corridor Improvements (South 188th Street to I-5)

An enlarged aerial image of the proposed SR 509 Corridor Improvements (South 188th

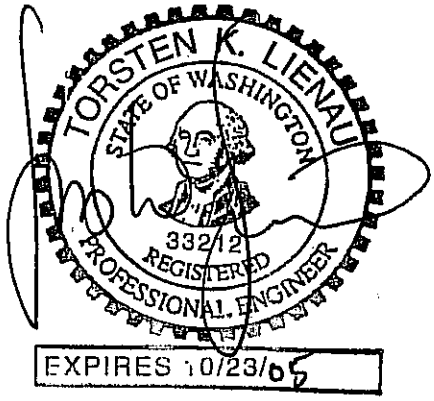
Internet

Local Street Traffic Impact Evaluation for King County Transfer Stations

Prepared for
King County Solid Waste Division

Prepared by
HDR Engineering, Inc.
500 108th Avenue NE, Suite 1200
Bellevue, WA 98004

March 18, 2005



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INTRODUCTION

King County is currently assessing existing conditions at five transfer stations in an effort to determine what improvements could be implemented at some or all of the facilities. The County is evaluating 19 measures of effectiveness, including but not limited to, travel time to the facility, time spent on site, recycling services meet goals, daily handling capacity, safety, meets local noise ordinances, and meets criteria for acceptable traffic impacts on local streets.

This technical report documents the analysis for addressing one of the 19 measures of effectiveness, specifically, Criteria 15 as follows:

15. *Meets Criteria for Acceptable Traffic Impacts on Local Streets*
    a) *Local intersections remain below capacity if additional traffic is added, as defined by the* Highway Capacity Manual
    b) *On average, traffic queues entering the transfer station do not spillover onto or impede local streets during 95 percent of the operating hours*

The five King County transfer stations that were evaluated are:

- Algona Station, located in the City of Algona and having immediate traffic impacts to Algona, Auburn and King County local streets,
- Bow Lake Station, located in the City of Tukwila and having immediate traffic impacts to Seatac, Kent, and King County local streets,
- Factoria Station, located in the City of Bellevue and having immediate traffic impacts to Bellevue local streets,
- Houghton Station, located in the City of Kirkland and having immediate traffic impacts to Kirkland, and
- Renton Station, located in the City of Renton and having immediate traffic impacts to Renton.

The methodology, data collection, and results for Criteria 15 are provided in detail in the following report.

METHODOLOGY

Intersection Analysis

For Criterion 15a, the traffic analysis software program Synchro/SimTraffic was used to analyze local intersections. Most agencies require the analysis of the weekday p.m. peak hour, because it is typically the time period that the local street system is experiencing the most traffic. Although traffic associated with King County transfer stations may not be the highest during the weekday p.m. peak hour, the total volume on the local street system will likely be higher during the weekday p.m. peak hour, than during an hour that demand is highest for a transfer station (typically on a weekend). For this reason the weekday p.m. peak hour was analyzed at each of the study intersections.

A traffic operational analysis (level of service (LOS) and volume-to-capacity calculation) was performed at the intersections selected by each host Agency deemed to be most impacted by transfer station traffic. LOS refers to the degree of congestion at an intersection, measured in average control delay, and based on the methodologies provided in the Highway Capacity Manual. LOS A represents free-flow conditions (motorists experience little or no delay and traffic levels are well below roadway capacity), LOS F represents forced-flow conditions (motorists experience very long delays, in excess of 80 seconds at signalized intersections

and more than 50 seconds at unsignalized intersections, and traffic levels exceed roadway capacity), and LOS B to E represent decreasing desirable conditions. A more detailed discussion of the LOS concept is presented in the technical report.

The volume-to-capacity ratio (v/c) is the peak hour traffic volume (vehicles/hour) at an intersection divided by the maximum traffic volume that the intersection can maintain. For example, when v/c equals 0.85, it can be said that peak hour traffic uses 85 percent of the intersection's capacity; or 15 percent of the capacity is not used. When v/c approaches 1.0 (e.g., 0.95), traffic flow becomes unstable such that small disruptions can cause traffic flow to break down and long traffic queues to form.

If an intersection operates at LOS F or exceeds a v/c of 1.0, Criteria 15a is not achieved.

As mentioned previously, each host Agency selected the intersections that they deemed to be most impacted by transfer station traffic, with the exception of the City of Renton. The intersections analyzed in the City of Renton were selected by the project team in the absence of recommendations directly from the City. Intersection p.m. peak hour turning movement counts and intersection channelization were either obtained directly from the host agency, or collected in the field. The selected intersections are as follows for each transfer station:

Algona
- West Valley Highway/Driveway
- West Valley Highway/15th Street SW
- West Valley Highway/1st Avenue N

Bow Lake
- Orillia Road/Driveway
- S. 188th Street/I-5 NB Ramp
- S. 188th Street/Military Rd.

Factoria
- Richards Road/SE 32nd
- Richards Road/Eastgate Way

Houghton
- 116th Avenue NE/NE 60th Street
- 116th Avenue NE/NE 70th Street
- 116th Avenue NE/I-405 NB ramps
- NE 60th Street/Driveway

Renton
- NE 3rd St/Edmonds Avenue NE
- NE 4th St/Jefferson Avenue NE
- NE 4th St/Union Avenue NE

Queue Analysis

For Criterion 15b, basic queuing theory as described in *Traffic Flow Fundamentals* (Adolf D. May, 1990) was applied to estimate the average queue formed at each transfer station weigh station upon entering. The equation used to estimate the average queue is as follows:

$$E(n) = (2\rho - \rho^2) \div (2(1-\rho))$$

$E(n)$ = average number in system (vehicle)
ρ = traffic intensity

$$\rho = \frac{\lambda}{\mu}$$

λ = mean arrival rate (vehicles per hour)
μ = mean service rate per lane (vehicles per hour)

In addition, the following assumptions were made in order to apply the above queuing equation to the available data:

- Vehicle arrival rate is assumed to be random, that is, vehicles do not arrive at transfer stations at equal increments of time, rather they arrive at "random" times.
- Vehicle service rate is assumed to be constant
- Traffic intensity (volume-to-capacity ratio) must be less than 1.0
- There is only one inbound scale at each transfer station

If the average vehicle queue exceeds the available storage capacity, then the queue is spilling over onto the local street system or impeding local street operations. The available storage capacity was defined as the distance from the inbound transfer station scale to the first driveway or intersection on a local street or a point on the local street at which the queue from the transfer station would impede non-transfer station traffic.

If the average queue exceeds the available storage capacity more than 95 percent of the operating hours, Criteria 15b is not met.

For Criteria 15b, transaction data entering each transfer station was obtained from King County, for every operating hour and every operating day in 2004. That data indicates the hourly demand for each transfer station by vehicle type. Based on two studies performed by King County in the mid 1990's at the Algona, Renton, Bow Lake, and 1st Avenue NE transfer stations, it was determined that the average time spent on the inbound scale is between 22 and 28 seconds. With these two pieces of data (hourly demand and average transaction time) the average vehicle queue waiting to be served entering a transfer station was calculated based on the equations listed above.

At one station, the Bow Lake Transfer Station, each hour was not analyzed. Out of the 22 hours of the day that Bow Lake is open, only the core hours of 8 am to 6 pm for weekdays and 8:30 am to 5:30 pm for weekends were analyzed, so that the data did not skew the results for hours where little traffic is experienced.

Forecasts

Both Criteria 15a and 15b were also analyzed based on 2030 projections, provided by King County. The Solid Waste Division developed the projections using its forecast model. This model predicts waste disposal based on such factors as growth in population, employment, income, and assumptions about additional recycling activity.

RESULTS

Intersection Analysis

The results for Criteria 15a, the intersection operational analysis, are summarized in **Tables 1** and **2** for existing conditions (2005) and 2025, respectively. In 2005, the Algona, Factoria, and Renton transfer stations all meet current intersection LOS standards (Criteria 15a). Both the Bow Lake and Houghton transfer stations have one intersection that does not meet the current intersection LOS standard, meaning, the intersection is LOS F and/or the v/c ratio is greater than or equal to 1.0. At Bow Lake, it is estimated that if there were no vehicles related to the transfer station at the intersection, the intersection would operate below capacity. Conversely, at the Houghton station, the intersection exceeds capacity even without traffic associated with the transfer station.

By 2025, all of the transfer stations have at least one over-capacity intersection impacted by the transfer station, with or without additional growth at the transfer station (see **Table 2** and **Figure 2**)

Figures 1 and **2** illustrate the same information presented in **Tables 1** and **2**, graphically.

Table 1

Criteria 15a - Existing Conditions (2005) Analysis Summary

			Existing w/o Transfer Station				Existing w/ Transfer Station			
Facility	Intersection		Delay (sec/veh)	LOS	V/C	Meets Criteria?	Delay (sec/veh)	LOS	V/C	Meets Criteria?
Algona	WVH/Driveway	STOP	n/a	n/a	0.82	YES	38.4	E	0.83	YES
	WVH/15th St		22.0	C	0.88	YES	22.7	C	0.89	YES
	WVH/1st Ave	STOP	41.8	E	0.39	YES	43.0	E	0.40	YES
Bow Lake	Orillia Rd/Driveway	STOP	n/a	n/a	0.75	YES	>110	F	1.09	NO
	188th St/I-5 NB Rmp		29.0	C	0.94	YES	29.9	C	0.95	YES
	188th St/Military Rd		27.5	C	0.68	YES	27.6	C	0.68	YES
Factoria	Richards Rd/32nd St		13.2	B	0.48	YES	15.1	B	0.50	YES
	Richards Rd/Eastgate		31.5	C	0.81	YES	31.2	C	0.81	YES
Houghton	116th Ave/60th St	STOP	18.8	C	0.80	YES	19.3	C	0.81	YES
	116th Ave/70th St		55.1	E	1.00	NO	55.3	E	1.00	NO
	116th Ave/I-405 NB Rmp		33.7	C	0.93	YES	34.3	C	0.93	YES
	60th St/Driveway	STOP	n/a	n/a	0.08	YES	9.4	A	0.08	YES
Renton	3rd St/Edmonds Ave		13.9	B	0.67	YES	13.9	B	0.67	YES
	4th St/Jefferson Ave		15.6	B	0.75	YES	15.6	B	0.75	YES
	4th St/Union Ave		17.0	B	0.72	YES	17.0	B	0.72	YES

Notes:

1. = signalized intersection, = stop-controlled intersection
2. Delay, or control delay, is measured in seconds per vehicle, and is a measure of all the delay contributable to traffic control measures, such as signals or stop signs. At signalized intersections and all-way stop-controlled intersections, the reported delay is the average of all the control delay experienced for all movements. At one-way and two-way stop-controlled intersections, the reported delay is for only one movement, the movement experiencing the worst control delay, which is typically one of the stop-controlled side street approaches. The control delay reported at two-way stop-controlled intersections is not a valid indication of the operations of the entire intersection.
3. LOS refers to Level of Service and is based on the methodologies outlined in the 2000 *Highway Capacity Manual*. LOS is rated from "A" (low delay) to "F" (delay in excess of 80 seconds per vehicle at signalized intersections, and 50 seconds at unsignalized intersections).
4. V/C = volume-to-capacity ratio
5. n/a = not available because this intersection is stop-controlled and the movement experiencing the worst control delay would be the movement exiting the transfer station, and because this scenario assumes no traffic associated with the transfer station, there is no control delay to report.

Table 2
Criteria 15a - Future Conditions (2025) Analysis Summary

Facility	Intersection	2025 w/o Growth at Transfer Station				2025 w/ Growth at Transfer Station			
		Delay (sec/veh)	LOS	V/C	Meets Criteria?	Delay (sec/veh)	LOS	V/C	Meets Criteria?
Algona	WVH/Driveway	>110	F	1.26	NO	>110	F	1.26	NO
	WVH/15th St	94.3	F	1.28	NO	94.5	F	1.29	NO
	WVH/1st Ave	>110	F	n/c	NO	>110	F	n/c	NO
Bow Lake	Orillia Rd/Driveway	>110	F	n/c	NO	>110	F	n/c	NO
	188th St/I-5 NB Rmp	>110	F	1.52	NO	>110	F	1.54	NO
	188th St/Military Rd	51.0	D	0.99	YES	51.5	D	0.99	YES
Factoria	Richards Rd/32nd St	24.2	C	0.76	YES	26.6	C	0.79	YES
	Richards Rd/Eastgate	>110	F	1.23	NO	>110	F	1.23	NO
Houghton	116th Ave/60th St	>110	F	1.37	NO	>110	F	1.44	NO
	116th Ave/70th St	>110	F	1.51	NO	>110	F	1.51	NO
	116th Ave/I-405 NB Rmp	>110	F	1.32	NO	>110	F	1.33	NO
	60th St/Driveway	10.2	B	0.12	YES	10.7	B	0.12	YES
Renton	3rd St/Edmonds Ave	21.8	C	0.95	YES	21.8	C	0.95	YES
	4th St/Jefferson Ave	17.8	B	0.85	YES	18.4	B	0.86	YES
	4th St/Union Ave	90.6	F	1.13	NO	91.3	F	1.13	NO

Notes:

1. = signalized intersection, = stop-controlled intersection
2. Delay, or control delay, is measured in seconds per vehicle, and is a measure of all the delay contributable to traffic control measures, such as signals or stop signs. At signalized intersections and all-way stop-controlled intersections, the reported delay is the average of all the control delay experienced for all movements. At one-way and two-way stop-controlled intersections, the reported delay is for only one movement, the movement experiencing the worst control delay, which is typically one of the stop-controlled side street approaches. The control delay reported at two-way stop-controlled intersections is not a valid indication of the operations of the entire intersection.
3. LOS refers to Level of Service and is based on the methodologies outlined in the 2000 *Highway Capacity Manual*. LOS is rated from "A" (low delay) to "F" (delay in excess of 80 seconds per vehicle at signalized intersections, and 50 seconds at unsignalized intersections).
4. V/C = volume-to-capacity ratio
5. n/c = the volume-to-capacity ratio exceeds calculable limits.

Figure 1
Criteria 15a - Existing Conditions (2005) Analysis Summary

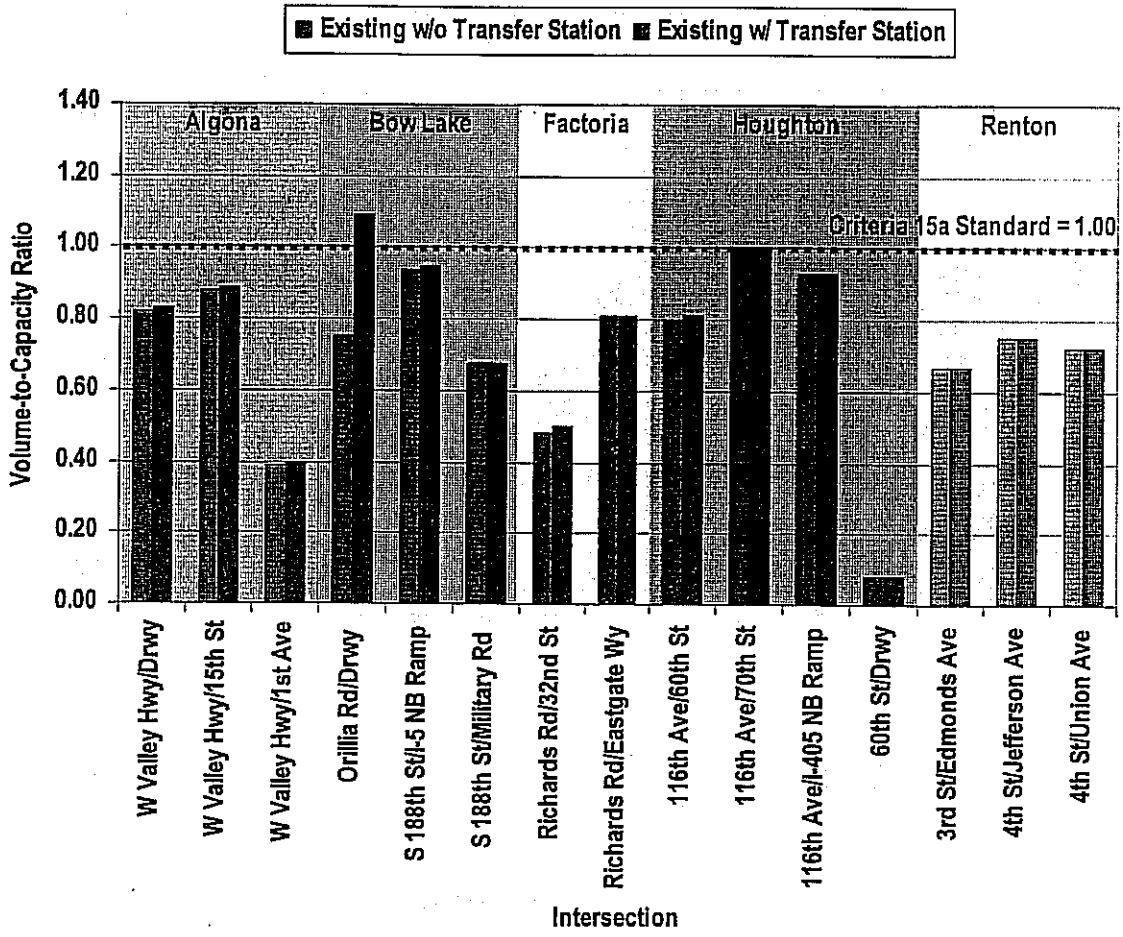
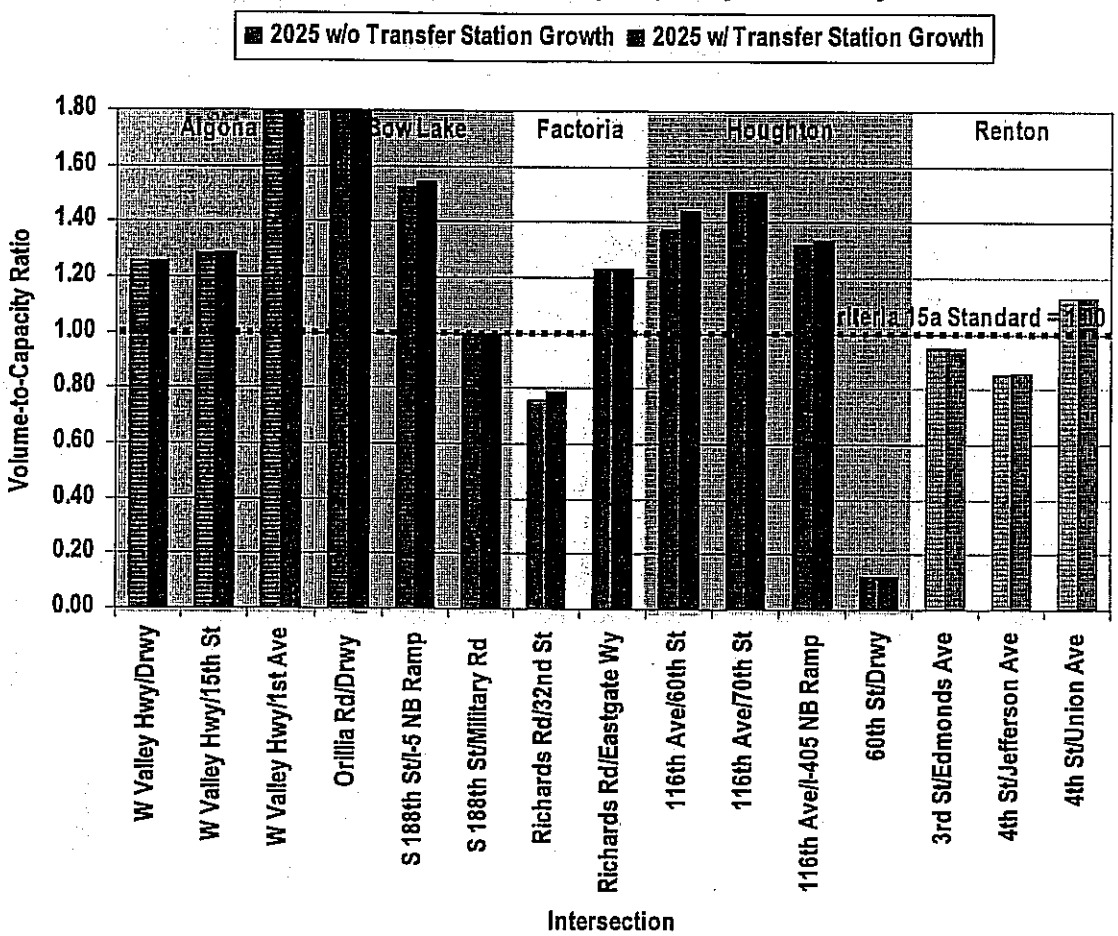


Figure 2
Criteria 15a - Future Conditions (2025) Analysis Summary



Queue Analysis

In order to determine if the average queue at each of the transfer stations exceed available storage, the average vehicle length must be calculated. The average vehicle length was calculated based on the mix of passenger cars versus transfer station trucks at each facility, and assuming 25 feet per passenger car and 75 feet per transfer station truck. The average vehicle length is summarized in **Table 3**.

Table 3
Average Queue Capacity by Site

Facility	Average Vehicle Length (feet)	On-Site Queue Capacity	
		Length (feet)	No. of Vehicles
Algona	27.4	135	4
Bow Lake	32.5	476	14
Factoria	26.8	64	2
Houghton	28.6	346	12
Renton	26.5	70	2

Notes:

1. The average vehicle length was calculated based on the average mix of passenger cars versus transfer station trucks at each facility, and assuming 25 feet per passenger car and 75 feet per transfer station truck.
2. The queue capacity was provided by King County and is the distance from the weigh station to the first off-site intersection or driveway that would be impacted by the queue of vehicles at the transfer station.

The 2004 existing condition results of the Criteria 15b analysis, queuing, are presented in **Table 4**. Based on all data available in 2004 from January to December, only the Renton transfer station meets Criteria 15b, where traffic queues entering the transfer station do not spillover onto or impede local streets during 95 percent of the operating hours. The data was further analyzed to determine if the majority of the off-site queuing took place on the weekend or weekday. In fact, all of the transfer station sites would meet the queue criteria on a weekday, i.e. none of the sites queue off-site more than 95 percent of the operating hours on a weekday. Conversely, all of the transfer stations fail the criteria 15b on weekends.

Table 4
Criteria 15b – Queue Capacity Analysis Summary
All Days in 2004

Facility	Days of Week Analyzed	Total Hours Analyzed	No. of Hours Queue Exceeds Capacity	Percent of Hours Queue Exceeds Capacity	Meets Criteria?
Algona	Weekday	2,995	45	2%	YES
	Weekend	1,002	454	44%	NO
	All Days	4,017	499	12%	NO
Bow Lake	Weekday	2,615	20	1%	YES
	Weekend	1,007	286	28%	NO
	All Days	3,622	306	8%	NO
Factoria	Weekday	4,010	35	1%	YES
	Weekend	1,018	415	41%	NO
	All Days	5,028	450	9%	NO
Houghton	Weekday	2,485	15	1%	YES
	Weekend	1,014	171	17%	NO
	All Days	3,499	186	5%	NO
Renton	Weekday	2,658	1	0%	YES
	Weekend	1,022	81	8%	NO
	All Days	3,680	82	2%	YES

It should be noted that at the Bow Lake transfer station, the analysis for Criteria 5, which evaluated the on-site capacity of each transfer station, indicated that station has adequate capacity (LOS C) in 2005 on site to handle existing traffic flows. Therefore, the fact that Bow Lake does not meet the off-site queue criteria would indicate that the off-site queue is not related to the on-site capacity for this station. Rather, the constraint is the process time at the scale.

King County implemented new operating hours and made some functional changes at all of the transfer stations in the latter half of 2004, specifically July to December. As a result, the queue data was re-analyzed using data from only the latter half of the year to determine if the hours of operation and functional changes would have made a difference with respect to off-site queuing. **Table 5** summarizes the queue analysis results for data represented by July to December 2004. Both Renton and Houghton meet Criteria 15b, when only the latter half of 2004 is analyzed. as well. Similar to the data analysis for the full year, all of the sites meet Criteria 15b on a weekday, while none of them meet the criteria on a weekend. With the exception of the Algona transfer station, all of the transfer stations experienced fewer occurrences of the queue spilling over onto City streets or impeding traffic flow.

Table 5
Criteria 15b – Queue Capacity Analysis Summary
July to December in 2004

Facility	Days of Week Analyzed	Total Hours Analyzed	No. of Hours Queue Exceeds Capacity	Percent of Hours Queue Exceeds Capacity	Meets Criteria?
Algona	Weekday	1,458	40	3%	YES
	Weekend	491	221	45%	NO
	All Days	1,949	261	13%	NO
Bow Lake	Weekday	1,308	18	1%	YES
	Weekend	487	107	22%	NO
	All Days	1,795	125	7%	NO
Factoria	Weekday	1,786	26	1%	YES
	Weekend	490	184	38%	NO
	All Days	2,276	210	9%	NO
Houghton	Weekday	1,199	14	1%	YES
	Weekend	489	69	14%	NO
	All Days	1,688	83	5%	YES
Renton	Weekday	1,326	1	0%	YES
	Weekend	493	29	6%	NO
	All Days	1,819	30	2%	YES

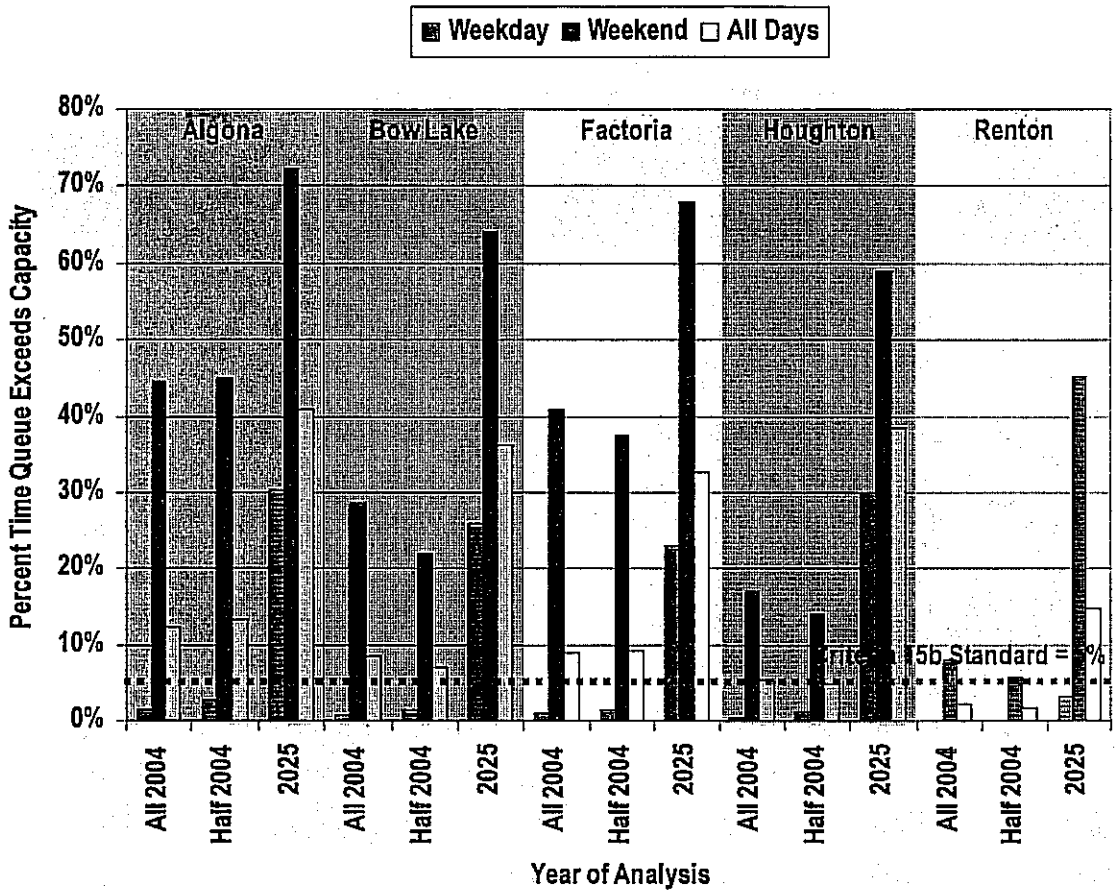
Table 6 summarizes the queue analysis based on 2025 projections of transfer station use. By 2025, none of the facilities will satisfy Criteria 15b, with queues extending off-site between 15 and 41 percent of the time, depending on the location. In fact, even weekdays will experience queue failure at all the transfer stations, with the exception of Renton.

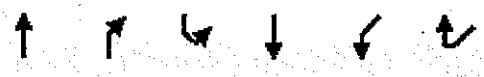
Table 6
Criteria 15b – 2025 Queue Capacity Analysis Summary

Facility	Days of Week Analyzed	Total Hours Analyzed	No. of Hours Queue Exceeds Capacity	Percent of Hours Queue Exceeds Capacity	Meets Criteria?
Algona	Weekday	1,458	442	30%	NO
	Weekend	490	354	72%	NO
	All Days	1,948	796	41%	NO
Bow Lake	Weekday	1,308	339	26%	NO
	Weekend	487	312	64%	NO
	All Days	1,795	651	36%	NO
Factoria	Weekday	1,786	412	23%	NO
	Weekend	490	333	68%	NO
	All Days	2,276	745	33%	NO
Houghton	Weekday	1,199	360	30%	NO
	Weekend	488	288	59%	NO
	All Days	1,687	648	38%	NO
Renton	Weekday	1,326	43	3%	YES
	Weekend	493	223	45%	NO
	All Days	1,819	266	15%	NO

Figure 3 illustrates the data provided **Tables 4, 5,** and **6,** graphically.

Figure 3
Criteria 15b – Queue Capacity Analysis Summary





Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1753	8	19	1444	8	21
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1905	9	21	1570	9	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				244		
pX, platoon unblocked					0.76	
vC, conflicting volume			1914		2736	957
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1914		2964	957
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			93		0	91
cM capacity (veh/h)			306		8	258

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1270	644	21	785	785	9	23
Volume Left	0	0	21	0	0	9	0
Volume Right	0	9	0	0	0	0	23
cSH	1700	1700	306	1700	1700	8	258
Volume to Capacity	0.75	0.38	0.07	0.46	0.46	1.09	0.09
Queue Length 95th (ft)	0	0	5	0	0	46	7
Control Delay (s)	0.0	0.0	17.6	0.0	0.0	944.9	20.3
Lane LOS			C			F	C
Approach Delay (s)	0.0		0.2			275.4	
Approach LOS						F	

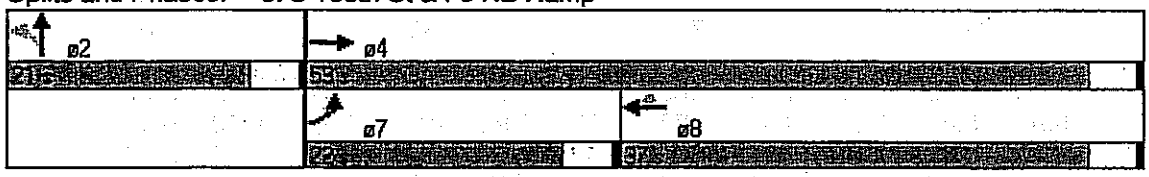
Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt						0.850		0.932				
Flt Protected	0.950						0.950	0.974				
Satd. Flow (prot)	1770	3539	0	0	3539	1583	1681	1606	0	0	0	0
Flt Permitted	0.950						0.950	0.974				
Satd. Flow (perm)	1770	3539	0	0	3539	1583	1681	1606	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						580		47				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		650			244			835			894	
Travel Time (s)		14.8			5.5			19.0			20.3	
Volume (vph)	367	1362	0	0	884	923	397	1	117	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	399	1480	0	0	961	1003	432	1	127	0	0	0
Lane Group Flow (vph)	399	1480	0	0	961	1003	280	280	0	0	0	0
Turn Type	Prot					Perm	Perm					
Protected Phases	7	4			8			2				
Permitted Phases						8	2					
Total Split (s)	22.0	59.0	0.0	0.0	37.0	37.0	21.0	21.0	0.0	0.0	0.0	0.0
Act Effct Green (s)	18.0	55.0			33.0	33.0	17.0	17.0				
Actuated g/C Ratio	0.22	0.69			0.41	0.41	0.21	0.21				
v/c Ratio	1.00	0.61			0.66	1.01	0.78	0.74				
Control Delay	79.6	8.0			21.6	43.1	47.3	38.1				
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0				
Total Delay	79.6	8.0			21.6	43.1	47.3	38.1				
LOS	E	A			C	D	D	D				
Approach Delay		23.2			32.6			42.7				
Approach LOS		C			C			D				
Stops (vph)	309	666			682	410	225	192				
Fuel Used(gal)	10	16			9	12	5	5				
CO Emissions (g/hr)	726	1123			653	848	378	331				
NOx Emissions (g/hr)	141	218			127	165	74	64				
VOC Emissions (g/hr)	168	260			151	196	88	77				
Dilemma Vehicles (#)	0	0			0	0	0	0				
Queue Length 50th (ft)	201	177			197	278	140	114				
Queue Length 95th (ft)	#378	231			263	#578	#267	#234				
Internal Link Dist (ft)		570			164			755			814	
Turn Bay Length (ft)												
Base Capacity (vph)	398	2433			1460	994	357	378				
Starvation Cap Reductn	0	0			0	0	0	0				
Spillback Cap Reductn	0	0			0	0	0	0				
Storage Cap Reductn	0	0			0	0	0	0				
Reduced v/c Ratio	1.00	0.61			0.66	1.01	0.78	0.74				

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 1.01
Intersection Signal Delay: 29.9 Intersection LOS: C
Intersection Capacity Utilization 102.1% ICU Level of Service G
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: S 188th St & I-5 NB Ramp

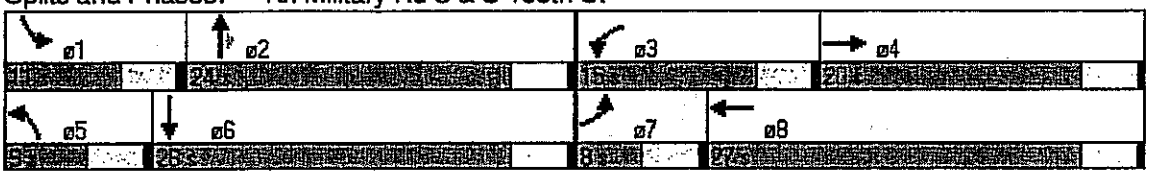


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.91	0.91
Frt		0.992			0.965				0.850		0.996	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1848	0	3433	1798	0	1770	3539	1583	1770	5065	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1848	0	3433	1798	0	1770	3539	1583	1770	5065	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			23				298		6	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1070			798			306			408	
Travel Time (s)		24.3			18.1			7.0			9.3	
Volume (vph)	15	128	7	379	280	86	71	635	274	103	1167	34
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	139	8	412	304	93	77	690	298	112	1268	37
Lane Group Flow (vph)	16	147	0	412	397	0	77	690	298	112	1305	0
Turn Type	Prot			Prot			Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Total Split (s)	8.0	20.0	0.0	15.0	27.0	0.0	9.0	24.0	24.0	11.0	26.0	0.0
Act Effct Green (s)	4.0	16.0		11.0	23.0		5.0	20.0	20.0	7.0	22.0	
Actuated g/C Ratio	0.06	0.23		0.16	0.33		0.07	0.29	0.29	0.10	0.31	
v/c Ratio	0.16	0.35		0.76	0.66		0.61	0.68	0.45	0.63	0.82	
Control Delay	35.1	24.7		39.3	25.0		54.4	26.3	5.2	48.4	27.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	35.1	24.7		39.3	25.0		54.4	26.3	5.2	48.4	27.3	
LOS	D	C		D	C		D	C	A	D	C	
Approach Delay		25.8			32.3			22.4			28.9	
Approach LOS		C			C			C			C	
Stops (vph)	18	107		341	288		63	541	34	93	1045	
Fuel Used(gal)	0	2		7	6		2	11	3	2	16	
CO Emissions (g/hr)	23	168		508	400		116	777	176	130	1137	
NOx Emissions (g/hr)	5	33		99	78		23	151	34	25	221	
VOC Emissions (g/hr)	5	39		118	93		27	180	41	30	264	
Dilemma Vehicles (#)	0	0		0	0		0	0	0	0	0	
Queue Length 50th (ft)	7	52		88	135		33	137	0	47	187	
Queue Length 95th (ft)	25	100		#149	226		#92	194	52	#114	239	
Internal Link Dist (ft)		990			718			226			328	
Turn Bay Length (ft)												
Base Capacity (vph)	101	425		539	606		126	1011	665	177	1596	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.16	0.35		0.76	0.66		0.61	0.68	0.45	0.63	0.82	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 27.6 Intersection LOS: C
Intersection Capacity Utilization 63.9% ICU Level of Service B
Analysis Period (min): 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 10: Military Rd S & S 188th St



Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1753	0	0	1444	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1905	0	0	1570	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				244		
pX, platoon unblocked					0.76	
vC, conflicting volume			1905		2690	953
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1905		2906	953
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			308		9	260

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1270	635	0	785	785	0	0
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.75	0.37	0.00	0.46	0.46	0.00	0.00
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						A	A
Approach Delay (s)	0.0		0.0			0.0	
Approach LOS						A	

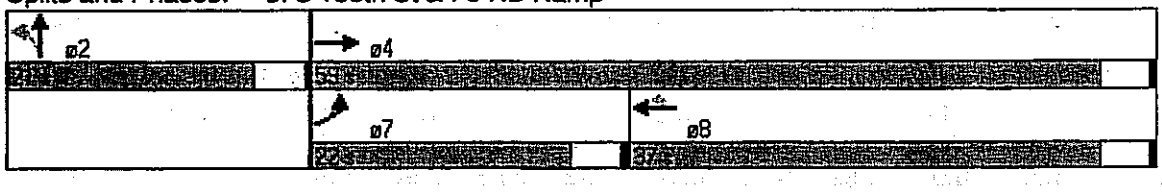
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt						0.850		0.936				
Flt Protected	0.950						0.950	0.972				
Satd. Flow (prot)	1770	3539	0	0	3539	1583	1681	1610	0	0	0	0
Flt Permitted	0.950						0.950	0.972				
Satd. Flow (perm)	1770	3539	0	0	3539	1583	1681	1610	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						580		42				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		650			244			835			894	
Travel Time (s)		14.8			5.5			19.0			20.3	
Volume (vph)	367	1362	0	0	874	912	397	1	107	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	399	1480	0	0	950	991	432	1	116	0	0	0
Lane Group Flow (vph)	399	1480	0	0	950	991	276	273	0	0	0	0
Turn Type	Prot					Perm	Perm					
Protected Phases	7	4			8			2				
Permitted Phases						8	2					
Total Split (s)	22.0	59.0	0.0	0.0	37.0	37.0	21.0	21.0	0.0	0.0	0.0	0.0
Act Effct Green (s)	18.0	55.0			33.0	33.0	17.0	17.0				
Actuated g/C Ratio	0.22	0.69			0.41	0.41	0.21	0.21				
v/c Ratio	1.00	0.61			0.65	1.00	0.77	0.73				
Control Delay	79.6	8.0			21.5	39.9	46.3	37.8				
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0				
Total Delay	79.6	8.0			21.5	39.9	46.3	37.8				
LOS	E	A			C	D	D	D				
Approach Delay		23.2			30.9			42.1				
Approach LOS		C			C			D				
Stops (vph)	309	666			672	402	223	189				
Fuel Used(gal)	10	16			9	11	5	5				
CO Emissions (g/hr)	726	1123			643	794	369	322				
NOx Emissions (g/hr)	141	218			125	155	72	63				
VOC Emissions (g/hr)	168	260			149	184	86	75				
Dilemma Vehicles (#)	0	0			0	0	0	0				
Queue Length 50th (ft)	201	177			194	249	137	113				
Queue Length 95th (ft)	#378	231			258	#563	#261	#229				
Internal Link Dist (ft)		570			164			755			814	
Turn Bay Length (ft)												
Base Capacity (vph)	398	2433			1460	994	357	375				
Starvation Cap Reductn	0	0			0	0	0	0				
Spillback Cap Reductn	0	0			0	0	0	0				
Storage Cap Reductn	0	0			0	0	0	0				
Reduced v/c Ratio	1.00	0.61			0.65	1.00	0.77	0.73				

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 1.00
Intersection Signal Delay: 29.0 Intersection LOS: C
Intersection Capacity Utilization 101.1% ICU Level of Service G
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: S 188th St & I-5 NB Ramp

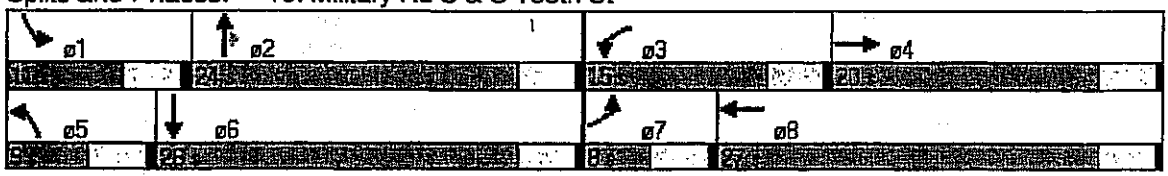


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.91	0.91
Frt		0.992			0.965				0.850		0.996	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1848	0	3433	1798	0	1770	3539	1583	1770	5065	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1848	0	3433	1798	0	1770	3539	1583	1770	5065	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			23				298		6	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1070			798			306			408	
Travel Time (s)		24.3			18.1			7.0			9.3	
Volume (vph)	15	128	7	378	280	86	71	630	274	103	1165	34
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	139	8	411	304	93	77	685	298	112	1266	37
Lane Group Flow (vph)	16	147	0	411	397	0	77	685	298	112	1303	0
Turn Type	Prot			Prot			Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Total Split (s)	8.0	20.0	0.0	15.0	27.0	0.0	9.0	24.0	24.0	11.0	26.0	0.0
Act Effct Green (s)	4.0	16.0		11.0	23.0		5.0	20.0	20.0	7.0	22.0	
Actuated g/C Ratio	0.06	0.23		0.16	0.33		0.07	0.29	0.29	0.10	0.31	
v/c Ratio	0.16	0.35		0.76	0.66		0.61	0.68	0.45	0.63	0.82	
Control Delay	35.1	24.7		39.1	25.0		54.4	26.2	5.2	48.4	27.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	35.1	24.7		39.1	25.0		54.4	26.2	5.2	48.4	27.2	
LOS	D	C		D	C		D	C	A	D	C	
Approach Delay		25.8			32.2			22.3			28.9	
Approach LOS		C			C			C			C	
Stops (vph)	18	107		340	288		63	535	34	93	1043	
Fuel Used(gal)	0	2		7	6		2	11	3	2	16	
CO Emissions (g/hr)	23	168		506	400		116	770	176	130	1134	
NOx Emissions (g/hr)	5	33		99	78		23	150	34	25	221	
VOC Emissions (g/hr)	5	39		117	93		27	178	41	30	263	
Dilemma Vehicles (#)	0	0		0	0		0	0	0	0	0	
Queue Length 50th (ft)	7	52		88	135		33	136	0	47	186	
Queue Length 95th (ft)	25	100		#148	226		#92	192	52	#114	239	
Internal Link Dist (ft)		990			718			226			328	
Turn Bay Length (ft)												
Base Capacity (vph)	101	425		539	606		126	1011	665	177	1596	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.16	0.35		0.76	0.66		0.61	0.68	0.45	0.63	0.82	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 27.5 Intersection LOS: C
Intersection Capacity Utilization 63.8% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 10: Military Rd S & S 188th St

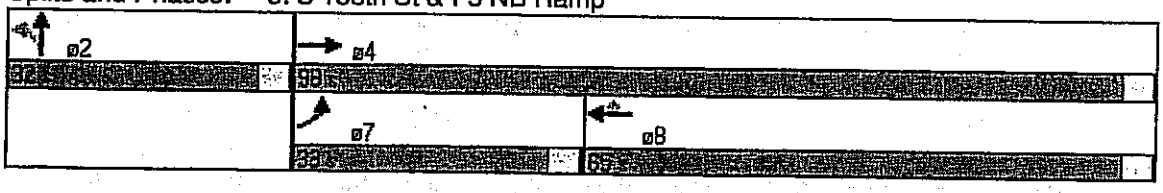


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt						0.850		0.930				
Flt Protected	0.950						0.950	0.974				
Satd. Flow (prot)	1770	3539	0	0	3539	1583	1681	1603	0	0	0	0
Flt Permitted	0.950						0.950	0.974				
Satd. Flow (perm)	1770	3539	0	0	3539	1583	1681	1603	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						544		16				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		650			244			835			894	
Travel Time (s)		14.8			5.5			19.0			20.3	
Volume (vph)	556	2064	0	0	1340	1399	602	2	177	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	604	2243	0	0	1457	1521	654	2	192	0	0	0
Lane Group Flow (vph)	604	2243	0	0	1457	1521	439	409	0	0	0	0
Turn Type	Prot					Perm	Perm					
Protected Phases	7	4			8			2				
Permitted Phases						8	2					
Total Split (s)	33.0	98.0	0.0	0.0	65.0	65.0	32.0	32.0	0.0	0.0	0.0	0.0
Act Effct Green (s)	29.0	94.0			61.0	61.0	28.0	28.0				
Actuated g/C Ratio	0.22	0.72			0.47	0.47	0.22	0.22				
v/c Ratio	1.53	0.88			0.88	1.47	1.21	1.14				
Control Delay	285.8	18.9			38.5	239.1	161.9	136.0				
Queue Delay	0.0	2.6			0.0	0.0	0.0	0.0				
Total Delay	285.8	21.4			38.5	239.1	161.9	136.0				
LOS	F	C			D	F	F	F				
Approach Delay		77.5			141.0			149.4				
Approach LOS		E			F			F				
Stops (vph)	402	1505			1162	734	327	301				
Fuel Used(gal)	39	32			19	75	18	15				
CO Emissions (g/hr)	2706	2211			1361	5230	1241	1015				
NOx Emissions (g/hr)	527	430			265	1018	241	197				
VOC Emissions (g/hr)	627	512			315	1212	288	235				
Dilemma Vehicles (#)	0	0			0	0	0	0				
Queue Length 50th (ft)	~712	672			570	~1513	~475	~413				
Queue Length 95th (ft)	#941	805			678	#1783	#694	#632				
Internal Link Dist (ft)		570			164			755			814	
Turn Bay Length (ft)												
Base Capacity (vph)	395	2559			1661	1032	362	358				
Starvation Cap Reductn	0	209			0	0	0	0				
Spillback Cap Reductn	0	0			0	0	0	0				
Storage Cap Reductn	0	0			0	0	0	0				
Reduced v/c Ratio	1.53	0.95			0.88	1.47	1.21	1.14				

Intersection Summary

Area Type: Other
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 1.53
Intersection Signal Delay: 115.0 Intersection LOS: F
Intersection Capacity Utilization 149.6% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: S 188th St & I-5 NB Ramp

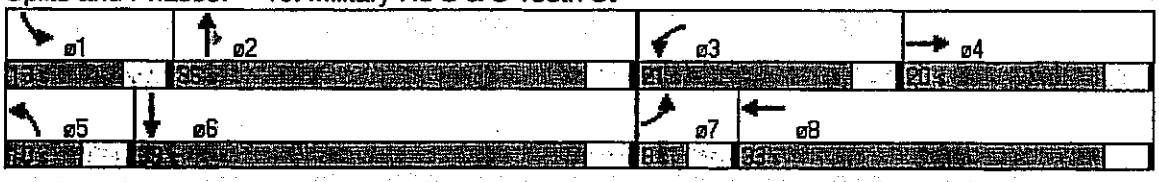


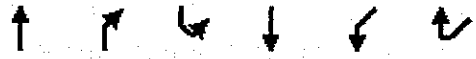
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.91	0.91
Frt		0.992			0.965				0.850		0.996	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1848	0	3433	1798	0	1770	3539	1583	1770	5065	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1848	0	3433	1798	0	1770	3539	1583	1770	5065	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			18				451		6	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1070			798			306			408	
Travel Time (s)		24.3			18.1			7.0			9.3	
Volume (vph)	23	194	11	574	424	130	108	962	415	156	1769	52
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	211	12	624	461	141	117	1046	451	170	1923	57
Lane Group Flow (vph)	25	223	0	624	602	0	117	1046	451	170	1980	0
Turn Type	Prot			Prot			Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Total Split (s)	8.0	20.0	0.0	21.0	33.0	0.0	10.0	36.0	36.0	13.0	39.0	0.0
Act Effct Green (s)	4.0	16.0		17.0	29.0		6.0	32.0	32.0	9.0	35.0	
Actuated g/C Ratio	0.04	0.18		0.19	0.32		0.07	0.36	0.36	0.10	0.39	
v/c Ratio	0.32	0.67		0.96	1.02		0.99	0.83	0.53	0.96	1.00	
Control Delay	52.4	45.5		64.9	72.6		126.1	33.6	4.6	101.2	49.5	
Queue Delay	0.0	1.1		6.5	0.0		0.0	0.0	0.0	0.0	0.7	
Total Delay	52.4	46.5		71.5	72.6		126.1	33.6	4.6	101.2	50.1	
LOS	D	D		E	E		F	C	A	F	D	
Approach Delay		47.1			72.0			32.2			54.2	
Approach LOS		D			E			C			D	
Stops (vph)	25	185		508	459		87	839	38	130	1606	
Fuel Used(gal)	1	5		14	14		4	18	4	4	33	
CO Emissions (g/hr)	40	324		976	991		284	1286	258	309	2308	
NOx Emissions (g/hr)	8	63		190	193		55	250	50	60	449	
VOC Emissions (g/hr)	9	75		226	230		66	298	60	72	535	
Dilemma Vehicles (#)	0	0		0	0		0	0	0	0	0	
Queue Length 50th (ft)	14	118		182	344		68	282	0	98	406	
Queue Length 95th (ft)	40	#207		#290	#565		#177	364	62	#223	#532	
Internal Link Dist (ft)		990			718			226			328	
Turn Bay Length (ft)												
Base Capacity (vph)	79	331		648	592		118	1258	853	177	1973	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	22		22	0		0	0	0	0	5	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.32	0.72		1.00	1.02		0.99	0.83	0.53	0.96	1.01	

Intersection Summary

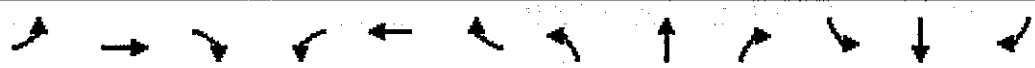
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 1.02
Intersection Signal Delay: 51.3 Intersection LOS: D
Intersection Capacity Utilization 88.2% ICU Level of Service E
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 10: Military Rd S & S 188th St





Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Sign Control	Free			Free	Stop	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt						0.850		0.930				
Flt Protected	0.950						0.950	0.974				
Satd. Flow (prot)	1770	3539	0	0	3539	1583	1681	1603	0	0	0	0
Flt Permitted	0.950						0.950	0.974				
Satd. Flow (perm)	1770	3539	0	0	3539	1583	1681	1603	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						551		16				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		650			244			835			894	
Travel Time (s)		14.8			5.5			19.0			20.3	
Volume (vph)	556	2064	0	0	1362	1421	602	2	177	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	604	2243	0	0	1480	1545	654	2	192	0	0	0
Lane Group Flow (vph)	604	2243	0	0	1480	1545	439	409	0	0	0	0
Turn Type	Prot					Perm	Perm					
Protected Phases	7	4			8			2				
Permitted Phases						8	2					
Total Split (s)	32.0	98.0	0.0	0.0	66.0	66.0	32.0	32.0	0.0	0.0	0.0	0.0
Act Effct Green (s)	28.0	94.0			62.0	62.0	28.0	28.0				
Actuated g/C Ratio	0.22	0.72			0.48	0.48	0.22	0.22				
v/c Ratio	1.59	0.88			0.88	1.48	1.21	1.14				
Control Delay	309.9	18.9			37.8	242.2	161.9	136.0				
Queue Delay	0.0	2.6			0.0	0.0	0.0	0.0				
Total Delay	309.9	21.4			37.8	242.2	161.9	136.0				
LOS	F	C			D	F	F	F				
Approach Delay		82.6			142.2			149.4				
Approach LOS		F			F			F				
Stops (vph)	395	1505			1178	744	327	301				
Fuel Used(gal)	41	32			20	77	18	15				
CO Emissions (g/hr)	2894	2211			1369	5375	1241	1015				
NOx Emissions (g/hr)	563	430			266	1046	241	197				
VOC Emissions (g/hr)	671	512			317	1246	288	235				
Dilemma Vehicles (#)	0	0			0	0	0	0				
Queue Length 50th (ft)	~724	672			576	~1545	~475	~413				
Queue Length 95th (ft)	#953	805			686	#1816	#694	#632				
Internal Link Dist (ft)		570			164			755			814	
Turn Bay Length (ft)												
Base Capacity (vph)	381	2559			1688	1043	362	358				
Starvation Cap Reductn	0	209			0	0	0	0				
Spillback Cap Reductn	0	0			0	0	0	0				
Storage Cap Reductn	0	0			0	0	0	0				
Reduced v/c Ratio	1.59	0.95			0.88	1.48	1.21	1.14				

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations	↑↑↱		↰	↑↑	↰	↱
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	2657	12	29	2189	29	76
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2888	13	32	2379	32	83
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage veh)						
Upstream signal (ft)				244		
pX, platoon unblocked					0.29	
vC, conflicting volume			2901		4147	1451
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			2901		9390	1451
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			75		0	31
cM capacity (veh/h)			124		0	120

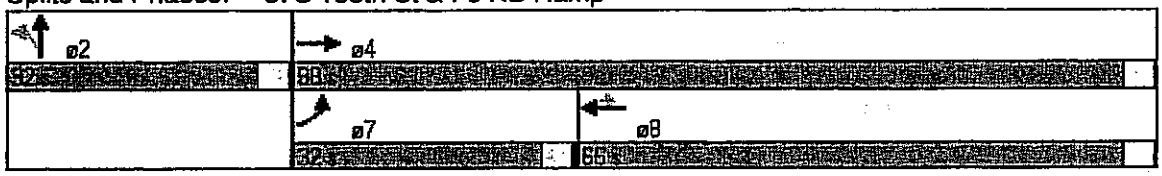
Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1	SW 2
Volume Total	1925	976	32	1190	1190	32	83
Volume Left	0	0	32	0	0	32	0
Volume Right	0	13	0	0	0	0	83
cSH	1700	1700	124	1700	1700	0	120
Volume to Capacity	1.13	0.57	0.25	0.70	0.70	Err	0.69
Queue Length 95th (ft)	0	0	24	0	0	Err	92
Control Delay (s)	0.0	0.0	43.7	0.0	0.0	Err	84.0
Lane LOS			E			F	F
Approach Delay (s)	0.0		0.6			2822.5	
Approach LOS						F	

Intersection Summary			
Average Delay	59.6		
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		

Intersection Summary

Area Type: Other
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 1.59
Intersection Signal Delay: 117.9 Intersection LOS: F
Intersection Capacity Utilization 150.9% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: S 188th St & I-5 NB Ramp

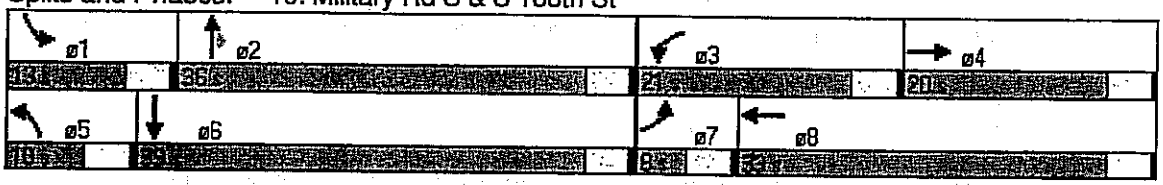


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.91	0.91
Frt		0.992			0.965				0.850		0.996	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1848	0	3433	1798	0	1770	3539	1583	1770	5065	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1848	0	3433	1798	0	1770	3539	1583	1770	5065	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			18				458		6	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1070			798			306			408	
Travel Time (s)		24.3			18.1			7.0			9.3	
Volume (vph)	23	194	11	574	424	130	110	976	421	156	1769	52
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	211	12	624	461	141	120	1061	458	170	1923	57
Lane Group Flow (vph)	25	223	0	624	602	0	120	1061	458	170	1980	0
Turn Type	Prot			Prot			Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Total Split (s)	8.0	20.0	0.0	21.0	33.0	0.0	10.0	36.0	36.0	13.0	39.0	0.0
Act Effct Green (s)	4.0	16.0		17.0	29.0		6.0	32.0	32.0	9.0	35.0	
Actuated g/C Ratio	0.04	0.18		0.19	0.32		0.07	0.36	0.36	0.10	0.39	
v/c Ratio	0.32	0.67		0.96	1.02		1.02	0.84	0.53	0.96	1.00	
Control Delay	52.4	45.5		64.9	72.6		132.4	34.3	4.7	101.2	49.5	
Queue Delay	0.0	1.1		6.5	0.0		0.0	0.0	0.0	0.0	0.7	
Total Delay	52.4	46.5		71.5	72.6		132.4	34.3	4.7	101.2	50.1	
LOS	D	D		E	E		F	C	A	F	D	
Approach Delay		47.1			72.0			33.2			54.2	
Approach LOS		D			E			C			D	
Stops (vph)	25	185		508	459		88	854	39	130	1606	
Fuel Used(gal)	1	5		14	14		4	19	4	4	33	
CO Emissions (g/hr)	40	324		976	991		299	1315	262	309	2308	
NOx Emissions (g/hr)	8	63		190	193		58	256	51	60	449	
VOC Emissions (g/hr)	9	75		226	230		69	305	61	72	535	
Dilemma Vehicles (#)	0	0		0	0		0	0	0	0	0	
Queue Length 50th (ft)	14	118		182	~344		~71	288	0	98	~406	
Queue Length 95th (ft)	40	#207		#290	#565		#182	#373	62	#223	#532	
Internal Link Dist (ft)		990			718			226			328	
Turn Bay Length (ft)												
Base Capacity (vph)	79	331		648	592		118	1258	858	177	1973	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	22		22	0		0	0	0	0	5	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.32	0.72		1.00	1.02		1.02	0.84	0.53	0.96	1.01	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 1.02
Intersection Signal Delay: 51.5 Intersection LOS: D
Intersection Capacity Utilization 88.3% ICU Level of Service E
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 10: Military Rd S & S 188th St



LEVEL OF SERVICE CONCEPT

Because intersection capacity and traffic flow performance, or "level of service", are prime factors in the process of developing and evaluating alternatives, a brief description is presented here for the benefit of the lay reader.

The ratio of existing traffic volume to available capacity provides a measure of the intensity of traffic loading relative to the ability of the street intersection to accommodate the traffic. The number of lanes, presence of turn lanes, type of traffic control, signal phasing, etc., are important factors in determining capacity. As the volume-to-capacity (v/c) ratio approaches a value of 1.0 at signalized intersections, extreme congestion sets in, with long backups and several complete changes of the signal cycles occuring before a motorist can proceed. Motorists at stop-sign controlled intersection approaches face extremely long delays when the v/c ratio approaches 1.0. As traffic queues lengthen, this congestion can also impede access to and from upstream abutting property.

The term "level of service" is used to describe traffic flow at intersections. For signalized intersections, the level of service is based on control delay per vehicle (see **table A-1**). Control delay is a measure of all the delay contributable to traffic control measures, such as a traffic signal. Control delay includes initial acceleration delay, queue move-up time, stopped delay, and final acceleration delay.

Table A-1
Level of Service and Volume/Capacity Ratio Relationships for Signalized Intersections

Level of Service	General Description	Control Delay (seconds/vehicle)[1]	Intersection V/C Ratio[2]
A	Free flow	≤ 10.0	≤ 0.60
B	Stable flow (slight delays)	10.1 to 20.0	0.61 to 0.70
C	Stable flow (acceptable delays)	20.1 to 35.0	0.71 to 0.80
D	Approaching unstable flow (tolerable delay - occasionally wait through more than one signal cycle before proceeding)	35.1 to 55.0	0.81 to 0.90
E	Unstable flow (intolerable delay, intersection operating at capacity)	55.1 to 80.0	0.91 to 1.00
F	Forced flow (jammed)	> 80.0	> 1.00

1. For operational analysis method which requires detailed geometric, traffic, and signal information usually used for existing conditions analysis.
2. For planning-level analysis method. Planning-level analysis is used when there is less certainty in the input when default values are typically relied upon and future traffic forecasts are used.

Source: "Highway Capacity Manual", Transportation Research Board, 2000; and "Interim Materials on Highway Capacity", *Circular 212*, Transportation Research Board, 1980.

Level of service A is a condition of unimpeded flow, while level of service C is often used in the design of new urban streets as the lowest acceptable level for peak periods. Congestion begins to occur at level of service D (v/c from 0.81 to 0.90). Because of funding and/or environmental constraints for improvements, this level of service is being used by more and more cities as an adequate level, particularly for improvements to congested existing facilities. Increasingly unstable traffic flow with excessive delay and congestion occurs as level of service E (capacity) is approached (v/c = 0.91 to 1.00). For v/c > 1.00, level of service F (forced flow) is obtained, and the intersection is overloaded or is jammed due to traffic backups from overloaded downstream intersections.

It should be noted that equal v/c ratios at several locations do not necessarily indicate equal overall performance of intersections. One intersection may experience a high v/c ratio for a considerable period of the day while at another intersection the peak period lasts a short time. In addition, a low level of service is more tolerable at a low-volume intersection than a high-volume location.

The general level of service concept also holds for stop-sign controlled intersections, although the capacity of the stop-sign controlled approaches is less than that of the signalized intersection approach. **Table A-2** shows the level of service criteria for unsignalized intersections.

Table A-2
Level of Service Criteria for Unsignalized Intersections

Control Delay (d)[1]	Level of Service
$d \leq 10$	A
$10 < d \leq 15$	B
$15 < d \leq 25$	C
$25 < d \leq 35$	D
$35 < d \leq 50$	E
$d > 50$	F[2]

1. Control delay is measured in seconds per vehicle.
2. For level of service F, when demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvements to the intersection.

Source: "Highway Capacity Manual", Transportation Research Board, 2000.

Capacity analysis for two-way stop-sign controlled intersections is based on the assumption that major street traffic is not affected by the minor street movements, and that left-turns from the major streets to the minor streets are influenced only by opposing major street through flow. Therefore, the level of service calculated for two-way stop intersections is based on delay experienced by only the minor street movements and the major street left-turn movement.

MEMORANDUM

To:	Karl Hufnagel	Date:	May 12, 2004
From:	Kurt Gahnberg	TG:	02250.00
cc:			
Subject:	Bow Lake Transfer Station – Summary of Preliminary Transportation Assessment		

This memorandum briefly documents the results of the preliminary traffic assessment of access enhancement options for the existing Bow Lake Transfer Station, that were presented to KCSWD staff at a meeting March 5, 2004. It includes:

- Background
- Comparison of Alternatives
- Summary

Background

Options to enhance access at the Bow Lake transfer station have been under investigation by the RW Beck team since summer 2003. Current site access is hampered by the close proximity of the transfer station access road to the existing ramp terminals at the S 188th Street/I-5 Interchange. This close spacing results in traffic queue interference with access traffic, especially slower moving transfer trucks. In addition, safety is a concern for traffic entering S 188th Street from the site, and for left turning traffic from S 188th Street into the site. The Bow Lake Transfer Station remains an important component of King County solid waste management strategy far into the future.

Range of Options Considered

A wide range of access enhancement options have been considered by the team, ranging from minor channelization modifications, to traffic signalization of the site entrance intersection with S. 188th Street, to significantly more-expensive roadway and ramp revisions requiring coordination with Washington State Department of Transportation (WSDOT) to effectively implement. None of the lowest cost options provided any substantial benefit to improve existing traffic operations, or adequately accommodate future traffic volume levels associated with anticipated growth.

The only conceptual option that was determined to provide adequate traffic operational benefit was to combine the I-5 northbound ramps with the site access road, as well as S. 188th Street and Orilla Road approaches, into what is commonly referred to as a single point interchange. The most recent analysis has focused on this

core option, with further examination of permutations of this option. The most current evaluation focuses on the following options:

- **Single Point Interchange (SPI)** – Basic design which brings the west leg of S. 188th Street into a single intersection with the I-5 northbound ramps, the east approach from Orillia Road, together with the access to the Bow Lake Transfer Station.
- **SPI With Right Turn Bypass** – Removes right turning traffic from theI-5 northbound off ramp from the intersection, and accommodates them in a separate turning ramp to eastbound Orillia Road.
- **SPI With Right turn Bypass and Orillia Road/I-5 Northbound Flyover** – This option removes the westbound Orillia Road destined for northbound for northbound I-5 from the intersection operation by accommodating them in a flyover ramp.

The basic option (SPI) improves operation over existing conditions by accommodating all traffic at a single point, allowing signalized control of the Bow Lake Transfer Station access, and doing so in a way that increases intersection spacing between the northbound and southbound I-5 ramp terminals. Implementation of any of the options above will require the close coordination between WSDOT and King County, as well as the neighboring city of Tukwila.

The analysis considered the following traffic characteristics:

- **Background Traffic Growth** – A long range traffic horizon was considered. Traffic forecast factors were acquired from King County, and included the Green River Valley and Highline subareas, which are forecast to grow at approximately 23 and 5 percent, respectively. Application of these two data points resulted in consideration of a worst case and probable traffic forecast for 2023 conditions.
- **AM and PM Peak Hour Traffic Analysis** – Both AM and PM peak hour traffic conditions were examined.
- **Intersection Level of Service** – Traditional intersection analysis was conducted to assess future traffic delays and compare the affect of the identified options on the traffic capacity of the I-5/S 188th Street/Orillia Road freeway ramps and site access driveway.
- **Traffic Queuing** – The close spacing of the S. 188th Street ramp terminals with northbound and southbound I-5, together with the Bow Lake Transfer Station access road, requires consideration of the relative effect of traffic queues occurring between intersections to understand the operational viability of future options.

Comparison of Alternatives

The following summarizes the preliminary traffic assessment of the single point interchange options considered. It describes intersection Level of Service (LOS), traffic queuing, and other factors relevant to comparing the operational options for the following

Intersection Level of Service

Attachment 1 (LOS Handout from Meeting) summarizes the LOS analysis for each of the alternatives for 2023 conditions. Two scenarios were developed. First, a worst case assumption that all traffic would grow at a rate consistent with the Green river Valley growth factor (23%) was evaluated. Second, a hybrid growth rate that applied the Green River Valley rate only to the east leg of the intersection (Orillia Road approach) while applying the lower 5 percent growth rate to the other primary approaches. The latter reflects a more-reasonable approach, in that the high level of existing traffic associated with the I-5 off ramps, as well as S. 188th Street to the west, are likely to grow at a substantially lower rate than the higher growth Green River Valley. They are both presented to reflect sensitivity analysis.

The analysis summarized in Attachment 1 generally shows that the PM peak hour will continue to experience higher levels of traffic congestion than occur during the AM peak hour. It also shows that the blended growth rate results in more-feasible levels of service associated with each of the options. During the PM peak hour, resulting traffic operations would be similar for both the basic and basic with right turn bypass case, LOS "E". When the effect of the traffic removed as a result of the flyover ramp is added, operations would improve by a complete level of service, resulting in LOS "D", and about 15 seconds less delay than described for the other options in the PM peak hour.

In summary, traffic growth to 2023 will contribute to further substantial decline in overall street system and access performance surrounding the Bow Lake Transfer Station. The single point interchange will improve operations and safety compared to doing nothing, but alone would result in continued significant delays. Addition of the right turn ramp bypass alone would improve AM peak hour operations, but have a minimal impact on relieving PM peak hour congestion. However, with the addition of the flyover ramp to eliminate westbound traffic from Orillia Road to northbound I-5 from the intersection, a significant operational improvement could occur.

Traffic Queuing

Traffic queuing associated with the 2023 conditions were also reviewed. All options would provide adequate queuing capacity to accommodate anticipated traffic demand, with the exception of the eastbound approach to the intersection on S. 188th Street. This movement currently has traffic queues that exceed the available capacity, and will continue to do so in the future under any scenario. This queuing, while significant, would not directly affect the access viability for the single point

interchange in serving the Bow Lake Transfer Station. However, fully understanding the interaction between traffic signals and intersections in the interchange area will require ongoing evaluation, and may receive additional scrutiny in light of any specific development or transportation improvement proposal.

Summary

KCSWD is considering the further development of the Bow Lake Transfer Station to support the County's solid waste management strategy. Current site access is problematic in that heavy through traffic volumes on S. 188th Street, together with turning movements associated with the closely spaced I-5 ramp terminals, result in substantial access delays, and safety concerns for traffic turning into and out of the Bow Lake site. Of the range of improvements considered, the modification of the I-5 northbound ramps to realign the landing point to provide a 5-way single intersection that combines the Bow Lake access road provides improved safety and operations. However, in order to provide operating conditions of LOS "D" or better during both AM and PM peak hour conditions, it is necessary to consider further substantial investment in the roadway infrastructure, including the development of a single point interchange with the I-5 northbound ramp terminal and the Bow Lake transfer station access, incorporation of a separate right turn access from the northbound off-ramp to eastbound Orillia Road, and the development of a flyover structure to intercept westbound Orillia Road traffic destined for northbound I-5.

Based on this analysis, further investigation of the feasibility and cost of construction associated with this concept should be undertaken.

Attachment

M\02\02150 Bow Lake TS\Summary Memo – Traffic Assessment.doc

Bow Lake Transfer Station
Level of Service

PM Peak Hour LOS – Single Point NB Ramp Intersection

Intersection Options	2023 with Green Valley Growth			2023 with Highline/Green Valley Growth		
	LOS[1]	Delay[2]	V/C[3]	LOS	Delay	V/C
Basic Design	F	88.4	1.08	E	61.3	1.01
w/ right by-pass	F	88.3	1.08	E	60.8	1.00
w/ right by-pass and flyover[4]	E	76.9	1.02	D	44.5	0.91

1. Level of service.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio.
4. The flyover alternative was also evaluated with the existing intersection geometry. The results indicated overall operations were similar to or worse than the option with the flyover added to the single-point intersection and resulting traffic queues between existing intersections were unacceptable.

AM Peak Hour LOS – Single Point NB Ramp Intersection

Intersection Options	2023 with Green Valley Growth			2023 with Highline/Green Valley Growth		
	LOS	Delay	V/C	LOS	Delay	V/C
Basic Design	E	76.6	1.04	E	61.4	0.98
w/ right by-pass	E	56.8	0.98	D	45.8	0.93
w/ right by-pass and flyover[4]	D	37.7	0.87	C	26.4	0.78

1. Level of service.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio.
4. The flyover alternative was also evaluated with the existing intersection geometry. The results indicated overall operations were similar to or worse than the option with the flyover added to the single-point intersection and resulting traffic queues between existing intersections were unacceptable.