

FINAL - TERMINAL 91 2019 TRAFFIC MONITORING STUDY

Prepared for:
Port of Seattle

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Introduction

The purpose of this report is to summarize the 2019 traffic monitoring study conducted for the Port of Seattle at Terminal 91. This study is conducted annually, as originally outlined in the Terminal 91 Short Fill Redevelopment Agreement (SFRA) between the neighborhood community councils of Magnolia and Queen Anne and the Port of Seattle. The 2019 study was conducted over an eleven-day period from Thursday, August 29 through Sunday, September 8, 2019. As part of this study, traffic counts at and around Terminal 91 are conducted and an evaluation is performed on the transportation system based on the performance measures and thresholds identified in the SFRA. The results of this study are compared to each of the annual reports dating back to 2012. Prior to 2016, the traffic monitoring study was prepared by Heffron Transportation. In 2019, the data collection locations were slightly expanded from recent annual reports to include new intersections and travel speeds along the 15th Avenue West / Elliott Avenue West corridor.

Short Fill Redevelopment Agreement and the Monitoring Process

The SFRA was established as a method of resolving disputes surrounding the Port's short fill redevelopment of Terminal 91. There were concerns from local residents and neighborhood community councils that the Port's redevelopment would cause significant adverse impacts to the surrounding roadway network. The SFRA outlines an annual monitoring program and a set of thresholds for traffic volumes and intersection level of service that were agreed upon by the Port and the neighborhood community councils. If these thresholds are exceeded, the SFRA states that further intensive review by the Port will be required as well as mitigation measures, if deemed necessary.

Key steps within the monitoring program stated in the SFRA are as follows:

- **Gates:** The Port will obtain daily (24 hour), AM and PM peak period gate counts of trucks and autos entering or leaving all Terminal 91 gates for one week each year. Gate counts will be reported as trip ends. A trip end is an arrival or a departure. As such, a single vehicle which enters and then leaves the terminal will generate two trip ends.
- **Intersections:** Congestion and delay at intersections are measured in terms of Level of Service (LOS) under a system described in the Highway Capacity Manual. Levels of service range from A through F, with LOS A representing congestion-free service and LOS F representing jammed conditions. The Port will obtain LOS determinations for the peak hours at the following intersections once a year:
 - Elliott Avenue West and West Galer Street (now the Galer Street flyover)
 - Elliott Avenue West/15th Avenue West and West Garfield Street
 - Elliott Avenue West and West Mercer Place
 - 15th Avenue West and West Dravus Street (counted this year for the first time recently)
 - 20th Avenue West and West Dravus Street (counted this year for the first time recently)

According to industry standard, the methodology to determine level of service has been updated many times since the original SFRA agreement was drafted. The original methodology for determining level of service was via hand-calculations. Software now allows more accurate measurement of intersection operations and vehicle delays, and was used to perform the analysis in this report. Intersection LOS is based on the average delay per vehicle traveling through that intersection. Appendix B provides a breakdown of how much delay equates to each LOS. For this report, Trafficware's Synchro software (version 10) was used to perform LOS calculations.

Another change that has occurred since the SFRA was created is construction of the Galer Street Flyover. The Galer Street Flyover/Elliott Avenue West intersection was evaluated instead of the West Galer Street/Elliott Avenue West intersection because the Galer Street Flyover is the new access

roadway for Terminal 91, and the West Galer Street railroad crossing is closed to vehicle traffic. Additionally, because the Center Gate to Terminal 91 is currently closed, no analysis was performed along the Magnolia Bridge. Finally, since the closure of the north gate, no intersections on West Dravus Street were performed until this year. For the 2019 study, counts were performed at the intersections of 15th Avenue West / West Dravus Street and 20th Avenue West / West Dravus Street as required in the original SFRA

The SFRA established thresholds for both automobile and truck traffic volumes over three specific time periods. The time periods and volume thresholds are summarized in Table 1. The SFRA defines a 75-minute period for the AM peak and a 105-minute period for the PM peak. This differs from a typical traffic analysis, where a 60-minute peak period is used.

Table 1. SFRA Traffic Volume Threshold Criteria

	Time Period	Automobiles	Trucks
AM Peak	7:15 – 8:30 A.M.	395	25
PM Peak	3:45 – 5:30 P.M.	612	48
Daily	24 hours	3,500	325

Traffic Counts

Vehicle Classification Count Locations

During the course of this study there were two locations where vehicular traffic could enter and exit Terminal 91; these are shown in Figure 1.

1. **East Gate** – This gate is located off Alaskan Way West and is accessed by the Galer Street Flyover.
2. **West Gate** – On days with cruise activity, a retractable gate at the west end of the Magnolia Bridge is open. Vehicles can enter or exit through this gate to access parking lot D, or to travel the area beneath the Magnolia Bridge to access Pier 91 south of the bridge. When cruise vessels are at sea, the gate is locked to the public in order to secure the cruise parking lot. Vehicles use the on/off ramps at the west end of the Magnolia Bridge to access the parking lot, as do general public vehicles traveling to Elliott Bay Marina (which are not included in this count).
3. **TNC Lane** – tube counts were conducted at a lane dedicated for Transportation Network Company (TNCs, such as Uber and Lyft) pickup up and drop offs during cruise ship times.

Figure 1. Terminal 91 Access Gates & TNC Count Locations

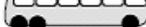
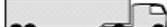


Vehicle classification counts (classification breakdown shown in Figure 2) were performed at both Terminal 91 gates, and the TNC access lane in late August and early September 2019. The TNC access lane was added this year after questions were asked by NAC members during the 2018 study about the impact of TNC traffic on cruise ship days. The classification counts (performed by pneumatic tube counters) track the types of vehicles entering and exiting the terminals for each hour of the day. These tube counters are thin tubes, laid across the study roadway in pairs a set distance apart, that use pressure measurements to record when a vehicle passes over them. The tubes can count the number of axles per vehicle to determine the classification of the vehicle. These data were collected over an eleven-day period from Thursday, August 29, 2019 through Sunday, September 8, 2019.

To complement the tube counts, camera counts were performed at both gates for four days: Thursday, August 29; Friday, August 30; Saturday, August 31; and Sunday, September 1. Three of these days, Friday, Saturday, and Sunday were cruise days and Thursday was a non-cruise day. These counts were

performed during the peak hours for disembarkation (7:30 to 9:45 A.M.) and embarkation (11:00 A.M. to 12:45 P.M.). The cameras were mounted upon existing light or maintenance poles to record video of a specific location. Software systems and manual observations of the camera footage are used to count the number and type of vehicles. The vehicle types were categorized: passenger vehicle (non-commercial, including TNCs), taxi, limo/towncar, shuttle van/bus, charter bus, school bus, small truck, medium truck and large truck. Figure 2 provides a breakdown of each of the vehicle classifications.

Figure 2. Vehicle Classification Breakdown

	Class #		# of Axles
	1	 MOTORCYCLES	2
	2	 ALL CARS CARS	2
		 CARS W/ 1-AXLE TRAILER	3
		 CARS W/ 2-AXLE TRAILER	4
	3	 PICK-UPS & VANS	2, 3, & 4
	4	 BUSES	2 & 3
Small & Med Trucks	5	 2-AXLE, SINGLE UNIT	2
	6	 3-AXLE, SINGLE UNIT	3
	7	 4-AXLE, SINGLE UNIT	4
Large Trucks	8	 2-AXLE, TRACTOR, 1-AXLE TRAILER (2&1)	3
		 2-AXLE, TRACTOR, 2-AXLE TRAILER (2&2)	4
		 3-AXLE, TRACTOR, 1-AXLE TRAILER (3&1)	4
	9	 3-AXLE, TRACTOR, 2-AXLE TRAILER (3&2)	5
		 3-AXLE, TRUCK W/ 2-AXLE TRAILER	5
	10	 TRACTOR W/ SINGLE TRAILER	6 & 7
	11	 5-AXLE MULTI-TRAILER	5
12	 6-AXLE MULTI-TRAILER	6	
13	ANY 7 OR MORE AXLE	7 or more	

The tube counts classify vehicles based on the number and spacing of axles; however, the accuracy of the classification counts can be affected by travel speed. A vehicle that travels faster or slower than expected could be registered as a different type of vehicle. The camera counts were used to validate the tube counts and determine if adjustments were needed. Discrepancies between the vehicle classification counts and the pneumatic tube counts were discovered, especially for buses, small to medium trucks and large trucks. These discrepancies are common for locations with low speeds, and this is likely the cause of the discrepancy for this count due to the tube counts being placed at the gates.

- Small/medium trucks were over-counted by pneumatic tube counters for all days by approximately a factor of two. To correct for this, all small and medium truck values were divided by two.
- Buses were found to have been under-counted by the tube counters by an approximate factor of two, so all bus values recorded by tube counters were multiplied by two.
- Large trucks were also undercounted, and had their counts increased by the same number of small and medium trucks that were decreased (i.e. for every small and medium truck count reduced, the number of large trucks was increased by one).

2019 Cruise Schedule

Cruise vessels were present at Terminal 91 on seven of the ten days surveyed in 2019. Table 2 provides a summary of the cruise schedule and the number of passengers per cruise ship during the ten-day study period (August 30 through September 8, 2019). Passenger volumes were highest on the two Fridays, when two ships were present at Terminal 91. On Monday, Wednesday and Thursday there were no cruise ships present. Cruise ships typically sail on every other Monday throughout cruise ship season and this study was conducted during a week when no cruise ships sailed on Monday.

Table 2. Cruise Passengers at Terminal 91 During 2019 Monitoring Survey

Date	Cruise Line	Number of Passengers		
		Embark	Disembark	Total Passengers
Fri, 8/30/19	ROYAL CARIBBEAN	4,314	4,641	8,955
	CELEBRITY CRUISES	2,828	2,878	5,706
Sat, 8/31/19	HOLLAND AMERICA LINE	2,111	2,187	4,298
	PRINCESS CRUISES	3,110	3,251	6,361
Sun, 9/1/19	PRINCESS CRUISES	2,631	2,768	5,399
	HOLLAND AMERICA LINE	1,916	2,032	3,948
Mon, 9/2/19				
Tues, 9/3/19	CARNIVAL CRUISE LINE	2,215	2,225	4,400
Wed, 9/4/19				
Thurs, 9/5/19				
Fri, 9/6/19	ROYAL CARIBBEAN	4,372	4,312	8,684
	CELEBRITY CRUISES	2,832	2,822	5,654
Sat, 9/7/19	HOLLAND AMERICA LINE	2,045	2,107	4,152
	PRINCESS CRUISES	2,970	3,103	6,073
Sun, 9/8/19	PRINCESS CRUISES	2,615	2,633	5,248
	HOLLAND AMERICA LINE	1,810	1,915	3,725

Source: *Port of Seattle and Cruise Terminals of America, 2019.*

Automobile Traffic

Automobile traffic that entered or exited Terminal 91 was added for both access locations (east and west gate) to determine the total number of automobiles accessing Terminal 91. In addition to passenger cars, vans and small shuttles (i.e. 10-person passenger vans) were also classified as an automobile. Table 3 summarizes the automobile trip ends (a trip to and from T-91 counts as two trips) and compares them to the thresholds established in the SFRA.

Figure 3 through Figure 5 summarize the AM, PM and daily volumes as compared to their respective thresholds. As shown, the AM peak period exceeded the thresholds on Fridays, Saturdays and Sundays when there were two cruise ships. Daily automobile thresholds were exceeded on all the days when a cruise ship was present at T-91. The PM peak period threshold was never exceeded as cruise ship arrivals and departures do not coincide with the PM peak period.

Table 3. Automobile Traffic to and from Terminal 91

Date	AM Peak (7:15 – 8:30 AM) Threshold = 395	PM Peak (3:45 – 5:30 PM) Threshold = 612	Daily (24-Hour) Threshold = 3,500
Fri, 8/30/19	982	230	8,320
Sat, 8/31/19	661	145	5,908
Sun, 9/1/19	548	158	4,470
Mon, 9/2/19	72	53	847
Tue, 9/3/19	369	224	4,929
Wed, 9/4/19	166	173	2,450
Thu, 9/5/19	309	148	3,651
Fri, 9/6/19	1,066	270	8,994
Sat, 9/7/19	712	179	5,979
Sun, 9/8/19	561	147	4,801

Source: Ten-day tube counts conducted by IDAX, Friday, August 30 to Sunday, September 8, 2019. Combined volumes at both East Gate and West Gate for entry to and from Terminal 91. Volumes in bold identify time periods where the SFRA threshold limit is met or exceeded.

Figure 3. Automobile Traffic – AM Peak Period (7:15 – 8:30 AM)

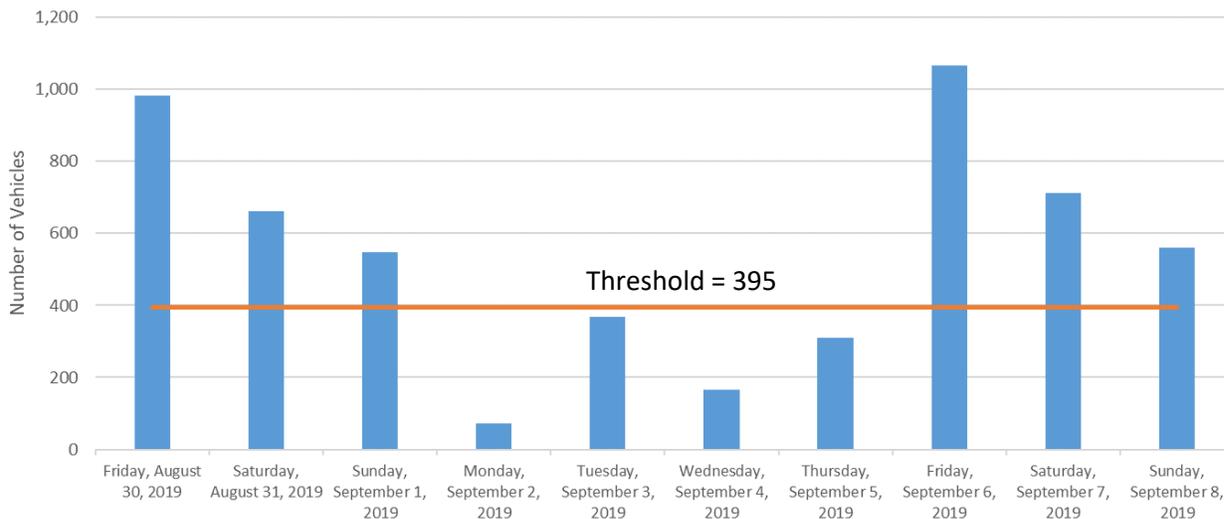


Figure 4. Automobile Traffic – PM Peak Period (3:45 – 5:30 PM)

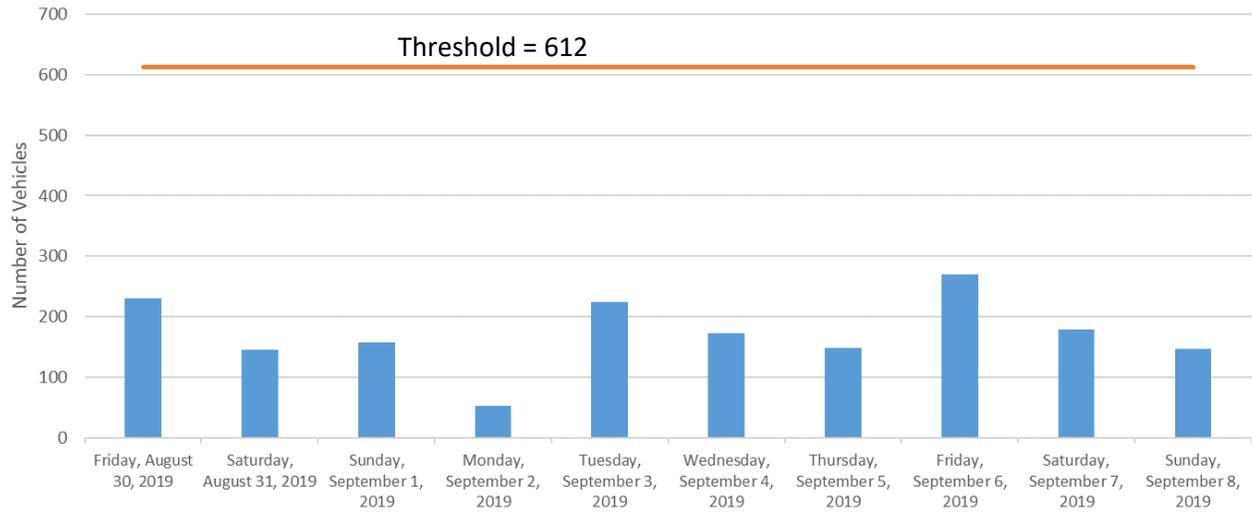


Figure 5. Automobile Traffic – Daily (24-Hour Period)

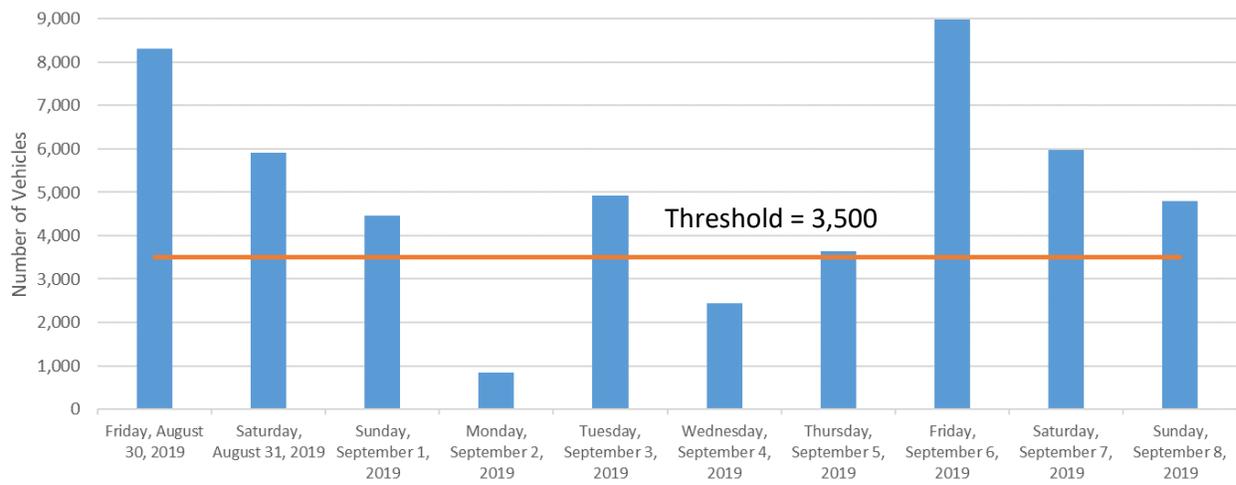


Figure 6 shows the Daily Automobile Volume by Access Location. On days without a cruise ship call, the parking lot at the West Gate is typically locked, and the small number of trips that entered or exited the terminal at the West Gate are likely related to security or maintenance personnel. Days with the largest number of vehicles accessing Terminal 91 correspond to days with cruise ship activity.

Figure 6. Daily Automobile Trips by Access Location

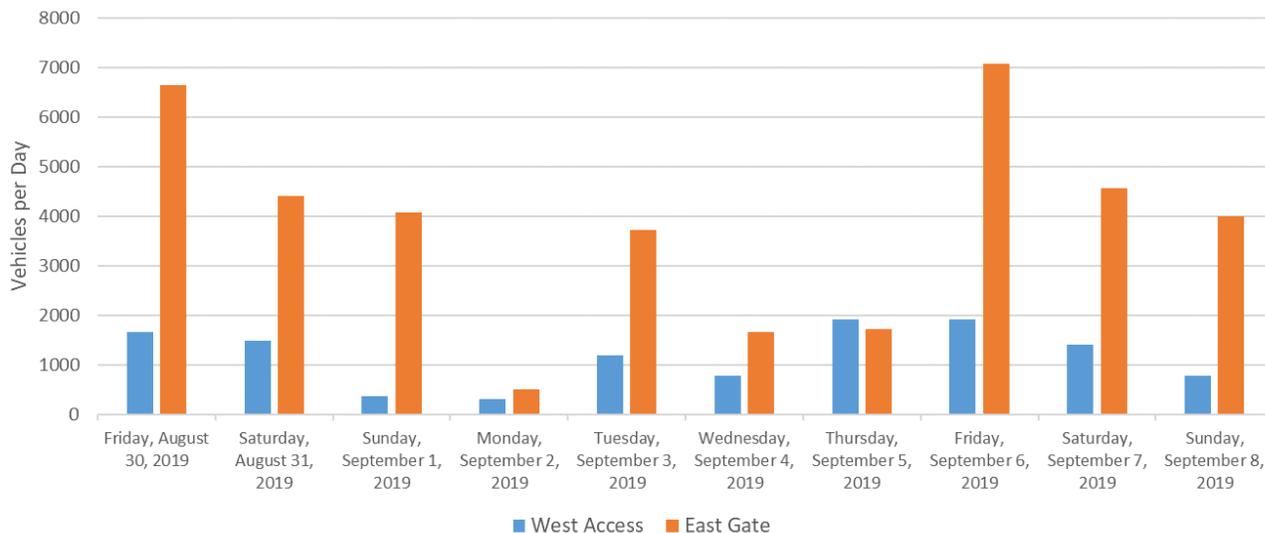


Table 4 shows the number of vehicles recorded during the AM peak, PM peak and daily at the TNC access lane. While this lane is primarily used for TNCs during cruise ship passenger pickup and drop off, the lane may be used for other vehicle access during non-cruise times. The number of vehicles in this lane on cruise days is representative of the number of TNCs carrying passengers to and from T-91. This access lane was monitored this year to estimate how many passengers are arriving by TNC vs passenger car, based on feedback from the NAC during the prior year’s monitoring efforts.

Table 4. Vehicles in TNC Lane at Terminal 91

Date	AM Peak (7:15 – 8:30 AM)	PM Peak (3:45 – 5:30 PM)	Daily (24-Hour)
Fri, 8/30/19	141	0	1038
Sat, 8/31/19	114	0	573
Sun, 9/1/19	100	0	595
Mon, 9/2/19	0	0	0
Tue, 9/3/19	39	0	172
Wed, 9/4/19	0	0	0
Thu, 9/5/19	0	0	0
Fri, 9/6/19	163	0	956
Sat, 9/7/19	129	0	668
Sun, 9/8/19	99	1	588

Source: Ten-day tube counts conducted by IDAX, Friday, August 30 to Sunday, September 8, 2019.

Truck Traffic

Truck traffic volumes were counted for large vehicles (trucks and buses) entering at both gates to Terminal 91 and compared to SFRA thresholds. Almost all large vehicles access Terminal 91 through the East Gate, although some smaller trucks and shuttles may use the West Gate. The total number of truck trip ends for both access locations is summarized in Table 5. As shown, the volume of trucks, shuttles and buses exceeded the AM peak and daily thresholds on all days of the week except Monday. The PM peak threshold was never exceeded.

Table 5. Truck, Bus and Shuttle Volumes to and from Terminal 91

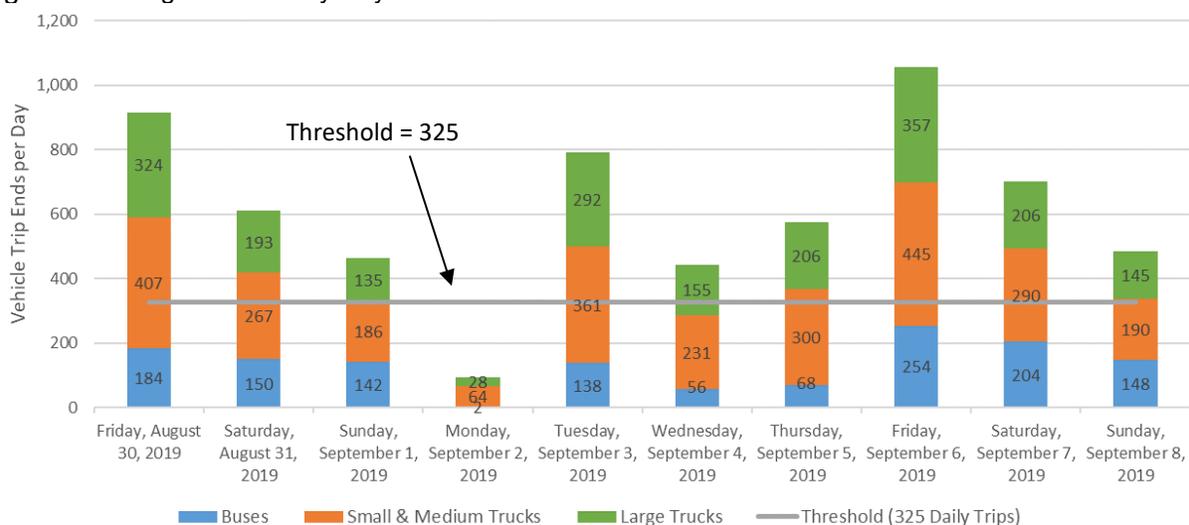
Date	AM Peak (7:15 – 8:30 AM) Threshold = 25	PM Peak (3:45 – 5:30 PM) Threshold = 48	Daily (24-Hour) Threshold = 325
Fri, 8/30/19	90	30	915
Sat, 8/31/19	75	7	610
Sun, 9/1/19	61	4	463
Mon, 9/2/19	11	2	94
Tue, 9/3/19	62	19	791
Wed, 9/4/19	29	25	442
Thu, 9/5/19	53	26	574
Fri, 9/6/19	90	29	1,056
Sat, 9/7/19	60	9	700
Sun, 9/8/19	58	3	483

Source: Ten-day tube counts conducted by IDAX, Friday, August 30 to Sunday, September 8, 2019. Combined volumes at both East Gate and West Gate for entry to and from Terminal 91.

Volumes in bold identify time periods where the Short-Fill Redevelopment Agreement threshold limit is met or exceeded.

The types of vehicles were compiled for each day to show the proportion of each type of large vehicle: buses, small and medium trucks and large trucks (see Figure 2 for classification breakdown). Figure 7 summarizes the daily truck and bus volumes entering Terminal 91.

Figure 7. Large Vehicles by Day of Week



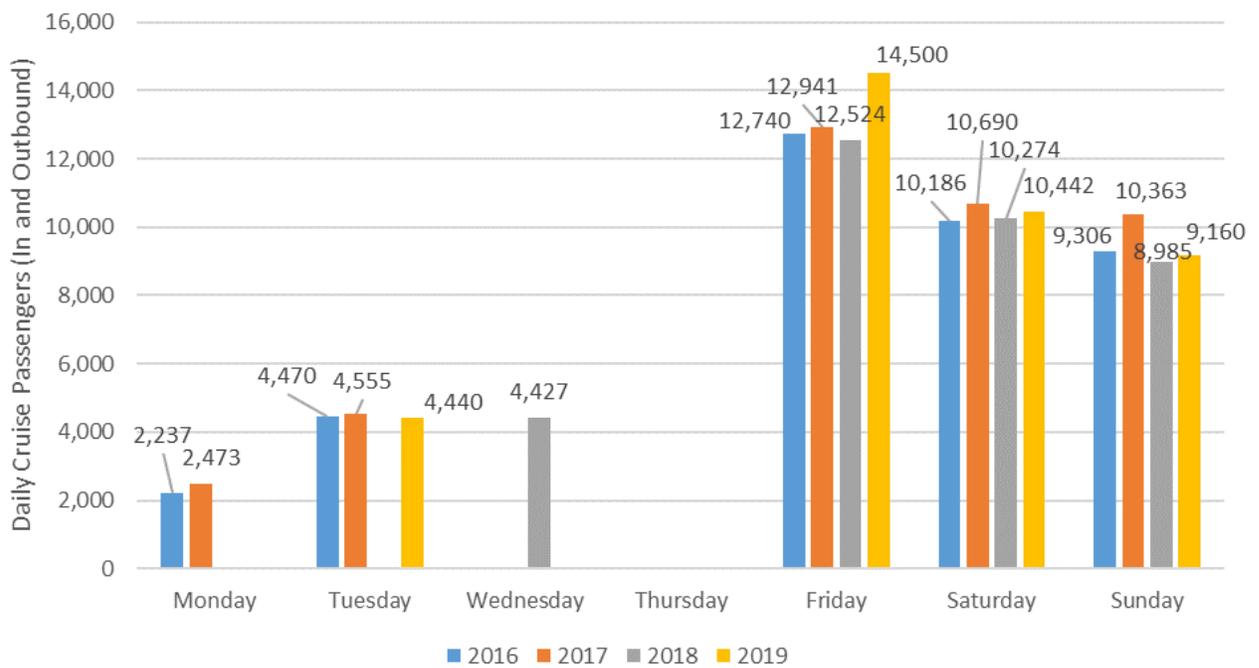
Historic Trends

This section compares results from the four most recent traffic monitoring studies—September 2016, 2017, 2018 and 2019.

Passenger Trends

Traffic volumes at Terminal 91 fluctuate from day to day. The largest changes result from cruise activities. Figure 8 shows the number of passengers that embark and disembark cruise ships at the terminal by day of week for the past four monitoring years. Typical 2019 cruise ship schedules included cruise ship calls at T-91 on Tuesdays, Fridays, Saturdays and Sundays and every other Monday. No cruise activity has occurred on Thursday in recent years. Cruise ship passenger volumes increased in 2019 compared to 2018 when passenger volumes decreased for the first time in recent years.

Figure 8. Cruise Ship Passenger Volume Trends



Automobile Traffic Trends

Figures 9, 10, and 11 compare historic automobile traffic monitoring results for the AM peak, PM peak and 24-hour periods, respectively. Traffic volumes remain consistent with cruise ship passenger trends during the last four years of traffic monitoring. The AM peak period automobile traffic volumes continue to exceed the threshold on Friday, Saturday and Sunday. AM traffic volumes were similar to previous years, apart from the one-time Wednesday cruise ship in 2018. The PM peak period automobile traffic volumes remain similar to volumes from previous years. Volumes during the PM are well below the established threshold. Daily automobile traffic volumes exceed the threshold on Tuesday, Thursday, Friday, Saturday and Sunday.

Figure 9. Automobile Trends – AM Peak Period (7:15 – 8:30 AM)

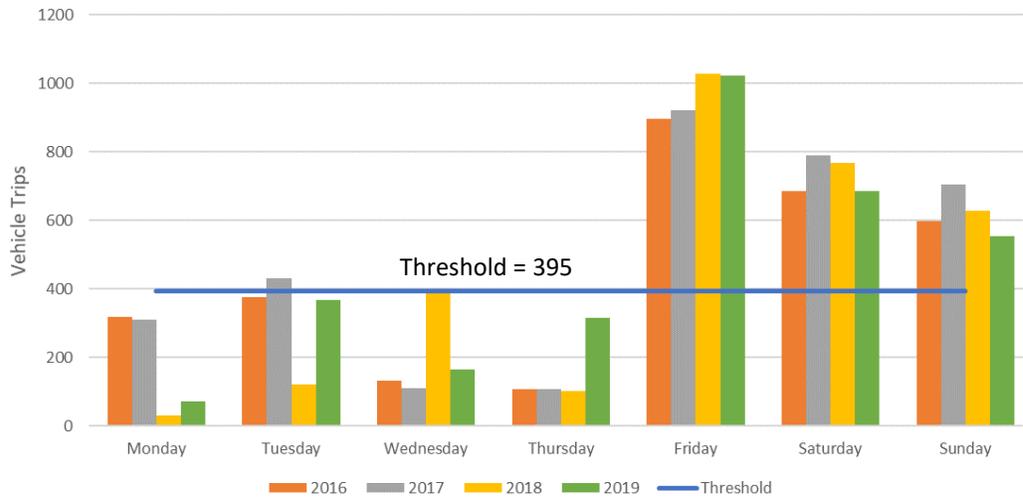


Figure 10. Automobile Trends – PM Peak Period (3:45 – 5:30 PM)

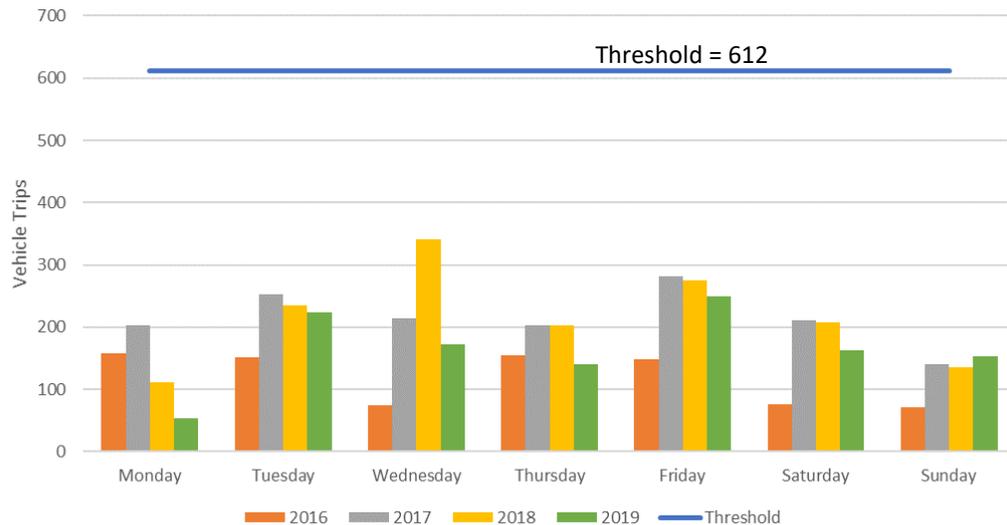
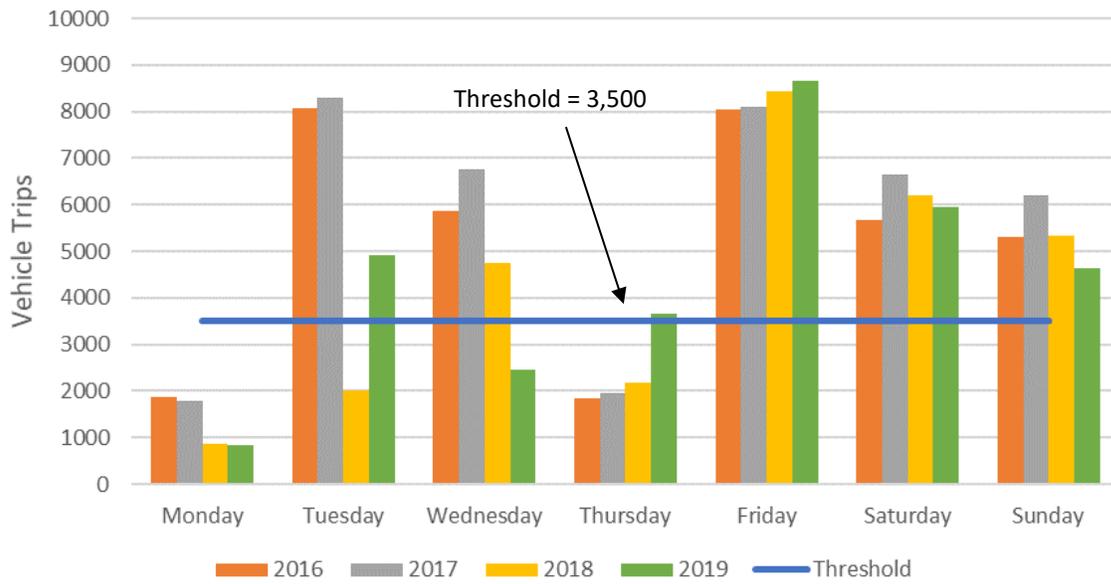


Figure 11. Automobile Trends – Daily (24-Hour Period)



Truck and Bus Traffic Trends

Figures 12, 13, and 14 compare truck volumes to prior monitoring results for the AM peak, PM peak, and 24-hour periods, respectively. These volumes include buses and trucks. The AM peak period and daily volumes of trucks have fluctuated during the weekdays (apart from Wednesday in 2018, where AM truck volumes were high). Weekend AM and daily volumes in 2019 were greater than previous years, but PM truck volumes decreased in 2019 compared to previous years, during all days of the week. As in past years, truck volume thresholds were met or exceeded every day during the AM peak period and the daily (24-hour) period except Mondays. The PM peak period threshold was not met on any day.

Figure 12. Truck and Bus Trends – AM Peak Period (7:15 – 8:30 AM)

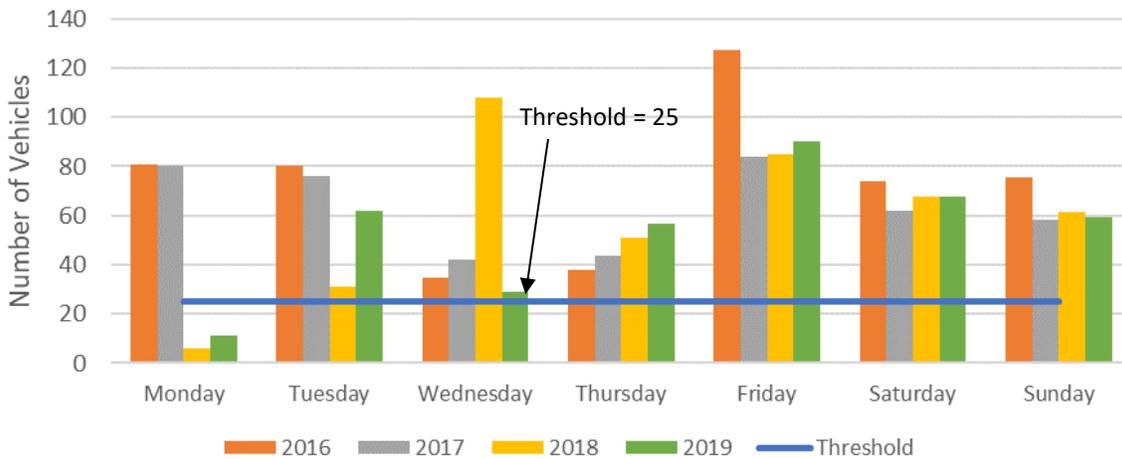


Figure 13. Truck and Bus Trends – PM Peak Period (3:45 – 5:30 PM)

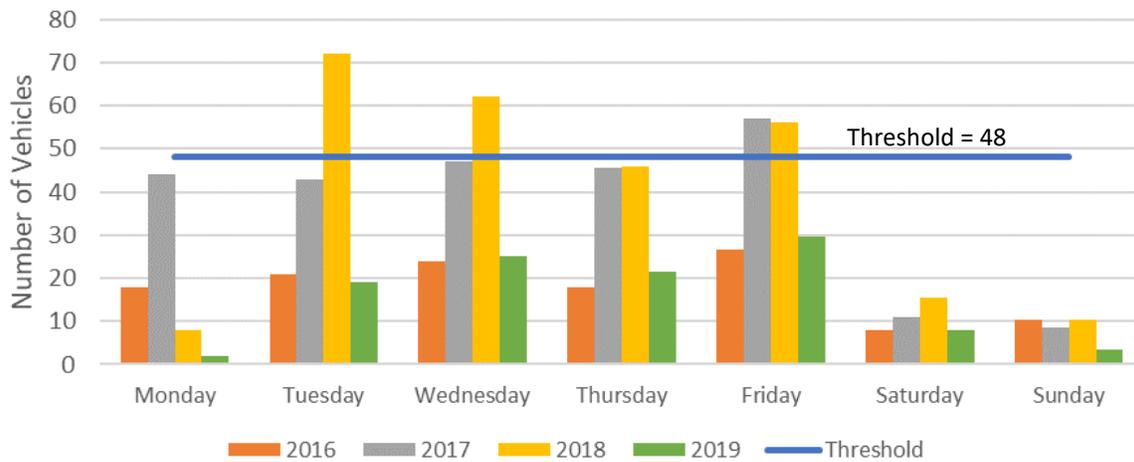
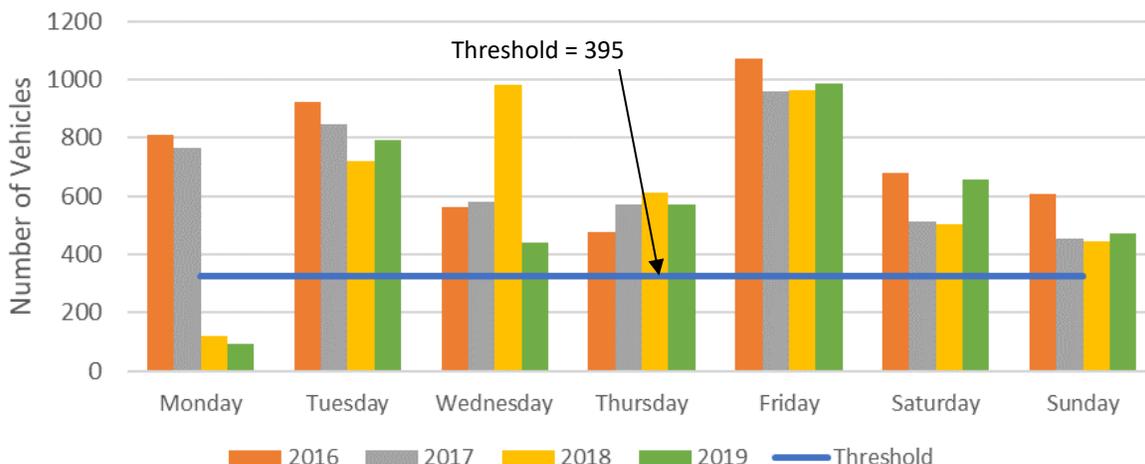


Figure 14. Truck and Bus Trends – Daily (24-Hour Period)



Intersection Level of Service

Trigger Levels

The SFRA established level of service trigger levels for five off-site intersections. Level of service is a qualitative measure used to characterize traffic operating conditions. Six letter designations, “A” through “F,” are used to define level of service. LOS A is the best and represents good traffic operations with little or no delay to motorists. LOS F is the worst and indicates poor traffic operations with long delays. The trigger levels are summarized in Table 6. It is noted that the SFRA included the West Galer Street intersection on Elliott Avenue West, which was the primary access to Terminal 91 when the SFRA was created. That access has been replaced with the Galer Street Flyover. Therefore, the trigger level previously established for Galer Street was applied to the Elliott Avenue West/West Galer Street Flyover intersection. This year for 2019, additional intersections of 20th Avenue West / West Dravus Street and 15th Avenue West / West Dravus Street are included in the report consistent with the original SFRA.

Table 6. Level of Service Trigger Levels from SFRA

Intersection	Trigger Level
Elliott Avenue W / Galer Street Flyover	LOS E
Elliott Avenue W / W Garfield Street	LOS C
Elliott Avenue W / W Mercer Place	LOS E
15th Avenue W / W Dravus Street	LOS D
20th Avenue W / W Dravus Street	LOS D

Source: Terminal 91 Short Fill Redevelopment Agreement (as amended 1985 and 1998). SFRA included the Elliott Avenue West / West Galer Street Intersection, which was the primary access to Terminal 91. That access has been replaced with the Galer Street Flyover. Intersections at Dravus are now included.

As previously discussed, the level of service methodology prescribed by the SFRA (Critical Lane Analysis) is outdated. Computers now allow more complex calculations to occur, which have resulted in more accurate analyses of intersection operations. For this study, intersection levels of service were determined using the methodologies in the Highway Capacity Manual (Transportation Research Board, 2000). Levels of service for study area intersections were calculated using Trafficware’s Synchro 10 traffic operations analysis software, which is also the latest version of software. Current level of service criteria for signalized intersections can be found in Appendix B.

In 2013, SDOT installed Traffic Responsive Operations Systems technology along the Elliott Avenue/15th Avenue corridor between West Armour Street and West Harrison Street. The signalized intersections along this corridor section use volume detection technology to change the traffic signal cycles and operation based on traffic volume. The technology allows for 15 different operational programs that are available during the day (five AM peak hour options, five PM peak hour options, and five off-peak options), instead of just one per time period under the former signal system. Each operational program is triggered when a specific traffic demand threshold is met. Since the operations can change as volumes change throughout the day, SDOT staff recommended that the Synchro model's cycle length and signal phase times should be "optimized" for each condition. This analysis uses the recommended approach.

SDOT is preparing to install SCOOT, an adaptive signal system which dynamically changes intersection signal timing in real time based on traffic volumes, along Elliott Avenue West and 15th Avenue West. This system was recently installed on the Mercer Street corridor in Seattle, and studies have shown an increase in vehicle throughput and a decrease in vehicle delays as a result. This traffic signal system upgrade is being paid for by Expedia as part of their permitting requirements. While this system was not in operation at the time of this report, in the future it should increase vehicle throughput, minimize delays at signals and overall improve corridor operations on the 15th Avenue / Elliott Avenue corridor. SDOT has not finalized the list of intersections where SCOOT will be installed, but the preliminary list includes the following:

- Elliott Avenue West and Western Avenue
- Elliott Avenue West and Harrison Street
- Elliott Avenue West and West Mercer Street
- Elliott Avenue West and West Mercer Place
- Elliott Avenue West and West Prospect Street
- Elliott Avenue West and Galer Street Flyover
- Elliott Avenue West and West Galer Street
- 15th Avenue West and West Garfield Street
- 15th Avenue West and West Howe Street
- 15th Avenue West and West Armory Way
- 15th Avenue West and West Wheeler Street
- 15th Avenue West and Gilman Drive West
- 15th Avenue West and West Armour St

The levels of service models developed by Seattle Department of Transportation (SDOT) for the Elliott Avenue/15th Avenue corridor were used for all analyses; these models reflect the current configuration (with the BAT lanes) and the volume-responsive traffic signal timing. However, these models use phasing plans that are not compatible with the stricter HCM 2010 phasing requirements (such as dedicated pedestrian phases). As a result, HCM 2000 was used to evaluate the intersection level of service since 2016. It is noted that HCM methodology was not used to calculate intersection level of service in years prior to 2016. This change, along with slight alterations to the traffic signal timing and phasings implemented by the City of Seattle, result in more variation in average vehicle delay when comparing results before and after 2016.

Year 2019 Traffic Volumes

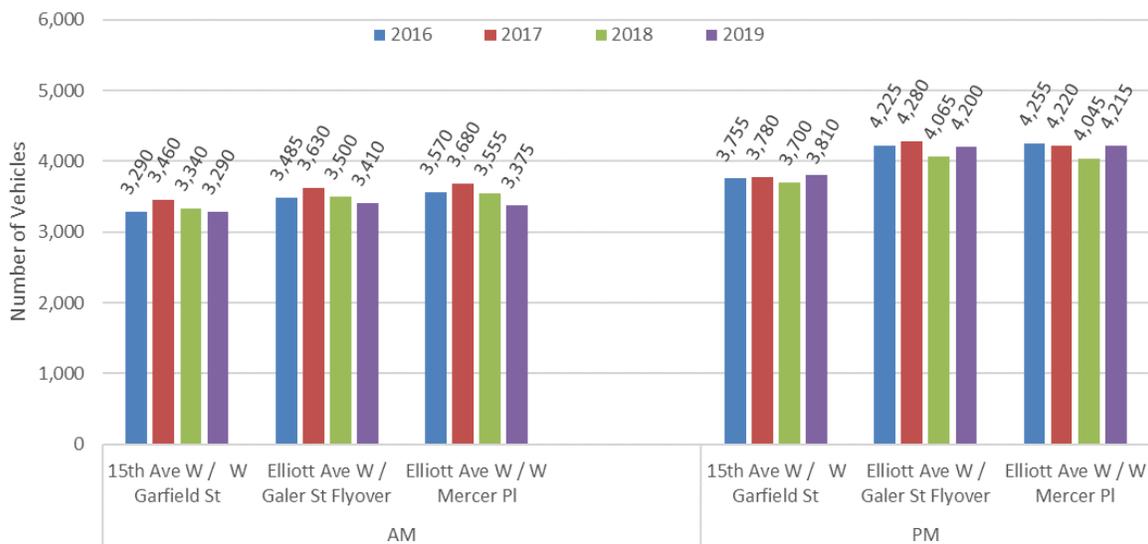
Without Cruise Activity

New intersection counts were performed at all three study intersections on Thursday August 29, 2019 for two hours during the AM (7:00 – 9:00 AM) and PM (4:00 – 6:00 PM) peak periods. These counts were performed when no cruise activity was occurring at the Port. The peak one hour during each of the count periods was identified and used for the intersection analysis. These peak one-hour traffic volumes are reported from 7:45 to 8:45 A.M. and from 4:30 to 5:30 P.M. It is noted that these peak hours differ from the longer-than-60-minute periods prescribed by the SFRA. The peak hours were selected to meet industry standard for traffic analysis and level of service definitions and are consistent with other traffic studies performed by the City of Seattle. Traffic volumes without cruise activity are shown on Figure 16 for the AM and PM peak hours, respectively. Additionally, the raw intersection turning movement counts are shown in Appendix A.

The study found that intersection traffic volumes have changed little since 2016. For each year since 2016, the total number of vehicles entering each of the intersections during the peak hours is compared on Figure 15. All sets of counts reflect late August or September conditions without cruise activity at Terminal 91. Volumes during both the AM and PM peak hours have remained nearly constant from 2015 to 2019, as both intersections are near capacity. This makes processing more vehicles during peak periods difficult, even if travel demand is generally increasing.

The Expedia Group has been renovating the former Amgen site south of Terminal 91 for their Expedia Campus. During Summer 2019 construction traffic was underway and may have been included in these counts. Employee move in began in October 2019 (after the study) and will show in next year’s study.

Figure 15. Total Traffic Entering Intersection – Without Cruise Activity



Source: Intersection turning movement counts performed for the respective Terminal 91 Monitoring Studies. All sets of counts reflect Q3 conditions without cruise activity at Terminal 91.

With Cruise Activity

The gate counts described in the prior sections were used to determine the net change in AM and PM peak hour traffic associated with cruise activity at Terminal 91. Two conditions with cruise activity were evaluated: a typical weekday with one ship call at the terminal (Tuesday) and a peak weekday with two large ship calls (Friday). These were compared to a day with no cruise (Wednesday) to determine the traffic associated with cruise activity. The trip generation estimates are summarized in Table 7. As shown, cruise related trips are highest during the AM peak hour with 781 trips generated on the peak Friday. During the PM peak hour, on the same day, there were 45 more trips on a peak cruise ship day than on a non-cruise ship day accessing Terminal 91, highlighting that PM peak hour traffic is largely unaffected by cruise ship activity. The raw intersection turning movement counts are shown in Appendix A.

Due to low traffic volumes during the PM peak hour at both gates, the small number of vehicles generated in the PM peak hour and the relatively low number of vehicles that use the west gate, a small change in daily traffic volumes can result in a net negative number of vehicles when comparing a cruise day to a non-cruise day.

Table 7. Weekday Peak Hour Traffic: Cruise Day vs. Non-Cruise Day - 2019

	East Gate		West Gate		Total Terminal 91		
	Enter	Exit	Enter	Exit	Enter	Exit	Total
AM Peak Hour (7:45 to 8:45 AM)							
Non-Cruise Day (Wed 9/4/2018)	46	37	89	2	135	39	174
Typical Weekday Cruise Day (Tues 9/3/2018)	147	162	107	0	254	162	416
Peak Weekday Cruise Day (Fri 9/6/2018)	378	372	107	98	485	470	955
Net Change with Typical Weekday Cruise	101	125	18	-2	119	123	242
Net Change with Peak Weekday Cruise	332	335	18	96	350	431	781
PM Peak Hour (4:30 to 5:30 PM)							
Non-Cruise Day (Wed 9/4/2018)	19	69	0	0	19	69	88
Typical Weekday Cruise Day (Tues 9/4/2018)	33	65	2	0	35	65	100
Peak Weekday Cruise Day (Fri 9/6/2018)	23	108	2	0	25	108	133
Net Change with Typical Weekday Cruise	14	-4	2	0	16	-4	12
Net Change with Peak Weekday Cruise	4	39	2	0	6	39	45

Source: Ten-day tube counts conducted by IDAX, Friday, August 30 to Sunday, September 8, 2019. Combined volumes at both East Gate and West Gate for entry to and from Terminal 91.

The additional peak hour traffic generated by the cruise terminal on an average weekday (with one ship call) and the peak weekday (two ship calls) was distributed to the roadway network and assigned to the study-area intersections according to defined travel patterns established in the 2010 monitoring study. The AM and PM cruise terminal trips for one and two cruise ship conditions are shown in Figure 17 and Figure 18, respectively.



Existing (2019) Peak Hour Traffic Volumes Without Cruise Activity at T91 FIGURE



Additional Peak Hour Traffic due to One Cruise

Terminal 91 - Annual Traffic Monitoring - 2019

FIGURE



Additional Peak Hour Traffic due to Two Cruises

FIGURE



Peak Hour Traffic Volumes With One Cruise at T91

FIGURE



Peak Hour Traffic Volumes With Two Cruises at T91

FIGURE

Level of Service Analysis

Peak hour traffic volumes shown on Figures 16 through 20 were used to determine the level of service for study-area intersections. The analysis reflects existing conditions on a normal day (without cruise operations at Terminal 91), on a weekday with one ship call, and on a weekday with two ship calls. The methodology used to determine level of service was previously described in the *Trigger Levels* section. The results are summarized in Table 8 and the detailed level of service reports can be found in Appendix C.

The study found that the level of service results for the ‘without cruise conditions’ at each study intersection all operate below the SFRA threshold level. The addition of the traffic resulting from a typical one-ship day does not significantly impact operations at any of the study intersections. On two-cruise ship days, intersection LOS results also operate below the SFRA threshold level.

Table 8. Weekday Peak Hour Traffic: Cruise Day vs. Non-Cruise Day – 2019

	SFRA Trigger Level ^A	Average Weekday Without Cruise		Average Weekday With One Ship		Peak Weekday With Two Ships	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
AM Peak Hour							
15th Ave / Garfield Street	LOS C	A	6.0	A	6.3	A	7.0
Elliott Ave / Galer Flyover	LOS E	A	4.1	A	6.7	B	13.7
Elliott Ave / W Mercer Place	LOS E	B	18.2	B	18.4	C	22.7
15th Ave / Dravus Street NB	LOS D	B	18.2	B	18.5	B	19.3
15th Ave / Dravus Street SB	LOS D	C	23.6	C	23.6	C	23.9
20th Ave / Dravus Street	LOS D	B	14.4	B	14.6	B	14.8
PM Peak Hour							
15th Ave / Garfield Street	LOS C	A	7.6	A	7.6	A	7.6
Elliott Ave / Galer Flyover	LOS E	A	7.2	A	7.3	A	7.8
Elliott Ave / W Mercer Place	LOS E	C	29.2	C	29.3	C	29.5
15th Ave / Dravus Street NB	LOS D	D	37.4	D	37.4	D	37.8
15th Ave / Dravus Street SB	LOS D	C	27.0	C	27.0	C	27.0
20th Ave / Dravus Street	LOS D	C	22.8	C	22.9	C	22.9

Source: Levels of service were calculated using traffic operations models developed by SDOT for the Elliott Avenue corridor. They reflect existing signal timing and lane geometry. All analysis was performed using the Synchro 10.0 model and analysis methodology.

A. Level of service threshold established by Short-Fill Redevelopment Agreement, January 2000. The SFRA included the Elliott Avenue W / W Galer Street intersection which was the primary access to Terminal 91. That access has been replaced with the Galer Street Flyover. The intersections of 15th / Dravus and 20th / Dravus were removed from annual monitoring after the North Gate was closed, but are now included. Table 7 shows the historic SFRA trigger levels for these intersections.

Level of service results from Terminal 91 Monitoring Reports dating back to 2016 are compared on Figure 21 for the Elliott Avenue West / Galer Street Flyover intersection and on Figure 22 for the Elliott Avenue West / West Mercer Place intersection. The intersection of 15th Avenue West / West Garfield Street has operated well (LOS A) throughout the course of the annual T-91 studies, and therefore no figure has been provided below. The graphs compare the average vehicle delay with and without cruise traffic. Operations during the peak periods were similar in 2019 compared to previous years. Figures 21 and 22 show that both intersections operate well within the delay associated with the LOS E threshold established by the SFRA.

Figure 21. Traffic Operations at Elliott Avenue West / Galer Street Flyover Intersection

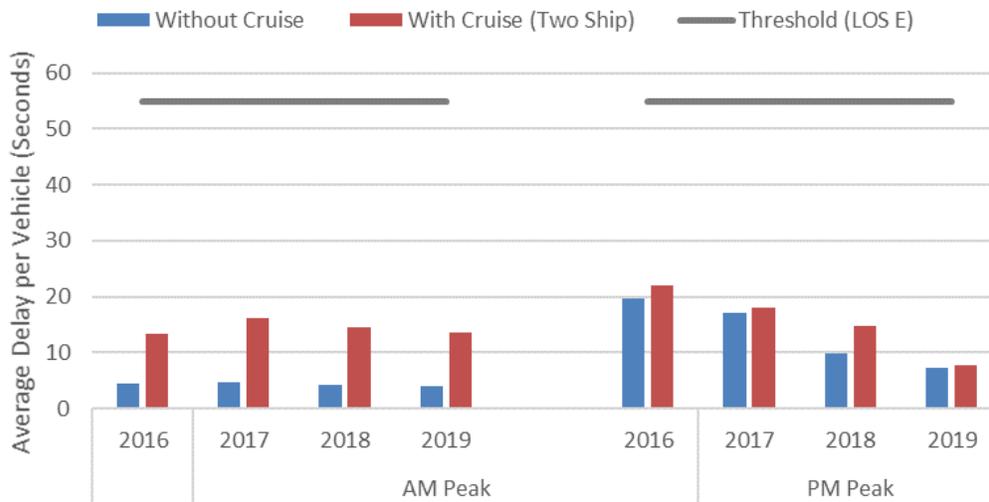
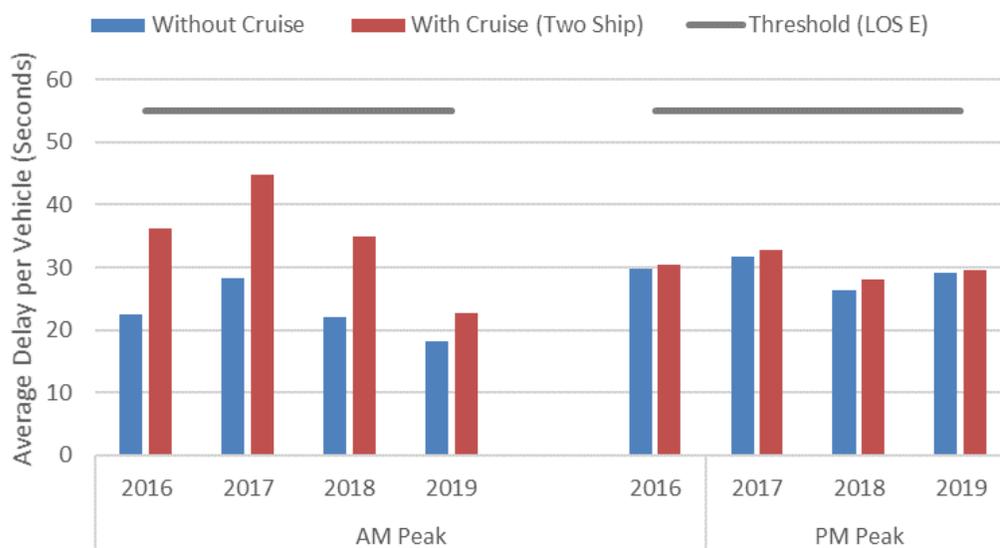


Figure 22. Traffic Operations at Elliott Avenue West / West Mercer Place Intersection



Elliott Avenue West / 15th Avenue West Corridor Travel Speeds

The 2019 monitoring study included travel speeds. This was the first time the study has ever included travel speed as part of the review. Speeds were collected along Elliott Avenue West and 15th Avenue West Corridor between Market Street on the north and West Mercer Place on the south. This provides an additional measurement of traffic flow in the T-91 area, as a complement to intersection LOS based on NAC feedback from prior annual reports. Corridor travel speeds are related to intersection LOS because intersection delays are usually the biggest contributor to the decrease in corridor speed. These speeds were captured via INRIX, a company that purchases GPS data from vehicle fleets and uses it to measure minute by minute roadway travel speeds. These GPS data points are pulled from a sample of the total traffic stream and based on previous studies that compare INRIX to other methods of travel speed capture, represent a statistically significant portion of the traffic. This results in INRIX produce statistically accurate estimates for roadway travel speeds.

Figure 23 and Figure 24 show the average northbound and southbound travel speeds for the Elliott Avenue West / 15th Avenue West Corridor for an average weekday in September of 2016, 2017, 2018 and 2019.

Travel speeds in the northbound direction are relatively consistent throughout the day, but slow during the PM peak period. Southbound travel speeds decrease during the AM peak, and then remain relatively consistent for the rest of the day. Northbound travel speeds decrease during the PM peak period but are relatively consistent for the rest of the day. Both northbound and southbound travel speeds were generally slowest in 2017, increased in 2018, then decreased slightly in 2019. In both the AM and PM peak periods, speeds in the peak direction along Elliott Avenue West / 15th Avenue South decrease to 40 – 50 percent of their typical free flow speeds, indicating measurable congestion is present along the corridor.

This method of travel speed measurement is much newer than the original SFRA, and as such there is no SFRA threshold for travel speed. It is included in the 2019 report to provide another method of measuring traffic flow in the T-91 area, that can be compared year to year. This method of collecting roadway travel speeds is becoming increasingly common, and data availability will continue to increase in the coming years.

Figure 23. Elliott Ave W / 15th Ave W Corridor: Northbound Travel Speed Comparison

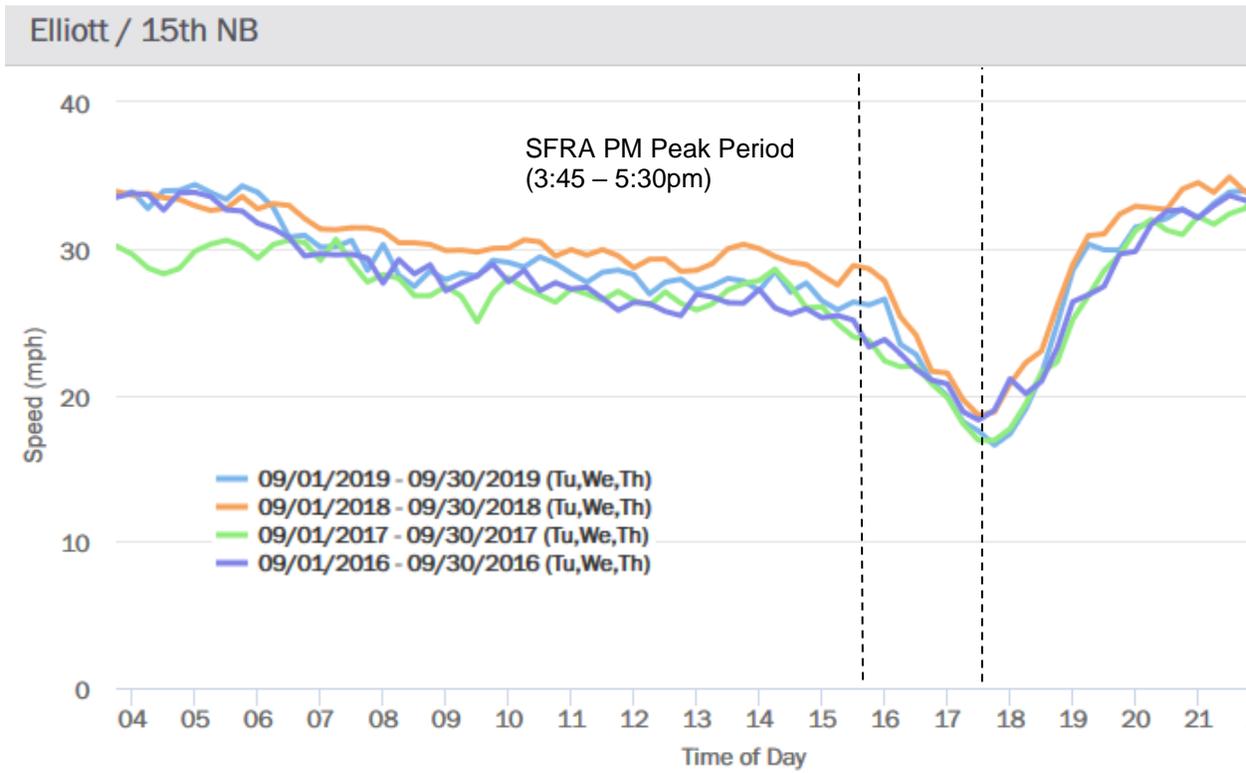
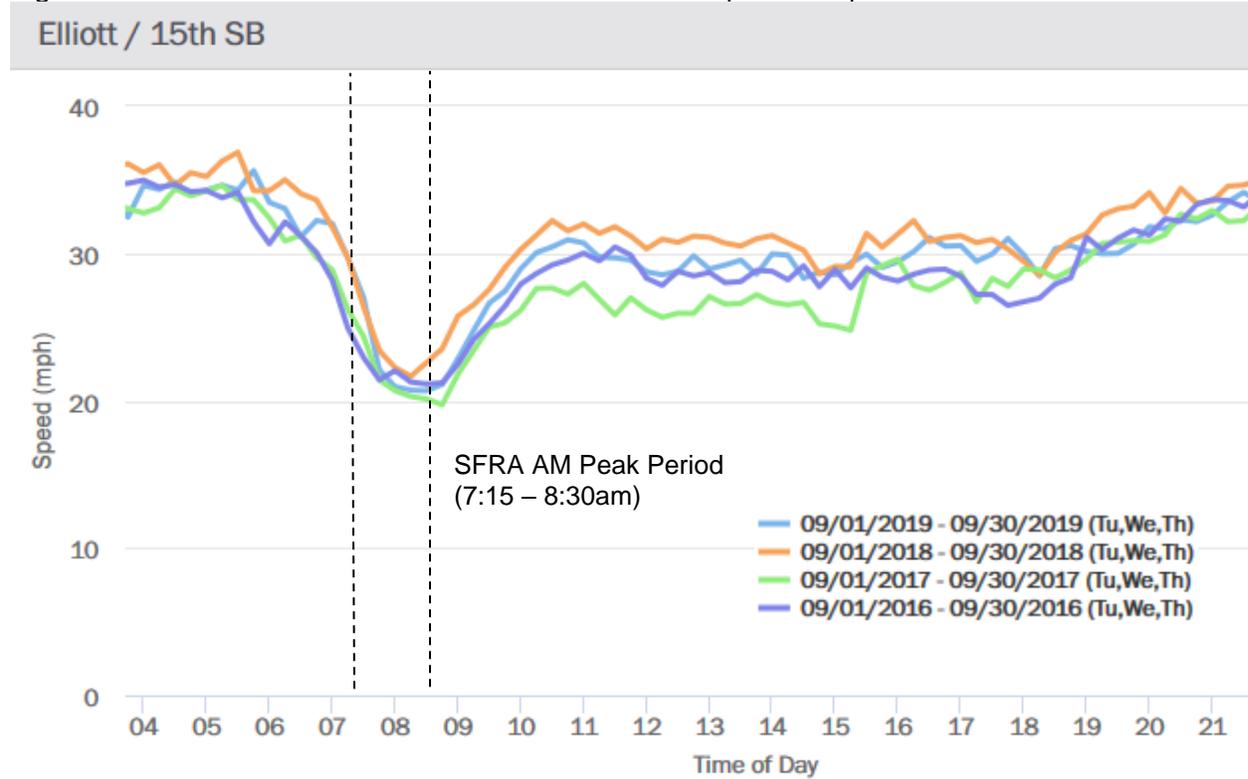


Figure 24. Elliott Ave W / 15th Ave W Southbound Travel Speed Comparison



Conclusions

The 2019 Terminal 91 Traffic Monitoring Study shows that truck trips continue to exceed the volume thresholds for AM and daily periods. Automobile trips exceed the thresholds during the AM and daily periods on days with cruise operations. However, despite the traffic volume thresholds being exceeded, traffic operations along the Elliott Avenue West / 15th Avenue West corridor still operate below the intersection trigger levels listed in the Short Fill Redevelopment Agreement (SFRA) at each of the study intersections during both the AM and PM peak hours.

Appendix A: Intersection Traffic Counts

AM Counts

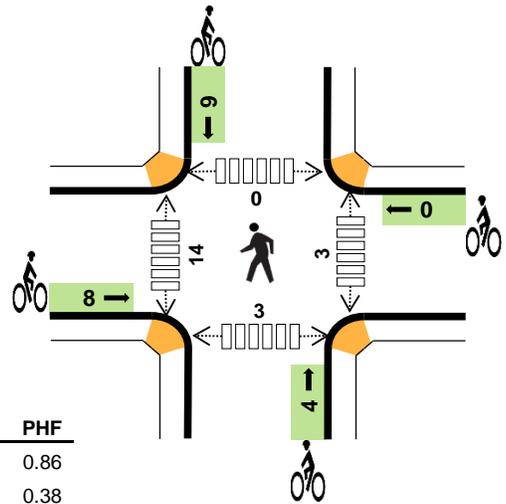
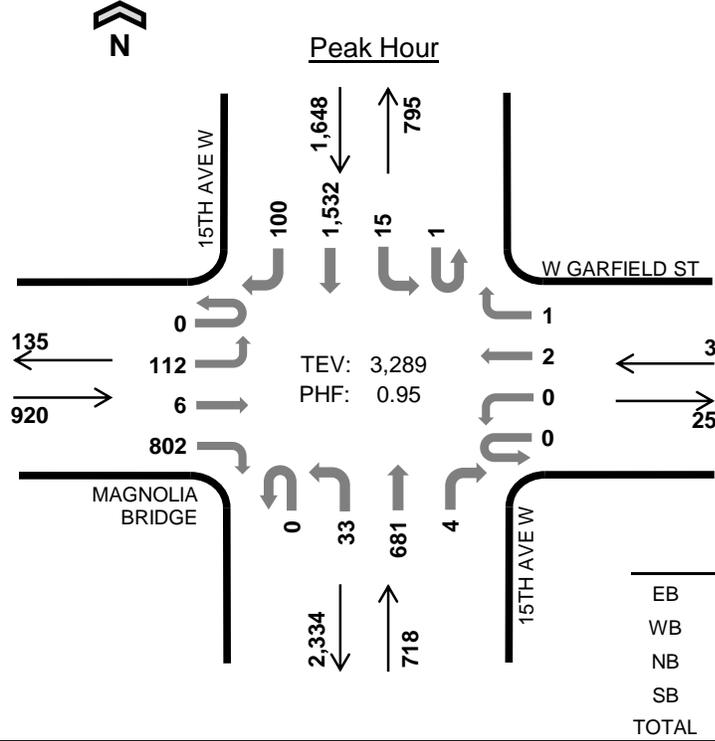


15TH AVE W W GARFIELD ST

Date: Thu, Aug 29, 2019

Count Period: 7:00 AM to 9:00 AM

Peak Hour: 7:45 AM to 8:45 AM



	HV %:	PHF
EB	1.8%	0.86
WB	0.0%	0.38
NB	6.1%	0.92
SB	3.5%	0.96
TOTAL	3.6%	0.95

Two-Hour Count Summaries

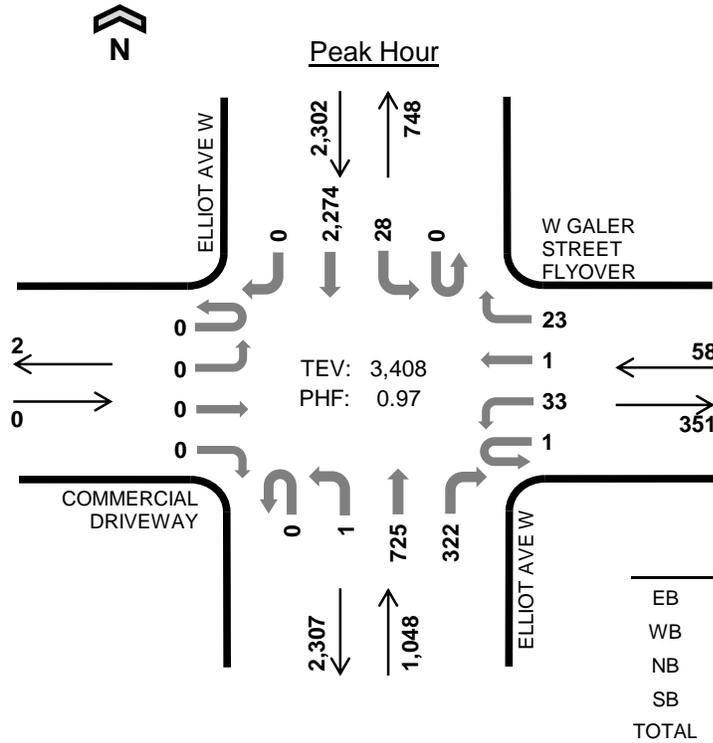
Interval Start	MAGNOLIA BRIDGE				W GARFIELD ST				15TH AVE W				15TH AVE W				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	11	0	148	0	0	0	0	0	8	143	0	0	0	290	5	605	0
7:15 AM	0	12	0	170	0	0	0	0	0	8	131	0	0	2	317	18	658	0
7:30 AM	0	19	0	170	0	0	0	0	0	6	146	0	0	4	419	17	781	0
7:45 AM	0	25	2	190	0	0	1	0	0	9	178	0	0	6	379	29	819	2,863
8:00 AM	0	24	0	176	0	0	0	0	0	8	168	3	0	3	402	22	806	3,064
8:15 AM	0	29	3	234	0	0	0	0	0	6	189	0	1	5	375	27	869	3,275
8:30 AM	0	34	1	202	0	0	1	1	0	10	146	1	0	1	376	22	795	3,289
8:45 AM	0	32	0	180	0	0	0	1	0	8	183	0	0	2	340	31	777	3,247
Count Total	0	186	6	1,470	0	0	2	2	0	63	1,284	4	1	23	2,898	171	6,110	0
Peak Hour	0	112	6	802	0	0	2	1	0	33	681	4	1	15	1,532	100	3,289	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

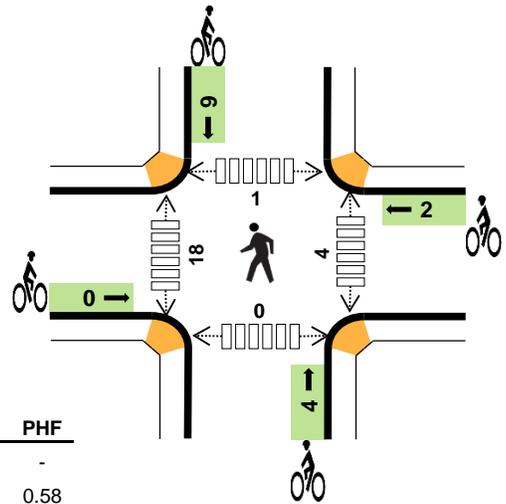
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	7	0	19	9	35	0	0	2	2	4	1	2	0	0	3
7:15 AM	3	0	10	11	24	6	0	0	2	8	1	4	0	0	5
7:30 AM	3	0	16	14	33	0	0	0	2	2	2	2	0	0	4
7:45 AM	6	0	7	10	23	1	0	0	4	5	1	5	0	1	7
8:00 AM	3	0	11	15	29	1	0	0	0	1	0	1	0	0	1
8:15 AM	5	0	21	17	43	4	0	3	3	10	1	3	0	0	4
8:30 AM	3	0	5	15	23	2	0	1	2	5	1	5	0	2	8
8:45 AM	4	0	10	9	23	2	0	1	2	5	0	3	1	0	4
Count Total	34	0	99	100	233	16	0	7	17	40	7	25	1	3	36
Peak Hour	17	0	44	57	118	8	0	4	9	21	3	14	0	3	20



ELLIOT AVE W W GALER STREET FLYOVER



Date: Thu, Aug 29, 2019
 Count Period: 7:00 AM to 9:00 AM
 Peak Hour: 7:45 AM to 8:45 AM



	HV %:	PHF
EB	-	-
WB	34.5%	0.58
NB	7.6%	0.94
SB	3.1%	0.97
TOTAL	5.0%	0.97

Two-Hour Count Summaries

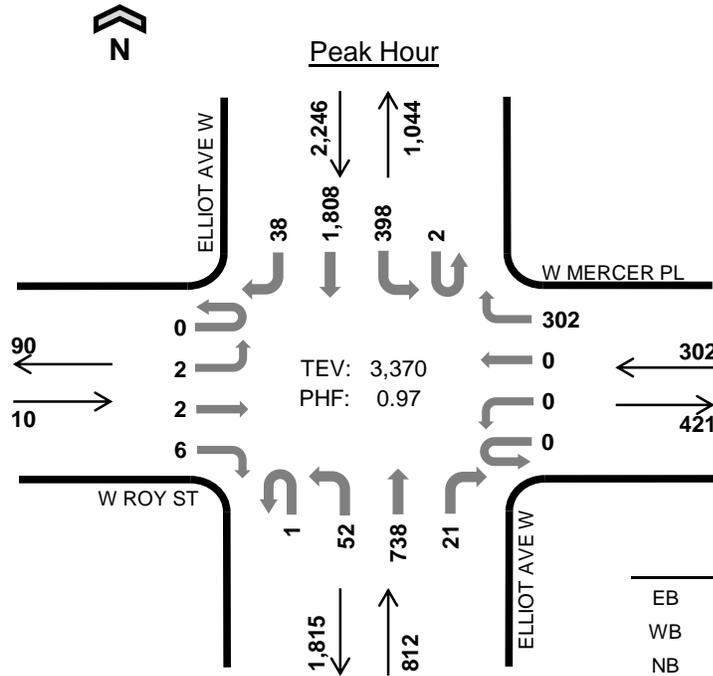
Interval Start	COMMERCIAL DRIVEWAY				W GALER STREET FLYOVER				ELLIOT AVE W Northbound				ELLIOT AVE W Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	0	0	0	5	0	8	0	0	133	87	0	7	431	0	671	0
7:15 AM	0	0	0	0	0	11	0	7	0	0	138	67	0	9	474	0	706	0
7:30 AM	0	0	0	0	0	13	0	7	0	0	147	84	0	8	568	0	827	0
7:45 AM	0	0	0	0	0	2	0	7	0	0	186	94	0	8	573	0	870	3,074
8:00 AM	0	0	0	0	0	10	0	2	0	0	182	72	0	13	536	0	815	3,218
8:15 AM	0	0	0	0	1	6	0	5	0	0	193	80	0	4	590	0	879	3,391
8:30 AM	0	0	0	0	0	15	1	9	0	1	164	76	0	3	575	0	844	3,408
8:45 AM	0	0	0	0	1	12	0	8	0	0	175	78	0	3	496	0	773	3,311
Count Total	0	0	0	0	2	74	1	53	0	1	1,318	638	0	55	4,243	0	6,385	0
Peak Hour	0	0	0	0	1	33	1	23	0	1	725	322	0	28	2,274	0	3,408	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	0	3	26	16	45	0	0	1	1	2	3	3	0	0	6
7:15 AM	0	5	17	13	35	0	0	0	5	5	1	4	0	0	5
7:30 AM	0	9	22	13	44	0	0	0	3	3	2	6	0	0	8
7:45 AM	0	3	20	16	39	0	0	0	3	3	2	4	0	0	6
8:00 AM	0	4	19	18	41	0	1	0	0	1	0	1	0	0	1
8:15 AM	0	4	28	21	53	0	1	2	4	7	0	7	0	0	7
8:30 AM	0	9	13	17	39	0	0	2	2	4	2	6	1	0	9
8:45 AM	0	6	17	12	35	0	0	1	5	6	0	5	0	0	5
Count Total	0	43	162	126	331	0	2	6	23	31	10	36	1	0	47
Peak Hour	0	20	80	72	172	0	2	4	9	15	4	18	1	0	23

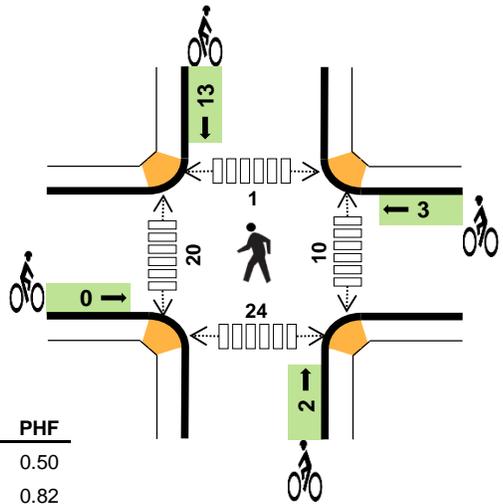


ELLIOT AVE W W MERCER PL



Date: Thu, Aug 29, 2019
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 7:45 AM to 8:45 AM

	HV %:	PHF
EB	20.0%	0.50
WB	12.6%	0.82
NB	6.9%	0.89
SB	3.9%	0.93
TOTAL	5.4%	0.97



Two-Hour Count Summaries

Interval Start	W ROY ST				W MERCER PL				ELLIOT AVE W				ELLIOT AVE W				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	1	1	0	0	0	88	0	7	143	5	0	99	326	5	675	0
7:15 AM	0	0	0	0	0	0	0	69	0	11	133	4	0	122	354	9	702	0
7:30 AM	0	0	0	2	0	0	0	100	0	9	169	4	0	91	477	6	858	0
7:45 AM	0	0	0	0	0	0	0	92	1	9	176	7	0	84	493	3	865	3,100
8:00 AM	0	0	1	1	0	0	0	59	0	16	207	4	1	100	392	9	790	3,215
8:15 AM	0	1	1	3	0	0	0	66	0	15	198	3	0	89	452	18	846	3,359
8:30 AM	0	1	0	2	0	0	0	85	0	12	157	7	1	125	471	8	869	3,370
8:45 AM	0	0	0	0	0	0	0	78	0	14	187	3	1	100	388	9	780	3,285
Count Total	0	2	3	9	0	0	0	637	1	93	1,370	37	3	810	3,353	67	6,385	0
Peak Hour	0	2	2	6	0	0	0	302	1	52	738	21	2	398	1,808	38	3,370	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

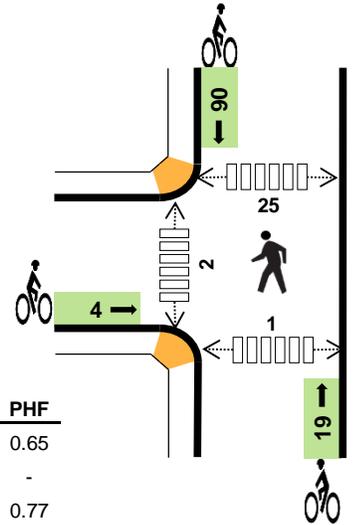
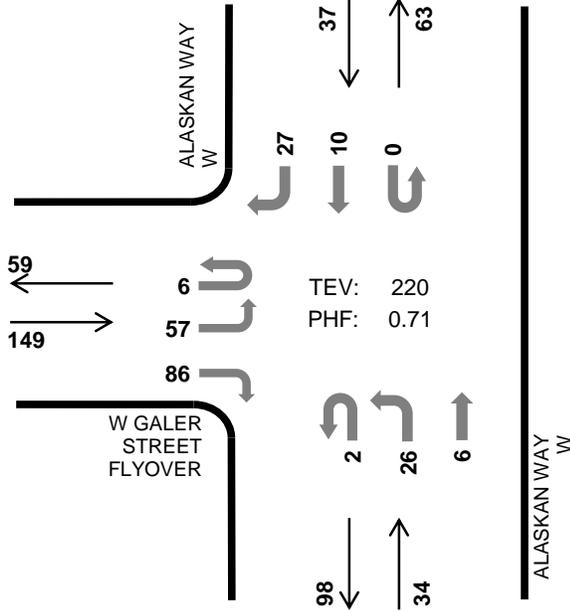
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	0	9	19	21	49	0	0	1	1	2	0	1	0	3	4
7:15 AM	0	8	10	17	35	0	0	0	7	7	1	4	0	3	8
7:30 AM	1	18	12	18	49	0	0	0	4	4	2	7	0	8	17
7:45 AM	0	7	16	21	44	0	0	0	4	4	2	8	0	6	16
8:00 AM	0	12	15	17	44	0	0	0	0	0	0	1	0	1	2
8:15 AM	1	11	20	23	55	0	1	1	6	8	5	4	0	8	17
8:30 AM	1	8	5	26	40	0	2	1	3	6	3	7	1	9	20
8:45 AM	0	11	10	14	35	0	0	1	4	5	4	4	0	3	11
Count Total	3	84	107	157	351	0	3	4	29	36	17	36	1	41	95
Peak Hour	2	38	56	87	183	0	3	2	13	18	10	20	1	24	55

ALASKAN WAY W W GALER STREET FLYOVER



Peak Hour

Date: Thu, Aug 29, 2019
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 7:00 AM to 8:00 AM



	HV %:	PHF
EB	17.4%	0.65
WB	-	-
NB	29.4%	0.77
SB	35.1%	0.84
TOTAL	22.3%	0.71

Two-Hour Count Summaries

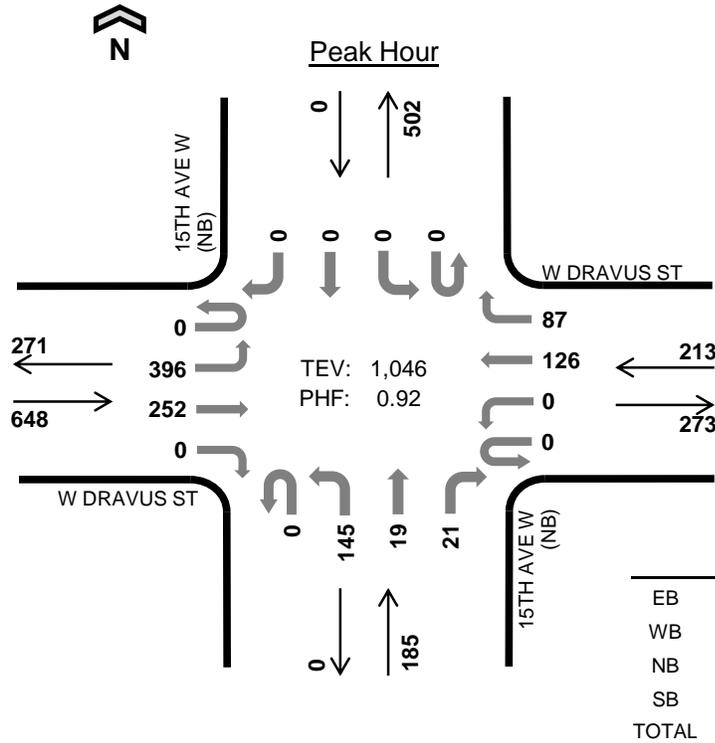
Interval Start	W GALER STREET FLYOVER				0				ALASKAN WAY W				ALASKAN WAY W				15-min Total	Rolling One Hour
	Eastbound		Westbound		Northbound		Southbound		UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	2	16	0	39	0	0	0	0	1	7	2	0	0	0	5	6	78	0
7:15 AM	2	17	0	15	0	0	0	0	0	9	2	0	0	0	2	6	53	0
7:30 AM	2	13	0	17	0	0	0	0	1	8	0	0	0	0	1	10	52	0
7:45 AM	0	11	0	15	0	0	0	0	0	2	2	0	0	0	2	5	37	220
8:00 AM	1	23	0	6	0	0	0	0	0	6	2	0	0	0	2	9	49	191
8:15 AM	0	10	0	7	0	0	0	0	0	6	0	0	0	0	1	4	28	166
8:30 AM	4	14	0	10	0	0	0	0	0	16	3	0	0	0	2	12	61	175
8:45 AM	1	14	0	11	0	0	0	0	0	5	2	0	0	0	2	7	42	180
Count Total	12	118	0	120	0	0	0	0	2	59	13	0	0	0	17	59	400	0
Peak Hour	6	57	0	86	0	0	0	0	2	26	6	0	0	0	10	27	220	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

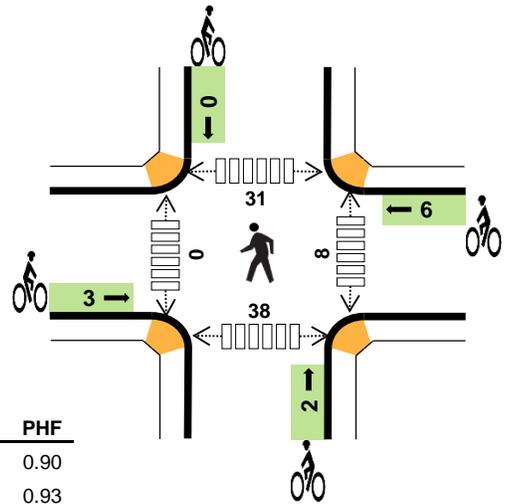
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	6	0	0	4	10	0	0	6	13	19	6	0	6	0	12
7:15 AM	4	0	3	4	11	2	0	6	19	27	6	0	6	0	12
7:30 AM	8	0	5	3	16	0	0	3	25	28	11	0	9	0	20
7:45 AM	8	0	2	2	12	2	0	4	33	39	7	2	4	1	14
8:00 AM	5	0	2	5	12	1	0	3	23	27	7	4	9	1	21
8:15 AM	4	0	1	1	6	2	0	3	29	34	10	0	8	2	20
8:30 AM	5	0	7	6	18	1	0	8	22	31	8	0	8	5	21
8:45 AM	6	0	0	4	10	2	0	6	22	30	10	0	9	1	20
Count Total	46	0	20	29	95	10	0	39	186	235	65	6	59	10	140
Peak Hr	26	0	10	13	49	4	0	19	90	113	30	2	25	1	58



15TH AVE W (NB) W DRAVUS ST



Date: Thu, Aug 29, 2019
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 7:45 AM to 8:45 AM



	HV %:	PHF
EB	3.2%	0.90
WB	1.4%	0.93
NB	14.1%	0.93
SB	-	-
TOTAL	4.8%	0.92

Two-Hour Count Summaries

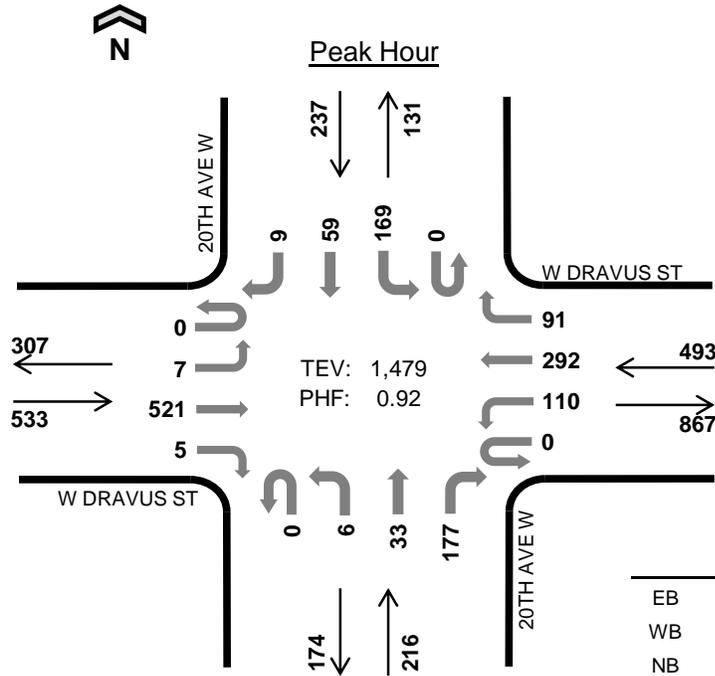
Interval Start	W DRAVUS ST				W DRAVUS ST				15TH AVE W (NB)				15TH AVE W (NB)				15-min Total	Rolling One Hour
	Eastbound		Westbound		Northbound		Southbound		UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	78	38	0	0	0	23	16	0	13	2	6	0	0	0	0	176	0
7:15 AM	0	75	47	0	0	0	11	11	0	26	3	5	0	0	0	0	178	0
7:30 AM	0	82	47	0	0	0	32	26	0	23	3	4	0	0	0	0	217	0
7:45 AM	0	116	64	0	0	0	32	24	0	37	4	6	0	0	0	0	283	854
8:00 AM	0	85	50	0	0	0	32	18	0	42	5	3	0	0	0	0	235	913
8:15 AM	0	84	73	0	0	0	26	24	0	32	4	6	0	0	0	0	249	984
8:30 AM	0	111	65	0	0	0	36	21	0	34	6	6	0	0	0	0	279	1,046
8:45 AM	0	108	74	0	0	0	28	21	0	27	3	6	0	0	0	0	267	1,030
Count Total	0	739	458	0	0	0	220	161	0	234	30	42	0	0	0	0	1,884	0
Peak Hour	0	396	252	0	0	0	126	87	0	145	19	21	0	0	0	0	1,046	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

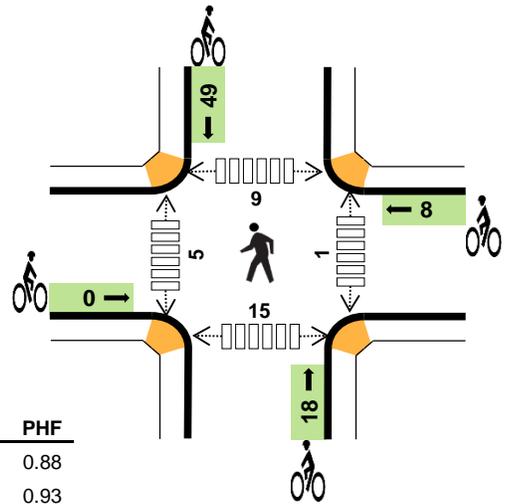
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	3	0	3	0	6	2	1	0	0	3	3	0	5	4	12
7:15 AM	6	0	6	0	12	0	1	1	0	2	2	1	8	14	25
7:30 AM	4	2	8	0	14	2	2	0	0	4	2	0	4	10	16
7:45 AM	3	1	4	0	8	1	1	0	0	2	1	0	8	14	23
8:00 AM	3	1	4	0	8	0	2	0	0	2	4	0	11	9	24
8:15 AM	7	1	9	0	17	1	2	1	0	4	0	0	6	8	14
8:30 AM	8	0	9	0	17	1	1	1	0	3	3	0	6	7	16
8:45 AM	10	1	4	0	15	1	1	0	0	2	2	0	4	5	11
Count Total	44	6	47	0	97	8	11	3	0	22	17	1	52	71	141
Peak Hour	21	3	26	0	50	3	6	2	0	11	8	0	31	38	77



20TH AVE W W DRAVUS ST



Date: Tue, Sep 10, 2019
 Count Period: 7:00 AM to 9:00 AM
 Peak Hour: 8:00 AM to 9:00 AM



	HV %:	PHF
EB	2.1%	0.88
WB	4.5%	0.93
NB	6.0%	0.87
SB	2.5%	0.77
TOTAL	3.5%	0.92

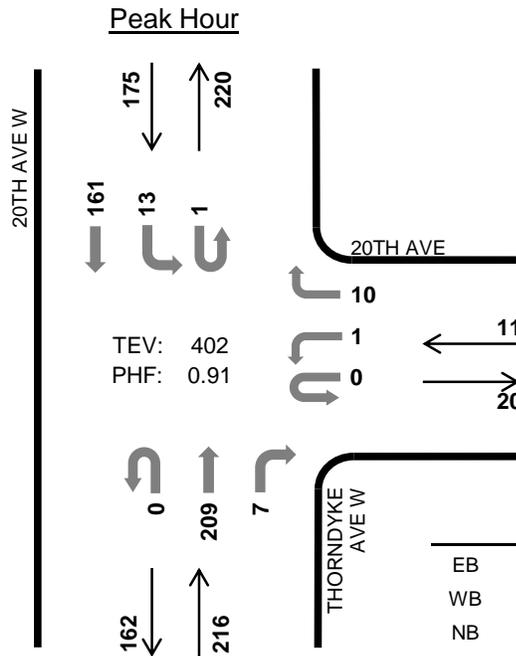
Two-Hour Count Summaries

Interval Start	W DRAVUS ST				W DRAVUS ST				20TH AVE W				20TH AVE W				15-min Total	Rolling One Hour
	Eastbound		Westbound		Northbound		Southbound		UT		LT		TH		RT			
7:00 AM	0	0	68	1	0	10	31	21	0	0	7	30	0	39	5	2	214	0
7:15 AM	0	1	105	0	0	25	49	16	0	1	6	38	0	35	9	0	285	0
7:30 AM	0	0	101	3	0	21	45	18	0	1	9	45	0	46	13	3	305	0
7:45 AM	0	0	125	0	0	17	58	12	0	3	4	44	0	47	19	2	331	1,135
8:00 AM	0	4	141	0	0	22	72	26	0	3	12	45	0	57	19	1	402	1,323
8:15 AM	0	0	151	1	0	33	81	15	0	1	7	54	0	39	10	5	397	1,435
8:30 AM	0	0	114	2	0	29	63	19	0	1	10	36	0	41	16	1	332	1,462
8:45 AM	0	3	115	2	0	26	76	31	0	1	4	42	0	32	14	2	348	1,479
Count Total	0	8	920	9	0	183	475	158	0	11	59	334	0	336	105	16	2,614	0
Peak Hour	0	7	521	5	0	110	292	91	0	6	33	177	0	169	59	9	1,479	0

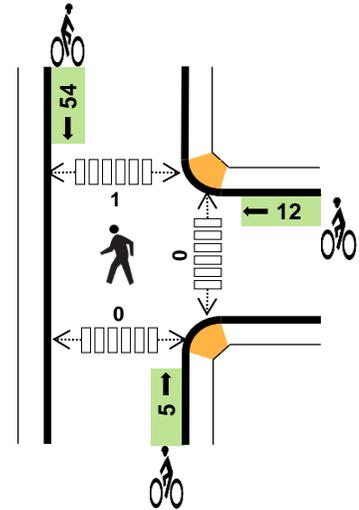
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	1	5	4	1	11	0	0	5	8	13	0	1	3	4	8
7:15 AM	5	3	2	2	12	0	3	3	5	11	1	3	0	6	10
7:30 AM	0	9	1	2	12	0	2	4	12	18	1	1	0	3	5
7:45 AM	0	4	2	4	10	0	2	3	11	16	3	0	1	5	9
8:00 AM	2	7	4	1	14	0	1	4	18	23	0	1	4	6	11
8:15 AM	3	3	2	1	9	0	4	3	10	17	0	1	1	4	6
8:30 AM	4	5	5	3	17	0	2	5	10	17	0	0	3	4	7
8:45 AM	2	7	2	1	12	0	1	6	11	18	1	3	1	1	6
Count Total	17	43	22	15	97	0	15	33	85	133	6	10	13	33	62
Peak Hour	11	22	13	6	52	0	8	18	49	75	1	5	9	15	30

THORNDYKE AVE W 20TH AVE



Date: Tue, Sep 10, 2019
 Count Period: 7:00 AM to 9:00 AM
 Peak Hour: 7:45 AM to 8:45 AM



	HV %:	PHF
EB	-	-
WB	18.2%	0.55
NB	4.6%	0.84
SB	1.7%	0.91
TOTAL	3.7%	0.91

Two-Hour Count Summaries

Interval Start	0				20TH AVE				THORNDYKE AVE W				20TH AVE W				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	0	0	0	1	0	5	0	0	31	3	0	0	16	0	56	0
7:15 AM	0	0	0	0	0	0	0	1	0	0	44	1	1	2	33	0	82	0
7:30 AM	0	0	0	0	0	0	0	2	0	0	55	1	0	3	35	0	96	0
7:45 AM	0	0	0	0	0	0	0	3	0	0	49	3	0	1	38	0	94	328
8:00 AM	0	0	0	0	0	0	0	2	0	0	55	1	1	5	36	0	100	372
8:15 AM	0	0	0	0	0	0	0	1	0	0	61	3	0	5	41	0	111	401
8:30 AM	0	0	0	0	0	1	0	4	0	0	44	0	0	2	46	0	97	402
8:45 AM	0	0	0	0	0	1	0	0	1	0	35	1	1	7	36	0	82	390
Count Total	0	0	0	0	0	3	0	18	1	0	374	13	3	25	281	0	718	0
Peak Hour	0	0	0	0	0	1	0	10	0	0	209	7	1	13	161	0	402	0

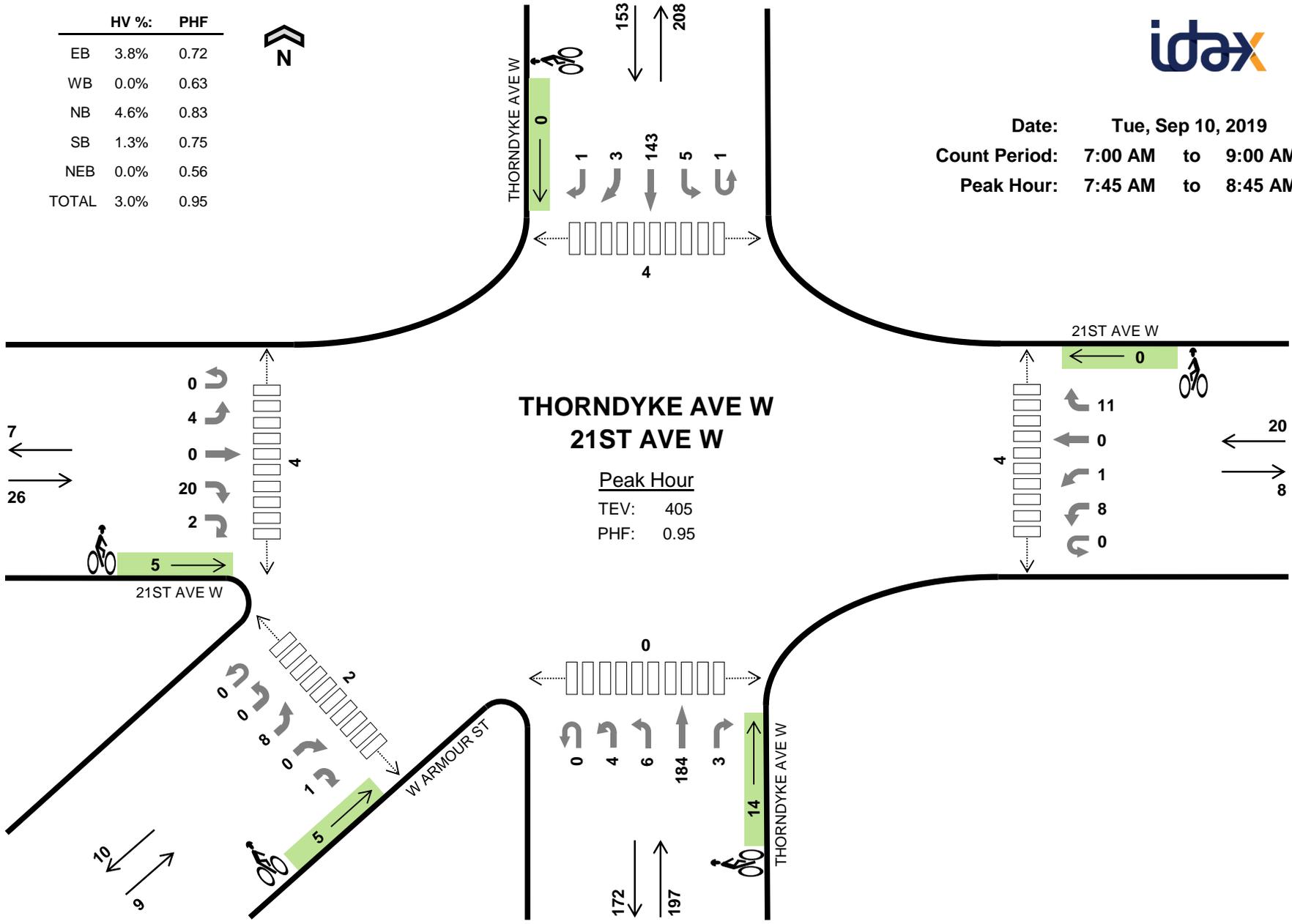
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	0	3	3	2	8	0	6	0	9	15	0	1	0	0	1
7:15 AM	0	0	2	1	3	0	3	0	9	12	1	2	1	0	4
7:30 AM	0	0	1	4	5	0	4	2	13	19	0	1	0	0	1
7:45 AM	0	1	1	0	2	0	2	1	13	16	0	4	0	0	4
8:00 AM	0	0	2	0	2	0	3	1	15	19	0	0	1	0	1
8:15 AM	0	0	3	2	5	0	2	3	17	22	0	0	0	0	0
8:30 AM	0	1	4	1	6	0	5	0	9	14	0	3	0	0	3
8:45 AM	0	0	1	1	2	0	4	1	15	20	0	2	0	0	2
Count Total	0	5	17	11	33	0	29	8	100	137	1	13	2	0	16
Peak Hr	0	2	10	3	15	0	12	5	54	71	0	7	1	0	8

	HV %:	PHF
EB	3.8%	0.72
WB	0.0%	0.63
NB	4.6%	0.83
SB	1.3%	0.75
NEB	0.0%	0.56
TOTAL	3.0%	0.95



Date: Tue, Sep 10, 2019
 Count Period: 7:00 AM to 9:00 AM
 Peak Hour: 7:45 AM to 8:45 AM



Two-Hour Count Summaries

Interval Start	21ST AVE W Eastbound					21ST AVE W Westbound					THORNDYKE AVE W Northbound					THORNDYKE AVE W Southbound					W ARMOUR ST Northeastbound					15-min Total	Rolling One Hour
	UT	LT	TH	RT	HR	UT	LT	BL	TH	RT	UT	HL	LT	TH	RT	UT	LT	TH	BR	RT	UT	HL	BL	BR	HR		
7:00 AM	0	1	0	0	0	0	2	1	0	2	0	0	1	25	0	0	0	15	2	0	0	0	2	0	0	51	0
7:15 AM	0	0	0	2	0	0	1	0	0	2	0	0	0	37	1	0	1	28	0	1	0	0	5	0	2	80	0
7:30 AM	1	0	0	4	0	0	3	0	0	6	0	0	0	40	0	0	1	34	3	0	0	0	12	0	0	104	0
7:45 AM	0	0	0	1	2	0	5	1	0	2	0	0	3	44	2	0	2	28	1	0	0	0	4	0	0	95	330
8:00 AM	0	2	0	3	0	0	1	0	0	6	0	1	1	44	1	0	2	34	1	0	0	0	1	0	0	97	376
8:15 AM	0	2	0	7	0	0	1	0	0	1	0	2	1	56	0	1	0	32	0	1	0	0	2	0	1	107	403
8:30 AM	0	0	0	9	0	0	1	0	0	2	0	1	1	40	0	0	1	49	1	0	0	0	1	0	0	106	405
8:45 AM	0	0	0	2	0	0	0	0	0	1	0	1	0	34	1	0	0	33	0	2	0	0	2	0	2	78	388
Count Total	1	5	0	28	2	0	14	2	0	22	0	5	7	320	5	1	7	253	8	4	0	0	29	0	5	718	0
Peak Hour	0	4	0	20	2	0	8	1	0	11	0	4	6	184	3	1	5	143	3	1	0	0	8	0	1	405	0

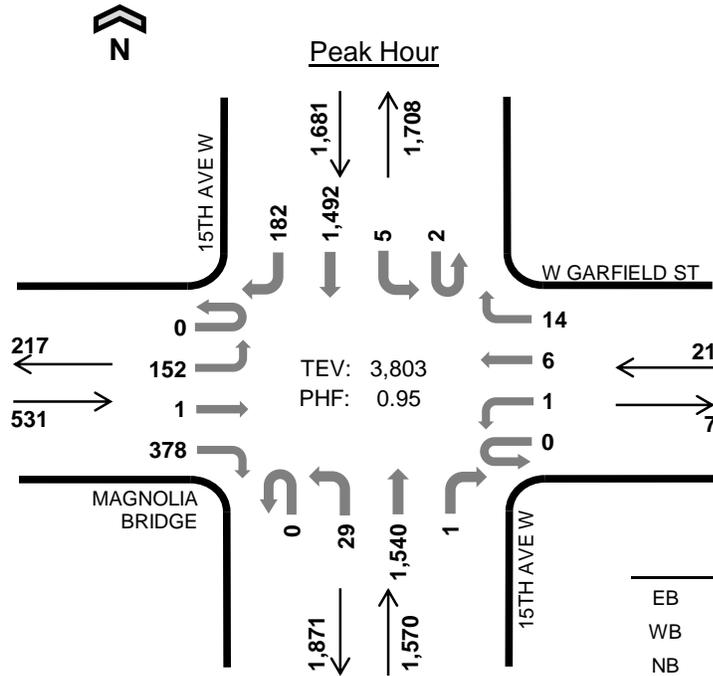
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals						Bicycles					Pedestrians (Crossing Leg)						
	EB	WB	NB	SB	NEB	Total	EB	WB	NB	SB	NEB	Total	East	West	North	South	Southwest	Total
7:00 AM	1	0	2	2	0	5	0	0	0	0	0	0	1	1	1	0	0	3
7:15 AM	0	0	2	1	0	3	1	1	0	0	2	4	3	5	0	0	5	13
7:30 AM	0	0	1	2	0	3	0	1	5	0	1	7	3	4	1	0	1	9
7:45 AM	0	0	1	0	0	1	1	0	3	0	3	7	1	0	1	0	0	2
8:00 AM	0	0	2	0	0	2	2	0	3	0	2	7	2	3	1	0	0	6
8:15 AM	1	0	3	1	0	5	1	0	5	0	0	6	1	0	0	0	1	2
8:30 AM	0	0	3	1	0	4	1	0	3	0	0	4	0	1	2	0	1	4
8:45 AM	0	0	1	1	0	2	1	0	3	1	1	6	0	0	1	0	1	2
Count Total	2	0	15	8	0	25	7	2	22	1	9	41	11	14	7	0	9	41
Peak Hr	1	0	9	2	0	12	5	0	14	0	5	24	4	4	4	0	2	14

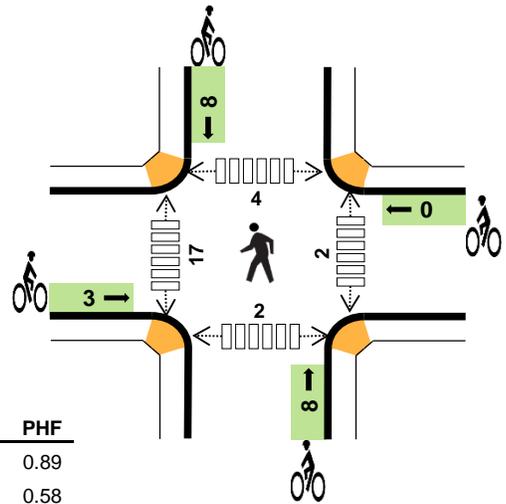
PM Counts



15TH AVE W W GARFIELD ST



Date: Thu, Aug 29, 2019
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 4:15 PM to 5:15 PM



	HV %:	PHF
EB	3.8%	0.89
WB	0.0%	0.58
NB	1.8%	0.94
SB	2.7%	0.96
TOTAL	2.5%	0.95

Two-Hour Count Summaries

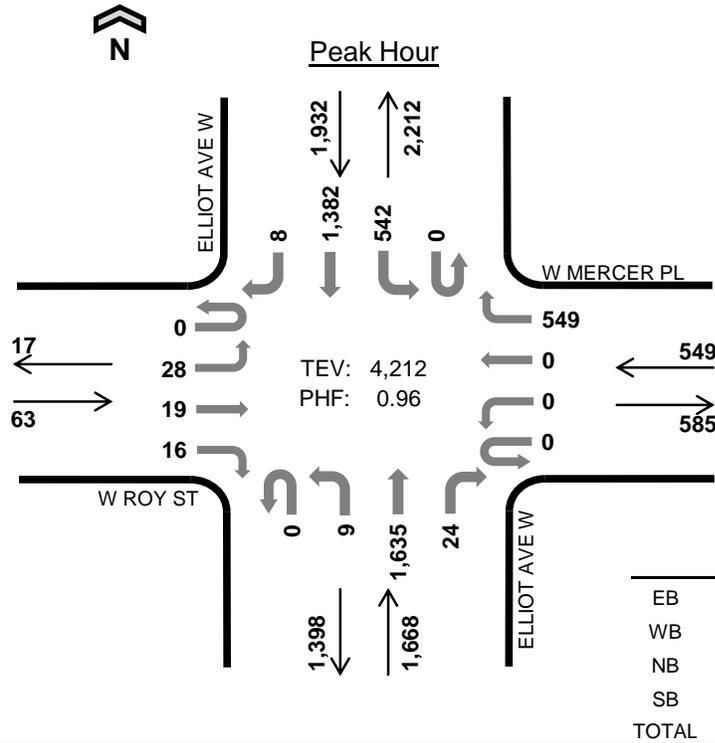
Interval Start	MAGNOLIA BRIDGE				W GARFIELD ST				15TH AVE W				15TH AVE W				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	43	1	83	0	0	1	7	0	6	330	0	0	3	362	49	885	0
4:15 PM	0	36	0	97	0	0	3	2	0	8	404	0	1	1	336	54	942	0
4:30 PM	0	37	0	87	0	0	0	7	0	10	365	0	0	3	383	44	936	0
4:45 PM	0	34	1	89	0	0	0	0	0	7	359	0	1	1	388	46	926	3,689
5:00 PM	0	45	0	105	0	1	3	5	0	4	412	1	0	0	385	38	999	3,803
5:15 PM	0	24	1	65	0	1	1	3	0	9	382	0	0	0	397	42	925	3,786
5:30 PM	0	46	0	95	0	0	2	0	0	6	393	0	0	1	341	56	940	3,790
5:45 PM	0	36	1	99	0	0	2	0	0	11	364	0	0	0	321	43	877	3,741
Count Total	0	301	4	720	0	2	12	24	0	61	3,009	1	2	9	2,913	372	7,430	0
Peak Hour	0	152	1	378	0	1	6	14	0	29	1,540	1	2	5	1,492	182	3,803	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

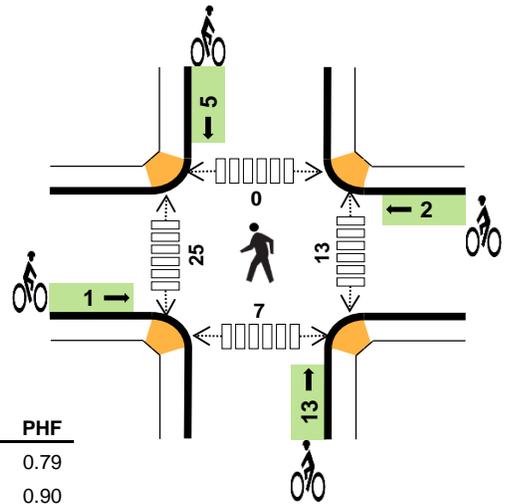
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	6	0	4	10	20	0	0	2	1	3	0	7	1	0	8
4:15 PM	6	0	7	8	21	0	0	0	3	3	0	11	1	0	12
4:30 PM	6	0	10	10	26	0	0	1	1	2	1	3	0	1	5
4:45 PM	4	0	5	7	16	2	0	2	3	7	1	2	3	0	6
5:00 PM	4	0	7	20	31	1	0	5	1	7	0	1	0	1	2
5:15 PM	4	0	9	19	32	1	0	8	1	10	1	7	1	0	9
5:30 PM	3	0	10	12	25	1	0	6	0	7	1	2	2	0	5
5:45 PM	3	0	11	8	22	0	0	3	0	3	4	3	2	0	9
Count Total	36	0	63	94	193	5	0	27	10	42	8	36	10	2	56
Peak Hour	20	0	29	45	94	3	0	8	8	19	2	17	4	2	25



ELLIOT AVE W W MERCER PL



Date: Thu, Aug 29, 2019
 Count Period: 4:00 PM to 6:00 PM
 Peak Hour: 4:45 PM to 5:45 PM



Two-Hour Count Summaries

Interval Start	W ROY ST				W MERCER PL				ELLIOT AVE W Northbound				ELLIOT AVE W Southbound				15-min Total	Rolling One Hour
	Eastbound				Westbound													
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	8	4	9	0	0	0	112	0	1	357	7	0	147	331	1	977	0
4:15 PM	0	14	5	5	0	0	0	128	0	1	407	5	1	125	324	3	1,018	0
4:30 PM	0	16	3	8	0	0	0	116	0	4	341	2	0	132	356	2	980	0
4:45 PM	0	6	3	2	0	0	0	136	0	1	381	5	0	118	378	2	1,032	4,007
5:00 PM	0	10	5	5	0	0	0	114	0	1	408	6	0	154	340	4	1,047	4,077
5:15 PM	0	7	8	5	0	0	0	147	0	2	383	7	0	149	333	0	1,041	4,100
5:30 PM	0	5	3	4	0	0	0	152	0	5	463	6	0	121	331	2	1,092	4,212
5:45 PM	0	3	2	2	0	0	0	132	0	3	396	5	0	115	340	4	1,002	4,182
Count Total	0	69	33	40	0	0	0	1,037	0	18	3,136	43	1	1,061	2,733	18	8,189	0
Peak Hour	0	28	19	16	0	0	0	549	0	9	1,635	24	0	542	1,382	8	4,212	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

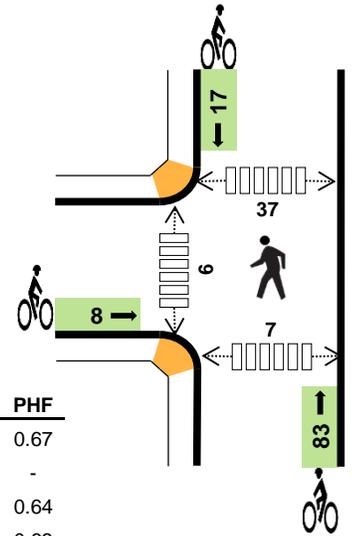
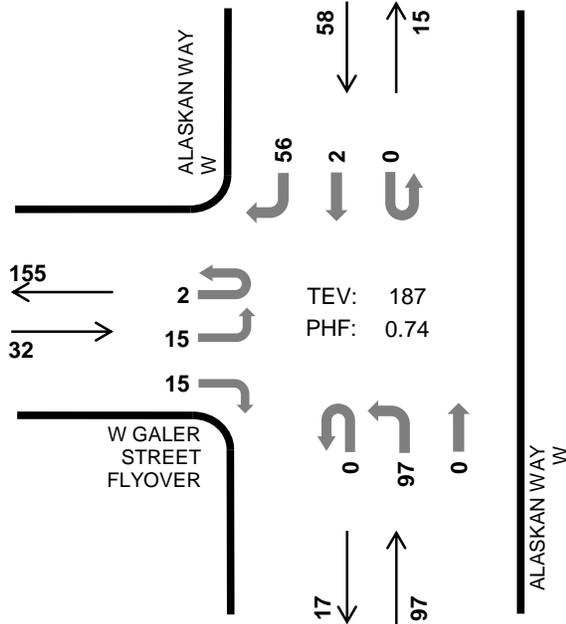
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	1	5	6	12	24	0	0	0	1	1	6	4	0	3	13
4:15 PM	0	6	8	15	29	0	0	1	2	3	3	13	0	7	23
4:30 PM	1	4	6	15	26	0	1	1	0	2	1	6	0	1	8
4:45 PM	0	2	9	9	20	1	0	0	1	2	3	8	0	2	13
5:00 PM	0	6	6	23	35	0	0	3	1	4	1	8	0	3	12
5:15 PM	0	3	9	19	31	0	1	4	1	6	3	5	0	1	9
5:30 PM	0	6	7	21	34	0	1	6	2	9	6	4	0	1	11
5:45 PM	0	5	13	13	31	0	1	2	0	3	6	5	0	6	17
Count Total	2	37	64	127	230	1	4	17	8	30	29	53	0	24	106
Peak Hour	0	17	31	72	120	1	2	13	5	21	13	25	0	7	45

ALASKAN WAY W W GALER STREET FLYOVER



Peak Hour

Date: Thu, Aug 29, 2019
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 4:00 PM to 5:00 PM



	HV %:	PHF
EB	18.8%	0.67
WB	-	-
NB	1.0%	0.64
SB	8.6%	0.63
TOTAL	6.4%	0.74

Two-Hour Count Summaries

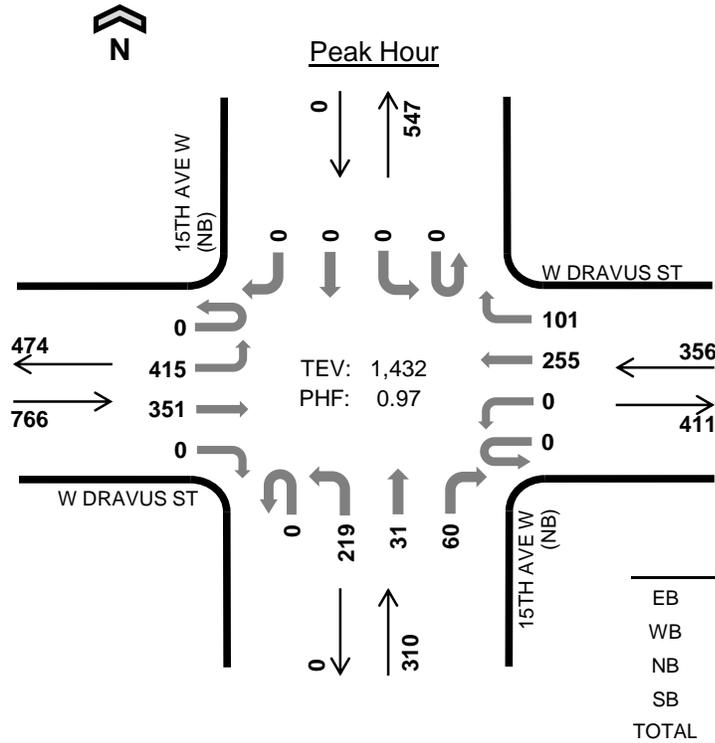
Interval Start	W GALER STREET FLYOVER				0				ALASKAN WAY W				ALASKAN WAY W				15-min Total	Rolling One Hour	
	Eastbound		Westbound		Northbound		Southbound		UT	LT	TH	RT	UT	LT	TH	RT			
4:00 PM	0	5	0	7	0	0	0	0	0	38	0	0	0	0	0	0	13	63	0
4:15 PM	1	4	0	3	0	0	0	0	0	20	0	0	0	0	0	0	12	40	0
4:30 PM	1	5	0	3	0	0	0	0	0	21	0	0	0	0	0	2	21	53	0
4:45 PM	0	1	0	2	0	0	0	0	0	18	0	0	0	0	0	0	10	31	187
5:00 PM	0	3	0	3	0	0	0	0	0	9	0	0	0	0	0	0	11	26	150
5:15 PM	0	3	0	0	0	0	0	0	0	10	0	0	0	0	0	0	13	26	136
5:30 PM	0	5	0	0	0	0	0	0	0	9	0	0	0	0	0	0	23	37	120
5:45 PM	2	6	0	5	0	0	0	0	0	9	0	0	0	0	0	0	11	33	122
Count Total	4	32	0	23	0	0	0	0	0	134	0	0	0	0	0	2	114	309	0
Peak Hour	2	15	0	15	0	0	0	0	0	97	0	0	0	0	0	2	56	187	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	0	0	0	2	2	4	0	10	4	18	9	1	9	1	20
4:15 PM	1	0	0	1	2	0	0	15	3	18	19	2	16	2	39
4:30 PM	4	0	0	2	6	1	0	28	4	33	5	2	4	1	12
4:45 PM	1	0	1	0	2	3	0	30	6	39	8	1	8	3	20
5:00 PM	2	0	0	1	3	2	0	39	1	42	7	0	6	0	13
5:15 PM	1	0	0	0	1	2	0	40	6	48	6	2	6	0	14
5:30 PM	0	0	0	3	3	2	0	57	3	62	8	1	8	1	18
5:45 PM	4	0	0	0	4	2	0	39	6	47	6	0	6	0	12
Count Total	13	0	1	9	23	16	0	258	33	307	68	9	63	8	148
Peak Hr	6	0	1	5	12	8	0	83	17	108	41	6	37	7	91

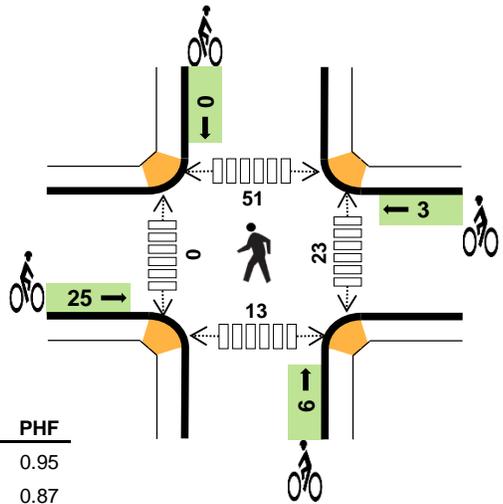


15TH AVE W (NB) W DRAVUS ST



Date: Thu, Aug 29, 2019
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 5:00 PM to 6:00 PM

	HV %:	PHF
EB	0.0%	0.95
WB	0.0%	0.87
NB	5.5%	0.86
SB	-	-
TOTAL	1.2%	0.97



Two-Hour Count Summaries

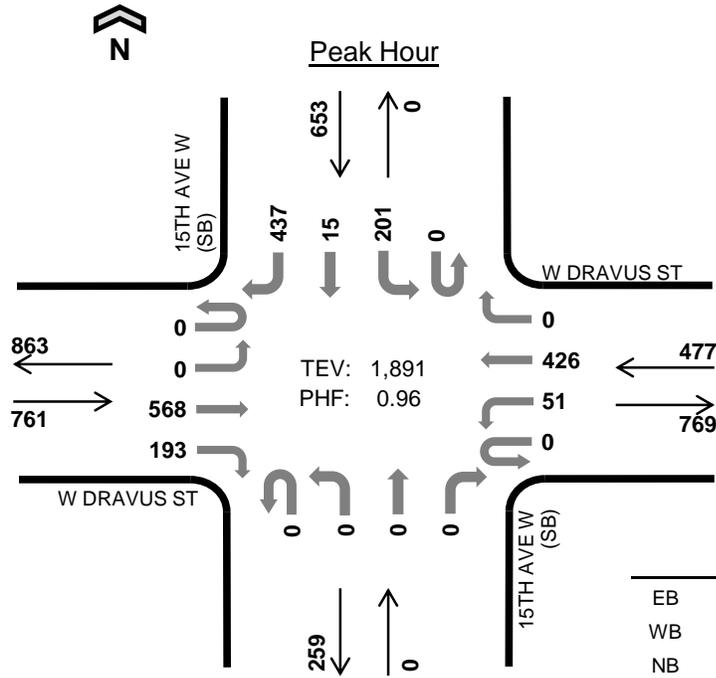
Interval Start	W DRAVUS ST				W DRAVUS ST				15TH AVE W (NB)				15TH AVE W (NB)				15-min Total	Rolling One Hour
	Eastbound		Westbound		Northbound		Southbound		UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	103	74	0	0	0	43	34	0	38	6	11	0	0	0	0	309	0
4:15 PM	0	124	115	0	0	0	50	22	0	39	6	5	0	0	0	0	361	0
4:30 PM	0	125	87	0	0	0	50	32	0	44	6	15	0	0	0	0	359	0
4:45 PM	0	111	87	0	0	0	47	22	0	36	2	15	0	0	0	0	320	1,349
5:00 PM	0	106	95	0	0	0	45	28	0	55	9	17	0	0	0	0	355	1,395
5:15 PM	0	112	87	0	0	0	68	19	0	41	7	13	0	0	0	0	347	1,381
5:30 PM	0	91	85	0	0	0	71	23	0	61	10	19	0	0	0	0	360	1,382
5:45 PM	0	106	84	0	0	0	71	31	0	62	5	11	0	0	0	0	370	1,432
Count Total	0	878	714	0	0	0	445	211	0	376	51	106	0	0	0	0	2,781	0
Peak Hour	0	415	351	0	0	0	255	101	0	219	31	60	0	0	0	0	1,432	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

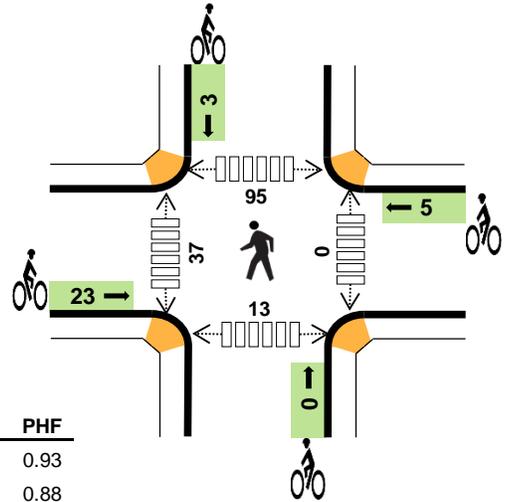
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	2	0	8	0	10	1	0	1	0	2	2	0	17	9	28
4:15 PM	2	1	3	0	6	0	0	2	0	2	3	0	10	7	20
4:30 PM	3	0	5	0	8	5	0	1	0	6	3	0	10	5	18
4:45 PM	5	1	1	0	7	7	0	0	0	7	2	0	7	4	13
5:00 PM	0	0	3	0	3	2	1	1	0	4	4	0	13	3	20
5:15 PM	0	0	5	0	5	6	2	0	0	8	4	0	6	3	13
5:30 PM	0	0	5	0	5	7	0	2	0	9	5	0	5	3	13
5:45 PM	0	0	4	0	4	10	0	3	0	13	10	0	27	4	41
Count Total	12	2	34	0	48	38	3	10	0	51	33	0	95	38	166
Peak Hour	0	0	17	0	17	25	3	6	0	34	23	0	51	13	87



15TH AVE W (SB) W DRAVUS ST



Date: Thu, Aug 29, 2019
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 5:00 PM to 6:00 PM



	HV %:	PHF
EB	1.1%	0.93
WB	0.2%	0.88
NB	-	-
SB	1.7%	0.91
TOTAL	1.1%	0.96

Two-Hour Count Summaries

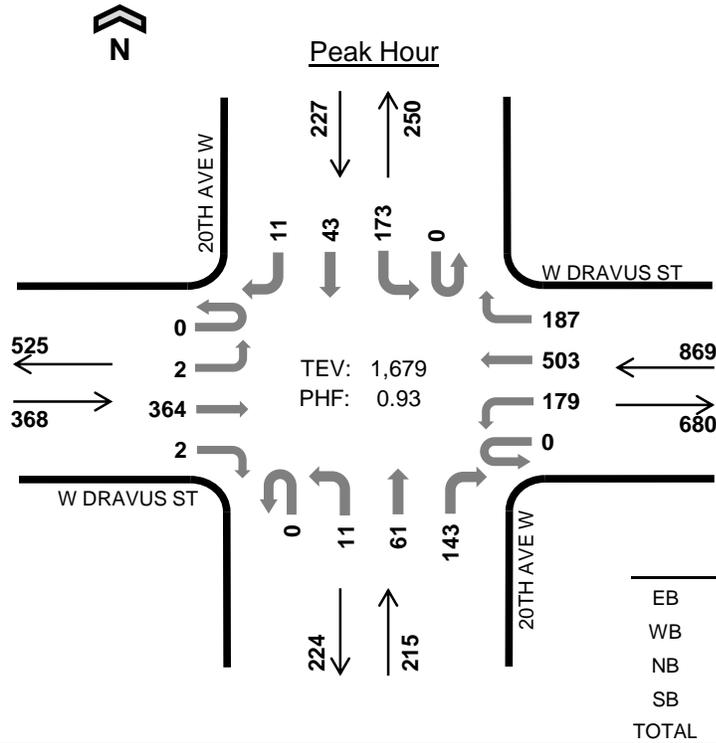
Interval Start	W DRAVUS ST				W DRAVUS ST				15TH AVE W (SB)				15TH AVE W (SB)				15-min Total	Rolling One Hour
	Eastbound		Westbound		Northbound		Southbound		UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	0	128	66	0	10	71	0	0	0	0	0	0	51	4	91	421	0
4:15 PM	0	0	176	40	0	15	75	0	0	0	0	0	0	65	6	93	470	0
4:30 PM	0	0	140	39	0	11	83	0	0	0	0	0	0	73	8	90	444	0
4:45 PM	0	0	152	47	0	9	70	0	0	0	0	0	0	50	5	116	449	1,784
5:00 PM	0	0	156	49	0	11	87	0	0	0	0	0	0	47	4	99	453	1,816
5:15 PM	0	0	140	38	0	13	100	0	0	0	0	0	0	56	4	120	471	1,817
5:30 PM	0	0	126	52	0	10	121	0	0	0	0	0	0	53	5	110	477	1,850
5:45 PM	0	0	146	54	0	17	118	0	0	0	0	0	0	45	2	108	490	1,891
Count Total	0	0	1,164	385	0	96	725	0	0	0	0	0	0	440	38	827	3,675	0
Peak Hour	0	0	568	193	0	51	426	0	0	0	0	0	0	201	15	437	1,891	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

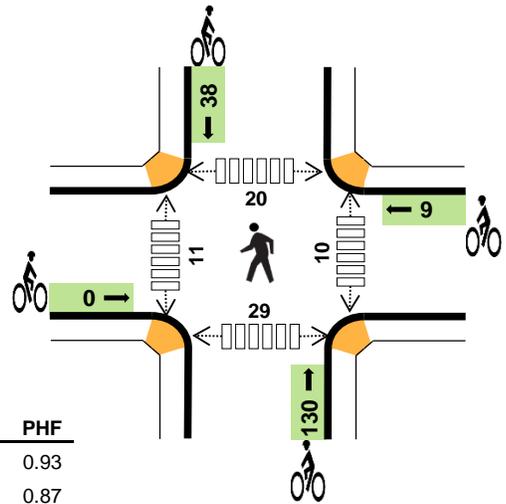
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	3	4	0	6	13	1	0	0	0	1	0	9	17	9	35
4:15 PM	3	1	0	4	8	1	0	0	1	2	0	5	16	5	26
4:30 PM	2	1	0	5	8	5	0	0	0	5	0	10	21	7	38
4:45 PM	9	1	0	4	14	7	0	0	0	7	0	8	9	3	20
5:00 PM	1	0	0	3	4	3	1	0	0	4	0	7	14	3	24
5:15 PM	4	0	0	2	6	6	2	0	0	8	0	5	14	3	22
5:30 PM	3	1	0	3	7	7	1	0	0	8	0	14	28	3	45
5:45 PM	0	0	0	3	3	7	1	0	3	11	0	11	39	4	54
Count Total	25	8	0	30	63	37	5	0	4	46	0	69	158	37	264
Peak Hour	8	1	0	11	20	23	5	0	3	31	0	37	95	13	145



20TH AVE W W DRAVUS ST



Date: Tue, Sep 10, 2019
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 5:00 PM to 6:00 PM



	HV %:	PHF
EB	0.8%	0.93
WB	0.1%	0.87
NB	0.9%	0.91
SB	0.9%	0.89
TOTAL	0.5%	0.93

Two-Hour Count Summaries

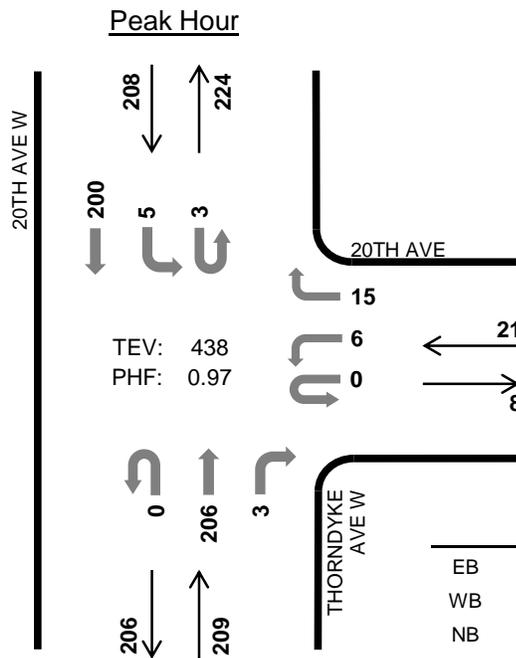
Interval Start	W DRAVUS ST Eastbound				W DRAVUS ST Westbound				20TH AVE W Northbound				20TH AVE W Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	0	93	1	0	40	109	35	0	3	14	38	0	41	17	2	393	0
4:15 PM	0	1	81	2	0	39	77	45	0	3	10	31	0	39	11	3	342	0
4:30 PM	0	2	89	1	0	42	100	42	0	2	6	47	0	30	7	3	371	0
4:45 PM	0	0	99	4	0	48	130	43	0	4	11	42	0	38	4	2	425	1,531
5:00 PM	0	0	81	0	0	50	113	27	0	4	16	37	0	40	11	0	379	1,517
5:15 PM	0	1	97	0	0	34	133	45	0	4	10	45	0	44	11	3	427	1,602
5:30 PM	0	1	97	1	0	50	121	46	0	2	19	21	0	43	13	8	422	1,653
5:45 PM	0	0	89	1	0	45	136	69	0	1	16	40	0	46	8	0	451	1,679
Count Total	0	5	726	10	0	348	919	352	0	23	102	301	0	321	82	21	3,210	0
Peak Hour	0	2	364	2	0	179	503	187	0	11	61	143	0	173	43	11	1,679	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

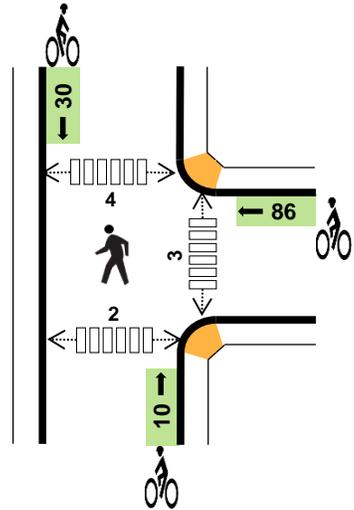
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	0	9	2	0	11	0	3	8	10	21	1	2	5	11	19
4:15 PM	5	2	2	1	10	0	0	12	7	19	1	1	5	8	15
4:30 PM	2	2	0	3	7	0	0	16	5	21	5	3	2	6	16
4:45 PM	3	4	0	2	9	0	1	11	9	21	2	1	1	4	8
5:00 PM	2	0	1	0	3	0	3	20	10	33	3	2	2	6	13
5:15 PM	0	0	0	0	0	0	1	33	4	38	1	2	1	11	15
5:30 PM	0	1	1	1	3	0	4	40	8	52	2	4	8	5	19
5:45 PM	1	0	0	1	2	0	1	37	16	54	4	3	9	7	23
Count Total	13	18	6	8	45	0	13	177	69	259	19	18	33	58	128
Peak Hour	3	1	2	2	8	0	9	130	38	177	10	11	20	29	70



THORNDYKE AVE W 20TH AVE



Date: Tue, Sep 10, 2019
 Count Period: 4:00 PM to 6:00 PM
 Peak Hour: 4:30 PM to 5:30 PM



	HV %:	PHF
EB	-	-
WB	4.8%	0.75
NB	1.0%	0.93
SB	1.0%	0.93
TOTAL	1.1%	0.97

Two-Hour Count Summaries

Interval Start	0				20TH AVE				THORNDYKE AVE W				20TH AVE W				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	2	0	0	57	0	0	2	58	0	119	0
4:15 PM	0	0	0	0	0	0	0	3	0	0	38	1	0	2	47	0	91	0
4:30 PM	0	0	0	0	0	1	0	6	0	0	50	1	2	2	47	0	109	0
4:45 PM	0	0	0	0	0	1	0	3	0	0	52	2	1	1	53	0	113	432
5:00 PM	0	0	0	0	0	3	0	3	0	0	48	0	0	2	54	0	110	423
5:15 PM	0	0	0	0	0	1	0	3	0	0	56	0	0	0	46	0	106	438
5:30 PM	0	0	0	0	0	0	0	2	0	0	39	2	0	0	64	0	107	436
5:45 PM	0	0	0	0	0	3	0	2	0	0	51	0	0	2	50	0	108	431
Count Total	0	0	0	0	0	9	0	24	0	0	391	6	3	11	419	0	863	0
Peak Hour	0	0	0	0	0	6	0	15	0	0	206	3	3	5	200	0	438	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	0	0	3	3	6	0	9	1	10	20	3	1	1	0	5
4:15 PM	0	0	0	0	0	0	13	6	7	26	2	4	0	0	6
4:30 PM	0	0	0	0	0	0	13	3	4	20	0	2	0	0	2
4:45 PM	0	1	2	2	5	0	19	1	12	32	1	2	2	2	7
5:00 PM	0	0	0	0	0	0	19	5	10	34	0	1	0	0	1
5:15 PM	0	0	0	0	0	0	35	1	4	40	2	0	2	0	4
5:30 PM	0	0	1	0	1	0	45	3	9	57	2	5	3	0	10
5:45 PM	0	0	0	0	0	0	32	6	16	54	0	1	1	1	3
Count Total	0	1	6	5	12	0	185	26	72	283	10	16	9	3	38
Peak Hr	0	1	2	2	5	0	86	10	30	126	3	5	4	2	14

Two-Hour Count Summaries

Interval Start	21ST AVE W Eastbound					21ST AVE W Westbound					THORNDYKE AVE W Northbound					THORNDYKE AVE W Southbound					W ARMOUR ST Northeastbound					15-min Total	Rolling One Hour
	UT	LT	TH	RT	HR	UT	LT	BL	TH	RT	UT	HL	LT	TH	RT	UT	LT	TH	BR	RT	UT	HL	BL	BR	HR		
4:00 PM	1	2	0	2	0	0	2	0	0	3	0	0	1	46	2	0	1	48	5	0	0	0	3	0	0	116	0
4:15 PM	0	0	0	1	0	0	0	0	0	3	0	0	0	32	4	1	3	35	3	0	0	0	4	0	0	86	0
4:30 PM	0	0	0	2	0	0	1	0	0	0	0	2	3	47	1	0	0	48	0	2	0	0	4	0	1	111	0
4:45 PM	0	1	0	2	0	0	3	1	0	5	0	1	1	47	1	2	3	48	0	0	0	0	0	0	0	115	428
5:00 PM	0	2	0	2	1	0	1	0	0	4	0	2	0	36	3	0	4	51	0	3	0	0	5	0	0	114	426
5:15 PM	0	0	0	8	1	0	1	0	0	2	0	0	7	46	1	0	2	51	2	1	0	0	5	0	0	127	467
5:30 PM	0	0	0	2	0	0	1	0	0	2	0	0	4	36	4	0	1	59	3	1	0	2	6	0	1	122	478
5:45 PM	0	0	0	0	0	0	1	0	0	1	0	0	5	43	3	0	4	43	4	0	0	0	2	0	2	108	471
Count Total	1	5	0	19	2	0	10	1	0	20	0	5	21	333	19	3	18	383	17	7	0	2	29	0	4	899	0
Peak Hour	0	3	0	14	2	0	6	1	0	13	0	3	12	165	9	2	10	209	5	5	0	2	16	0	1	478	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals						Bicycles						Pedestrians (Crossing Leg)					
	EB	WB	NB	SB	NEB	Total	EB	WB	NB	SB	NEB	Total	East	West	North	South	Southwest	Total
4:00 PM	1	0	3	2	0	6	0	2	1	1	0	4	8	10	2	0	4	24
4:15 PM	0	0	0	0	0	0	0	1	9	3	0	13	2	9	0	0	9	20
4:30 PM	0	0	0	1	0	1	0	2	2	1	7	1	2	2	0	2	7	
4:45 PM	0	0	1	2	0	3	0	3	1	5	9	3	4	1	0	3	11	
5:00 PM	0	0	0	1	0	1	0	3	5	3	11	4	13	3	0	5	25	
5:15 PM	0	0	0	0	0	0	0	3	3	2	8	4	3	1	0	1	9	
5:30 PM	0	0	1	0	0	1	1	3	3	5	12	3	9	1	0	6	19	
5:45 PM	0	0	0	0	0	0	0	4	6	11	21	3	2	1	0	1	7	
Count Total	1	0	5	6	0	12	1	21	30	32	85	28	52	11	0	31	122	
Peak Hr	0	0	2	3	0	5	1	12	12	15	40	14	29	6	0	15	64	

Appendix B: Level of Service Definitions

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. The Table below shows LOS criteria for signalized intersections, as described in the *Highway Capacity Manual* (Transportation Research Board, Special Report 209, 2000).

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)

Source: *Highway Capacity Manual*, Transportation Research Board, Special Report 209, 2000.

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).

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

Source: *Highway Capacity Manual*, Transportation Research Board, Special Report 209, 2000.

Appendix C: Intersection Operations Level of Service Reports

2019 – Existing

HCM Signalized Intersection Capacity Analysis
1: 15th & W Garfield St

AM Existing
No Cruise

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	110	5	800	0	5	5	35	680	5	15	1530	100	
Future Volume (vph)	110	5	800	0	5	5	35	680	5	15	1530	100	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	10	12	12	12	12	11	10	12	11	10	12	
Grade (%)		-7%			0%			-1%			0%		
Total Lost time (s)		4.5	4.5		4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00	
Frbp, ped/bikes		1.00	0.98		1.00		1.00	1.00	0.96	1.00	1.00	0.90	
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	0.99	1.00	1.00	
Frt		1.00	0.85		0.93		1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected		0.95	1.00		1.00		0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)		1717	1611		1772		1654	3195	1472	1668	3240	1392	
Flt Permitted		0.73	1.00		1.00		0.13	1.00	1.00	0.37	1.00	1.00	
Satd. Flow (perm)		1310	1611		1772		222	3195	1472	650	3240	1392	
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	
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Adj. Flow (vph)	116	5	842	0	5	5	37	716	5	16	1611	105	
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	1	0	0	15	
Lane Group Flow (vph)	0	121	842	0	6	0	37	716	4	16	1611	90	
Confl. Peds. (#/hr)			3	3			14		3	3		14	
Confl. Bikes (#/hr)			8						4			9	
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	6%	6%	6%	4%	4%	4%	
Turn Type	Perm	NA	custom		NA		Perm	NA	Perm	Perm	NA	Perm	
Protected Phases		4	4		4			2			2		
Permitted Phases	4		2	4			2		2	2		2	
Actuated Green, G (s)		18.3	131.0		18.3		112.7	112.7	112.7	112.7	112.7	112.7	
Effective Green, g (s)		18.3	131.0		18.3		112.7	112.7	112.7	112.7	112.7	112.7	
Actuated g/C Ratio		0.13	0.94		0.13		0.81	0.81	0.81	0.81	0.81	0.81	
Clearance Time (s)		4.5	4.5		4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		2.0	2.0		2.0		1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		171	1611		231		178	2571	1184	523	2608	1120	
v/s Ratio Prot			0.07		0.00			0.22			c0.50		
v/s Ratio Perm		c0.09	0.45				0.17		0.00	0.02		0.06	
v/c Ratio		0.71	0.52		0.02		0.21	0.28	0.00	0.03	0.62	0.08	
Uniform Delay, d1		58.3	0.6		53.1		3.2	3.4	2.7	2.7	5.3	2.8	
Progression Factor		1.00	1.00		1.00		0.26	0.15	0.00	1.00	1.00	1.00	
Incremental Delay, d2		10.4	0.1		0.0		2.5	0.3	0.0	0.1	1.1	0.1	
Delay (s)		68.7	0.7		53.1		3.4	0.8	0.0	2.8	6.4	3.0	
Level of Service		E	A		D		A	A	A	A	A	A	
Approach Delay (s)		9.2			53.1			0.9			6.2		
Approach LOS		A			D			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.0									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.63										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	9.0
Intersection Capacity Utilization			107.6%									ICU Level of Service	G
Analysis Period (min)			15										

HCM Signalized Intersection Capacity Analysis

2: Elliott & W Galer St Flyover

AM Existing
No Cruise

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 			  
Traffic Volume (vph)	35	25	725	320	30	2275
Future Volume (vph)	35	25	725	320	30	2275
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	14	16	10	13	9	10
Total Lost time (s)	5.0	5.0	5.5	5.0	5.0	5.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.91
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2767	1329	3120	1545	1577	4700
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2767	1329	3120	1545	1577	4700
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Growth Factor (vph)	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	36	26	747	330	31	2345
RTOR Reduction (vph)	0	24	0	112	0	0
Lane Group Flow (vph)	36	2	747	218	31	2345
Confl. Peds. (#/hr)		1		4	4	
Confl. Bikes (#/hr)		2		4		
Heavy Vehicles (%)	35%	35%	8%	8%	3%	3%
Turn Type	Prot	Perm	NA	custom	Prot	NA
Protected Phases	4		1	4 7	2	1 2
Permitted Phases		4				
Actuated Green, G (s)	11.0	11.0	102.5	85.5	11.0	119.0
Effective Green, g (s)	11.0	11.0	102.5	85.5	11.0	119.0
Actuated g/C Ratio	0.08	0.08	0.73	0.61	0.08	0.85
Clearance Time (s)	5.0	5.0	5.5		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	217	104	2284	943	123	3995
v/s Ratio Prot	0.01		0.24	c0.14	0.02	c0.50
v/s Ratio Perm		0.00				
v/c Ratio	0.17	0.02	0.33	0.23	0.25	0.59
Uniform Delay, d1	60.2	59.5	6.6	12.4	60.6	3.1
Progression Factor	1.00	1.00	0.82	0.38	0.93	0.34
Incremental Delay, d2	0.4	0.1	0.4	0.1	0.9	0.2
Delay (s)	60.6	59.6	5.8	4.8	57.0	1.2
Level of Service	E	E	A	A	E	A
Approach Delay (s)	60.2		5.5			2.0
Approach LOS	E		A			A
Intersection Summary						
HCM 2000 Control Delay			4.1		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.60			
Actuated Cycle Length (s)			140.0		Sum of lost time (s)	18.5
Intersection Capacity Utilization			57.4%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis
 3: Elliott & W Roy St/W Mercer PI

AM Existing
 No Cruise

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	5	5	0	0	300	50	740	20	400	1810	40
Future Volume (vph)	5	5	5	0	0	300	50	740	20	400	1810	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	10	12	10	10	12
Grade (%)		5%			0%			1%			0%	
Total Lost time (s)		4.5				4.0	5.5	4.5	4.5	5.5	4.5	4.5
Lane Util. Factor		1.00				1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frbp, ped/bikes		0.89				0.99	1.00	1.00	0.97	1.00	1.00	0.91
Flpb, ped/bikes		1.00				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.95				0.86	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1287				1436	1678	3133	1456	3143	3037	1420
Flt Permitted		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1287				1436	1678	3133	1456	3143	3037	1420
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
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	5	5	5	0	0	309	52	763	21	412	1866	41
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	9	0	0	10
Lane Group Flow (vph)	0	10	0	0	0	309	52	763	12	412	1866	31
Confl. Peds. (#/hr)	1		24	24		1	20		10	10		20
Confl. Bikes (#/hr)						3			2			13
Heavy Vehicles (%)	20%	20%	20%	13%	13%	13%	7%	7%	7%	4%	4%	4%
Parking (#/hr)												5
Turn Type	Split	NA				Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3					5	2		14		6
Permitted Phases						Free			2			6
Actuated Green, G (s)		2.2				140.0	7.0	80.5	80.5	42.8	106.8	106.8
Effective Green, g (s)		2.2				140.0	7.0	80.5	80.5	39.3	106.8	106.8
Actuated g/C Ratio		0.02				1.00	0.05	0.58	0.58	0.28	0.76	0.76
Clearance Time (s)		4.5					5.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)		3.0					0.2	0.2	0.2		0.2	0.2
Lane Grp Cap (vph)		20				1436	83	1801	837	882	2316	1083
v/s Ratio Prot		0.01					0.03	0.24		c0.13	c0.61	
v/s Ratio Perm						c0.22			0.01			0.02
v/c Ratio		0.50				0.22	0.63	0.42	0.01	0.47	0.81	0.03
Uniform Delay, d1		68.4				0.0	65.2	16.7	12.7	41.7	10.2	4.0
Progression Factor		1.00				1.00	1.00	1.00	1.00	0.99	0.99	22.76
Incremental Delay, d2		18.6				0.3	10.2	0.7	0.0	0.3	2.6	0.0
Delay (s)		86.9				0.3	75.4	17.4	12.8	41.4	12.7	91.7
Level of Service		F				A	E	B	B	D	B	F
Approach Delay (s)		86.9			0.3			20.9			19.2	
Approach LOS		F			A			C			B	
Intersection Summary												
HCM 2000 Control Delay			18.2				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)				18.0	
Intersection Capacity Utilization			72.2%				ICU Level of Service				C	

HCM Signalized Intersection Capacity Analysis

5: NB Off-Ramp

AM Existing
No Cruise

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 		 	 				
Traffic Volume (vph)	395	250	0	0	125	85	145	20	20	0	0	0
Future Volume (vph)	395	250	0	0	125	85	145	20	20	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5				
Lane Util. Factor		0.95			0.95		1.00	1.00				
Frbp, ped/bikes		1.00			0.93		1.00	0.99				
Flpb, ped/bikes		1.00			1.00		1.00	1.00				
Frt		1.00			0.94		1.00	0.93				
Flt Protected		0.97			1.00		0.95	1.00				
Satd. Flow (prot)		3401			3134		1583	1519				
Flt Permitted		0.63			1.00		0.95	1.00				
Satd. Flow (perm)		2202			3134		1583	1519				
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
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	429	272	0	0	136	92	158	22	22	0	0	0
RTOR Reduction (vph)	0	0	0	0	83	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	701	0	0	145	0	158	26	0	0	0	0
Confl. Peds. (#/hr)	31		38	38		31			8	8		
Confl. Bikes (#/hr)			3			6			2			
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	14%	14%	14%	0%	0%	0%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		4 3			7			2				
Permitted Phases	4 3						2					
Actuated Green, G (s)		55.8			10.3		20.4	20.4				
Effective Green, g (s)		55.8			10.3		20.4	20.4				
Actuated g/C Ratio		0.56			0.10		0.20	0.20				
Clearance Time (s)					4.5		4.5	4.5				
Vehicle Extension (s)					2.0		2.0	2.0				
Lane Grp Cap (vph)		1228			322		322	309				
v/s Ratio Prot					c0.05			0.02				
v/s Ratio Perm		c0.32					c0.10					
v/c Ratio		5.80dl			0.45		0.49	0.09				
Uniform Delay, d1		14.3			42.2		35.2	32.2				
Progression Factor		0.21			1.00		1.00	1.00				
Incremental Delay, d2		1.4			0.4		5.3	0.5				
Delay (s)		4.4			42.6		40.5	32.8				
Level of Service		A			D		D	C				
Approach Delay (s)		4.4			42.6			38.8			0.0	
Approach LOS		A			D			D			A	
Intersection Summary												
HCM 2000 Control Delay			18.2				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)		18.0			
Intersection Capacity Utilization			55.5%				ICU Level of Service			B		
Analysis Period (min)			15									
dl Defacto Left Lane. Recode with 1 though lane as a left lane.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: 15th Ave W/SB Off-Ramp & W Dravus St

AM Existing
No Cruise



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑						↑	↑
Traffic Volume (vph)	0	560	245	50	215	0	0	0	0	95	20	300
Future Volume (vph)	0	560	245	50	215	0	0	0	0	95	20	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5						4.5	4.5
Lane Util. Factor		0.95			0.95						1.00	1.00
Frb, ped/bikes		0.95			1.00						1.00	0.96
Flpb, ped/bikes		1.00			0.99						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.96	1.00
Satd. Flow (prot)		3164			3344						1659	1406
Flt Permitted		1.00			0.72						0.96	1.00
Satd. Flow (perm)		3164			2436						1659	1406
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
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	609	266	54	234	0	0	0	0	103	22	326
RTOR Reduction (vph)	0	50	0	0	0	0	0	0	0	0	0	159
Lane Group Flow (vph)	0	825	0	0	288	0	0	0	0	0	125	167
Confl. Peds. (#/hr)	35		38	38		35	44					44
Confl. Bikes (#/hr)			3			6						13
Heavy Vehicles (%)	3%	3%	3%	6%	6%	6%	0%	0%	0%	10%	10%	10%
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4!			7 2						3 4!	4
Permitted Phases				7 2						3 4!		3
Actuated Green, G (s)		33.8			35.2						55.8	51.3
Effective Green, g (s)		33.8			35.2						55.8	51.3
Actuated g/C Ratio		0.34			0.35						0.56	0.51
Clearance Time (s)		4.5										4.5
Vehicle Extension (s)		2.0										2.0
Lane Grp Cap (vph)		1069			857						925	784
v/s Ratio Prot		c0.26										c0.07
v/s Ratio Perm					c0.12						0.08	0.05
v/c Ratio		0.77			0.34						0.14	0.21
Uniform Delay, d1		29.6			23.8						10.6	13.3
Progression Factor		1.00			0.21						1.00	1.00
Incremental Delay, d2		5.4			0.1						0.3	0.6
Delay (s)		35.0			5.1						10.9	13.9
Level of Service		D			A						B	B
Approach Delay (s)		35.0			5.1			0.0			13.1	
Approach LOS		D			A			A			B	

Intersection Summary

HCM 2000 Control Delay	23.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: W Dravus St & 20th Ave W

AM Existing
No Cruise



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔			↕	↕	↕	↕	
Traffic Volume (vph)	5	520	5	110	290	90	5	35	175	170	60	10
Future Volume (vph)	5	520	5	110	290	90	5	35	175	170	60	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5	4.5	4.5	4.5	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frbp, ped/bikes		1.00			0.99			1.00	0.98	1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00	1.00	1.00	1.00	
Frt		1.00			0.97			1.00	0.85	1.00	0.98	
Flt Protected		1.00			0.99			0.99	1.00	0.95	1.00	
Satd. Flow (prot)		3532			3281			1781	1497	1752	1791	
Flt Permitted		0.95			0.70			0.95	1.00	0.95	1.00	
Satd. Flow (perm)		3358			2330			1695	1497	1752	1791	
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
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	5	565	5	120	315	98	5	38	190	185	65	11
RTOR Reduction (vph)	0	1	0	0	27	0	0	0	87	0	8	0
Lane Group Flow (vph)	0	574	0	0	506	0	0	43	103	185	68	0
Confl. Peds. (#/hr)	9		15	15		9	5		1	1		5
Confl. Bikes (#/hr)						8			18			49
Heavy Vehicles (%)	2%	2%	2%	5%	5%	5%	6%	6%	6%	3%	3%	3%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	pm+ov	Prot	NA	
Protected Phases		2		1	6			4	1	3	8	
Permitted Phases	2			6			4		4			
Actuated Green, G (s)		16.6			25.1			2.9	6.9	6.6	14.0	
Effective Green, g (s)		16.6			25.1			2.9	6.9	6.6	14.0	
Actuated g/C Ratio		0.35			0.52			0.06	0.14	0.14	0.29	
Clearance Time (s)		4.5			4.5			4.5	4.5	4.5	4.5	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1158			1294			102	354	240	521	
v/s Ratio Prot					c0.03				c0.02	c0.11	0.04	
v/s Ratio Perm		c0.17			0.17			0.03	0.04			
v/c Ratio		0.50			0.39			0.42	0.29	0.77	0.13	
Uniform Delay, d1		12.4			6.9			21.8	18.4	20.0	12.6	
Progression Factor		1.00			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3			0.2			2.8	0.5	14.2	0.1	
Delay (s)		12.8			7.1			24.6	18.9	34.2	12.7	
Level of Service		B			A			C	B	C	B	
Approach Delay (s)		12.8			7.1			19.9			27.9	
Approach LOS		B			A			B			C	

Intersection Summary

HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	48.1	Sum of lost time (s)	18.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: 15th & W Garfield St

PM Existing
No Cruise

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	150	5	380	5	5	15	30	1540	5	5	1490	180	
Future Volume (vph)	150	5	380	5	5	15	30	1540	5	5	1490	180	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	10	12	12	12	12	11	10	12	11	10	12	
Grade (%)		-7%			0%			-1%			0%		
Total Lost time (s)		4.5	4.0		4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00	
Frbp, ped/bikes		1.00	0.98		0.99		1.00	1.00	0.96	1.00	1.00	0.88	
Flpb, ped/bikes		0.99	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85		0.92		1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected		0.95	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)		1674	1572		1705		1719	3320	1535	1694	3271	1379	
Flt Permitted		0.71	1.00		0.95		0.13	1.00	1.00	0.12	1.00	1.00	
Satd. Flow (perm)		1253	1572		1635		233	3320	1535	213	3271	1379	
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)	158	5	400	5	5	16	32	1621	5	5	1568	189	
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	1	0	0	31	
Lane Group Flow (vph)	0	163	400	0	13	0	32	1621	4	5	1568	158	
Confl. Peds. (#/hr)	3		2	2		3	17		2	2		17	
Confl. Bikes (#/hr)			3						8			8	
Heavy Vehicles (%)	4%	4%	4%	0%	0%	0%	2%	2%	2%	3%	3%	3%	
Turn Type	Perm	NA	Free	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	
Protected Phases		4			4			2			2		
Permitted Phases	4		Free	4			2		2	2		2	
Actuated Green, G (s)		22.6	140.0		22.6		108.4	108.4	108.4	108.4	108.4	108.4	
Effective Green, g (s)		22.6	140.0		22.6		108.4	108.4	108.4	108.4	108.4	108.4	
Actuated g/C Ratio		0.16	1.00		0.16		0.77	0.77	0.77	0.77	0.77	0.77	
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		2.0			2.0		1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		202	1572		263		180	2570	1188	164	2532	1067	
v/s Ratio Prot								c0.49			0.48		
v/s Ratio Perm		c0.13	0.25		0.01		0.14		0.00	0.02		0.11	
v/c Ratio		0.81	0.25		0.05		0.18	0.63	0.00	0.03	0.62	0.15	
Uniform Delay, d1		56.6	0.0		49.6		4.1	7.0	3.6	3.7	6.9	4.0	
Progression Factor		1.00	1.00		1.00		0.11	0.16	0.02	1.00	1.00	1.00	
Incremental Delay, d2		19.5	0.4		0.0		1.7	0.9	0.0	0.3	1.1	0.3	
Delay (s)		76.1	0.4		49.6		2.1	2.1	0.1	4.0	8.0	4.3	
Level of Service		E	A		D		A	A	A	A	A	A	
Approach Delay (s)		22.3			49.6			2.0			7.6		
Approach LOS		C			D			A			A		
Intersection Summary													
HCM 2000 Control Delay			7.6									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.66										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	9.0
Intersection Capacity Utilization			65.5%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

2: Elliott & W Galer St Flyover

PM Existing
No Cruise



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖↗	↖	↕↕	↖	↖	↕↕
Traffic Volume (vph)	60	40	1510	700	20	1870
Future Volume (vph)	60	40	1510	700	20	1870
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	14	16	10	13	9	10
Total Lost time (s)	5.0	5.0	5.5	5.0	5.0	5.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00	0.95	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3557	1657	3303	1632	1562	3240
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3557	1657	3303	1632	1562	3240
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	61	41	1541	714	20	1908
RTOR Reduction (vph)	0	37	0	27	0	0
Lane Group Flow (vph)	61	4	1541	687	20	1908
Confl. Peds. (#/hr)		12		10	10	
Confl. Bikes (#/hr)		8		12		
Heavy Vehicles (%)	5%	5%	2%	2%	4%	4%
Turn Type	Prot	Perm	NA	custom	Prot	NA
Protected Phases	4		1	4 7	2	1 2
Permitted Phases		4		2		
Actuated Green, G (s)	14.9	14.9	99.6	129.5	10.0	115.1
Effective Green, g (s)	14.9	14.9	99.6	129.5	10.0	115.1
Actuated g/C Ratio	0.11	0.11	0.71	0.92	0.07	0.82
Clearance Time (s)	5.0	5.0	5.5		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	378	176	2349	1567	111	2663
v/s Ratio Prot	0.02		0.47	c0.37	0.01	c0.59
v/s Ratio Perm		0.00		0.05		
v/c Ratio	0.16	0.02	0.66	0.44	0.18	0.72
Uniform Delay, d1	56.9	56.0	10.9	0.7	61.1	5.4
Progression Factor	1.00	1.00	0.63	2.15	0.88	0.78
Incremental Delay, d2	0.2	0.1	0.9	0.1	3.0	1.4
Delay (s)	57.1	56.1	7.8	1.6	56.6	5.6
Level of Service	E	E	A	A	E	A
Approach Delay (s)	56.7		5.8			6.1
Approach LOS	E		A			A

Intersection Summary

HCM 2000 Control Delay	7.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Elliott & W Roy St/W Mercer PI

PM Existing
No Cruise

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	20	15	0	0	550	10	1635	25	540	1380	10
Future Volume (vph)	30	20	15	0	0	550	10	1635	25	540	1380	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	10	12	10	10	12
Grade (%)		5%			0%			1%			0%	
Total Lost time (s)		4.5				4.0	5.5	4.5	4.5	5.5	4.5	4.5
Lane Util. Factor		1.00				1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frbp, ped/bikes		0.99				0.98	1.00	1.00	0.96	1.00	1.00	0.90
Flpb, ped/bikes		1.00				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.97				0.86	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1729				1563	1761	3287	1513	3143	3037	1402
Flt Permitted		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1729				1563	1761	3287	1513	3143	3037	1402
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)	31	21	16	0	0	573	10	1703	26	562	1438	10
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	11	0	0	4
Lane Group Flow (vph)	0	60	0	0	0	573	10	1703	15	563	1438	6
Confl. Peds. (#/hr)			7	7			25		13	13		25
Confl. Bikes (#/hr)			1			2			13			5
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	2%	2%	2%	4%	4%	4%
Parking (#/hr)											5	
Turn Type	custom	NA				Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3					5	2		14	6	
Permitted Phases	3					Free			2			6
Actuated Green, G (s)		6.5				140.0	1.0	83.3	83.3	35.7	87.3	87.3
Effective Green, g (s)		6.5				140.0	1.0	83.3	83.3	32.2	87.3	87.3
Actuated g/C Ratio		0.05				1.00	0.01	0.59	0.59	0.23	0.62	0.62
Clearance Time (s)		4.5					5.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)		3.0					0.2	0.2	0.2		0.2	0.2
Lane Grp Cap (vph)		80				1563	12	1955	900	722	1893	874
v/s Ratio Prot		c0.03					0.01	c0.52		c0.18	0.47	
v/s Ratio Perm						c0.37			0.01			0.00
v/c Ratio		0.75				0.37	0.83	0.87	0.02	0.78	0.76	0.01
Uniform Delay, d1		66.0				0.0	69.4	23.8	11.6	50.6	18.8	10.0
Progression Factor		1.00				1.00	1.00	1.00	1.00	0.84	1.44	1.00
Incremental Delay, d2		32.6				0.7	163.6	5.7	0.0	3.6	2.1	0.0
Delay (s)		98.6				0.7	233.0	29.5	11.6	46.3	29.2	10.0
Level of Service		F				A	F	C	B	D	C	A
Approach Delay (s)		98.6			0.7			30.4			33.9	
Approach LOS		F			A			C			C	
Intersection Summary												
HCM 2000 Control Delay			29.2				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)				18.0	
Intersection Capacity Utilization			76.9%				ICU Level of Service				D	
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

5: NB Off-Ramp/15th Ave W

PM Existing
No Cruise



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕				
Traffic Volume (vph)	415	350	0	0	255	100	220	30	60	0	0	0
Future Volume (vph)	415	350	0	0	255	100	220	30	60	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5				
Lane Util. Factor		0.95			0.95		1.00	1.00				
Frbp, ped/bikes		1.00			0.93		1.00	0.96				
Flpb, ped/bikes		1.00			1.00		1.00	1.00				
Frt		1.00			0.96		1.00	0.90				
Flt Protected		0.97			1.00		0.95	1.00				
Satd. Flow (prot)		3515			3209		1703	1541				
Flt Permitted		0.61			1.00		0.95	1.00				
Satd. Flow (perm)		2189			3209		1703	1541				
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)	428	361	0	0	263	103	227	31	62	0	0	0
RTOR Reduction (vph)	0	0	0	0	38	0	0	53	0	0	0	0
Lane Group Flow (vph)	0	789	0	0	328	0	227	40	0	0	0	0
Confl. Peds. (#/hr)	51		13	13		51			23	23		
Confl. Bikes (#/hr)			25			3			6			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	6%	6%	0%	0%	0%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		4 3			7			2				
Permitted Phases	4 3						2					
Actuated Green, G (s)		65.5			15.3		15.7	15.7				
Effective Green, g (s)		65.5			15.3		15.7	15.7				
Actuated g/C Ratio		0.60			0.14		0.14	0.14				
Clearance Time (s)					4.5		4.5	4.5				
Vehicle Extension (s)					2.0		2.0	2.0				
Lane Grp Cap (vph)		1303			446		243	219				
v/s Ratio Prot					c0.10			0.03				
v/s Ratio Perm		c0.36					c0.13					
v/c Ratio		6.20dl			0.74		0.93	0.18				
Uniform Delay, d1		14.1			45.4		46.6	41.5				
Progression Factor		1.07			1.00		1.00	1.00				
Incremental Delay, d2		0.4			5.4		42.9	1.8				
Delay (s)		15.5			50.8		89.6	43.3				
Level of Service		B			D		F	D				
Approach Delay (s)		15.5			50.8			76.1			0.0	
Approach LOS		B			D			E			A	

Intersection Summary

HCM 2000 Control Delay	37.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: 15th Ave W/SB Off-Ramp

PM Existing
No Cruise



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑						↑	↑
Traffic Volume (vph)	0	570	195	50	425	0	0	0	0	200	15	435
Future Volume (vph)	0	570	195	50	425	0	0	0	0	200	15	435
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5						4.5	4.5
Lane Util. Factor		0.95			0.95						1.00	1.00
Frb, ped/bikes		0.97			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.96			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.96	1.00
Satd. Flow (prot)		3344			3584						1780	1496
Flt Permitted		1.00			0.79						0.96	1.00
Satd. Flow (perm)		3344			2846						1780	1496
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	594	203	52	443	0	0	0	0	208	16	453
RTOR Reduction (vph)	0	29	0	0	0	0	0	0	0	0	0	36
Lane Group Flow (vph)	0	768	0	0	495	0	0	0	0	0	224	417
Confl. Peds. (#/hr)	95		13	13		95	37					37
Confl. Bikes (#/hr)			23			5						3
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	0%	0%	0%	2%	2%	2%
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4!			7 2						3 4!	4
Permitted Phases				7 2						3 4!		3
Actuated Green, G (s)		31.3			35.5						65.5	61.0
Effective Green, g (s)		31.3			35.5						65.5	61.0
Actuated g/C Ratio		0.28			0.32						0.60	0.55
Clearance Time (s)		4.5										4.5
Vehicle Extension (s)		2.0										2.0
Lane Grp Cap (vph)		951			918						1059	890
v/s Ratio Prot		c0.23										c0.13
v/s Ratio Perm					c0.17						0.13	0.15
v/c Ratio		0.81			0.54						0.21	0.47
Uniform Delay, d1		36.5			30.5						10.3	14.7
Progression Factor		1.00			0.60						1.00	1.00
Incremental Delay, d2		7.3			0.2						0.0	0.1
Delay (s)		43.9			18.4						10.3	14.9
Level of Service		D			B						B	B
Approach Delay (s)		43.9			18.4			0.0			13.4	
Approach LOS		D			B			A			B	

Intersection Summary

HCM 2000 Control Delay	27.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: W Dravus St & 20th Ave W

PM Existing
No Cruise

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	365	5	180	505	185	10	60	145	175	45	10
Future Volume (vph)	5	365	5	180	505	185	10	60	145	175	45	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5			3.5			3.5	3.5	3.5	3.5	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frb, ped/bikes		1.00			0.99			1.00	0.91	1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00	1.00	1.00	1.00	
Frt		1.00			0.97			1.00	0.85	1.00	0.97	
Flt Protected		1.00			0.99			0.99	1.00	0.95	1.00	
Satd. Flow (prot)		3562			3399			1865	1457	1787	1814	
Flt Permitted		0.94			0.68			0.97	1.00	0.95	1.00	
Satd. Flow (perm)		3366			2323			1823	1457	1787	1814	
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	0.93
Adj. Flow (vph)	5	392	5	194	543	199	11	65	156	188	48	11
RTOR Reduction (vph)	0	1	0	0	40	0	0	0	99	0	6	0
Lane Group Flow (vph)	0	401	0	0	896	0	0	76	57	188	53	0
Confl. Peds. (#/hr)	20		29	29		20	11		10	10		11
Confl. Bikes (#/hr)						9			130			38
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	pm+ov	Prot	NA	
Protected Phases		2		1	6			4	1	3	8	
Permitted Phases	2			6			4		4			
Actuated Green, G (s)		18.1			25.2			16.6	20.2	8.4	28.5	
Effective Green, g (s)		18.1			25.2			16.6	20.2	8.4	28.5	
Actuated g/C Ratio		0.30			0.42			0.27	0.33	0.14	0.47	
Clearance Time (s)		3.5			3.5			3.5	3.5	3.5	3.5	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1003			1028			498	568	247	851	
v/s Ratio Prot					c0.05				0.01	c0.11	0.03	
v/s Ratio Perm		0.12			c0.31			c0.04	0.03			
v/c Ratio		0.40			0.87			0.15	0.10	0.76	0.06	
Uniform Delay, d1		17.0			16.3			16.7	14.0	25.2	8.8	
Progression Factor		1.00			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.2			8.2			0.6	0.1	12.9	0.1	
Delay (s)		18.2			24.5			17.4	14.1	38.1	8.9	
Level of Service		B			C			B	B	D	A	
Approach Delay (s)		18.2			24.5			15.1			31.1	
Approach LOS		B			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			22.8			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			60.7			Sum of lost time (s)			14.0			
Intersection Capacity Utilization			65.2%			ICU Level of Service				C		
Analysis Period (min)			15									
c	Critical Lane Group											

2019 – One Ship Day

HCM Signalized Intersection Capacity Analysis

1: 15th & W Garfield St

10/24/2019

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	116	5	821	0	5	5	35	705	5	15	1554	106	
Future Volume (vph)	116	5	821	0	5	5	35	705	5	15	1554	106	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	10	12	12	12	12	11	10	12	11	10	12	
Grade (%)		-7%			0%			-1%			0%		
Total Lost time (s)		4.5	4.5		4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00	
Frbp, ped/bikes		1.00	0.98		1.00		1.00	1.00	0.96	1.00	1.00	0.90	
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	0.99	1.00	1.00	
Frt		1.00	0.85		0.93		1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected		0.95	1.00		1.00		0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)		1717	1611		1772		1654	3195	1472	1669	3240	1392	
Flt Permitted		0.73	1.00		1.00		0.12	1.00	1.00	0.36	1.00	1.00	
Satd. Flow (perm)		1309	1611		1772		214	3195	1472	631	3240	1392	
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	
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Adj. Flow (vph)	122	5	864	0	5	5	37	742	5	16	1636	112	
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	1	0	0	16	
Lane Group Flow (vph)	0	127	864	0	6	0	37	742	4	16	1636	96	
Confl. Peds. (#/hr)			3	3			14		3	3		14	
Confl. Bikes (#/hr)			8						4			9	
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	6%	6%	6%	4%	4%	4%	
Turn Type	Perm	NA	custom		NA		Perm	NA	Perm	Perm	NA	Perm	
Protected Phases		4	4		4			2			2		
Permitted Phases	4		2	4			2		2	2		2	
Actuated Green, G (s)		18.8	131.0		18.8		112.2	112.2	112.2	112.2	112.2	112.2	
Effective Green, g (s)		18.8	131.0		18.8		112.2	112.2	112.2	112.2	112.2	112.2	
Actuated g/C Ratio		0.13	0.94		0.13		0.80	0.80	0.80	0.80	0.80	0.80	
Clearance Time (s)		4.5	4.5		4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		2.0	2.0		2.0		1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		175	1611		237		171	2560	1179	505	2596	1115	
v/s Ratio Prot			0.07		0.00			0.23			c0.50		
v/s Ratio Perm		c0.10	0.46				0.17		0.00	0.03		0.07	
v/c Ratio		0.73	0.54		0.02		0.22	0.29	0.00	0.03	0.63	0.09	
Uniform Delay, d1		58.1	0.6		52.6		3.3	3.6	2.8	2.8	5.6	3.0	
Progression Factor		1.00	1.00		1.00		0.30	0.16	0.00	1.00	1.00	1.00	
Incremental Delay, d2		11.9	0.2		0.0		2.8	0.3	0.0	0.1	1.2	0.2	
Delay (s)		70.0	0.8		52.6		3.8	0.9	0.0	2.9	6.8	3.1	
Level of Service		E	A		D		A	A	A	A	A	A	
Approach Delay (s)		9.6			52.6			1.0			6.5		
Approach LOS		A			D			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.3				HCM 2000 Level of Service			A			
HCM 2000 Volume to Capacity ratio			0.64										
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			9.0			
Intersection Capacity Utilization			109.5%				ICU Level of Service			H			
Analysis Period (min)			15										

HCM Signalized Intersection Capacity Analysis

2: Elliott & W Galer St Flyover

10/24/2019

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 			   
Traffic Volume (vph)	106	50	725	409	54	2296
Future Volume (vph)	106	50	725	409	54	2296
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	14	16	10	13	9	10
Total Lost time (s)	5.0	5.0	5.5	5.0	5.0	5.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.91
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2767	1332	3120	1545	1577	4700
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2767	1332	3120	1545	1577	4700
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Growth Factor (vph)	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	109	52	747	422	56	2367
RTOR Reduction (vph)	0	46	0	143	0	0
Lane Group Flow (vph)	109	6	747	279	56	2367
Confl. Peds. (#/hr)		1		4	4	
Confl. Bikes (#/hr)		2		4		
Heavy Vehicles (%)	35%	35%	8%	8%	3%	3%
Turn Type	Prot	Perm	NA	custom	Prot	NA
Protected Phases	4		1	4 7	2	1 2
Permitted Phases		4				
Actuated Green, G (s)	15.7	15.7	97.8	85.5	11.0	114.3
Effective Green, g (s)	15.7	15.7	97.8	85.5	11.0	114.3
Actuated g/C Ratio	0.11	0.11	0.70	0.61	0.08	0.82
Clearance Time (s)	5.0	5.0	5.5		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	310	149	2179	943	123	3837
v/s Ratio Prot	c0.04		0.24	0.18	0.04	c0.50
v/s Ratio Perm		0.00				
v/c Ratio	0.35	0.04	0.34	0.30	0.46	0.62
Uniform Delay, d1	57.4	55.4	8.4	12.9	61.6	4.8
Progression Factor	1.00	1.00	0.92	0.34	0.93	0.37
Incremental Delay, d2	0.7	0.1	0.4	0.2	2.1	0.2
Delay (s)	58.1	55.5	8.1	4.6	59.3	2.0
Level of Service	E	E	A	A	E	A
Approach Delay (s)	57.3		6.8			3.3
Approach LOS	E		A			A
Intersection Summary						
HCM 2000 Control Delay			6.7		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			140.0		Sum of lost time (s)	18.5
Intersection Capacity Utilization			57.8%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: Elliott & W Roy St/W Mercer PI

10/24/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	5	5	0	0	312	50	817	20	412	1890	40
Future Volume (vph)	5	5	5	0	0	312	50	817	20	412	1890	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	10	12	10	10	12
Grade (%)		5%			0%			1%			0%	
Total Lost time (s)		4.5				4.0	5.5	4.5	4.5	5.5	4.5	4.5
Lane Util. Factor		1.00				1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frbp, ped/bikes		0.89				0.99	1.00	1.00	0.97	1.00	1.00	0.91
Flpb, ped/bikes		1.00				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.95				0.86	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1287				1436	1678	3133	1456	3143	3037	1420
Flt Permitted		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1287				1436	1678	3133	1456	3143	3037	1420
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
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	5	5	5	0	0	322	52	842	21	425	1948	41
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	9	0	0	10
Lane Group Flow (vph)	0	10	0	0	0	322	52	842	12	425	1948	31
Confl. Peds. (#/hr)	1		24	24		1	20		10	10		20
Confl. Bikes (#/hr)						3			2			13
Heavy Vehicles (%)	20%	20%	20%	13%	13%	13%	7%	7%	7%	4%	4%	4%
Parking (#/hr)												5
Turn Type	Split	NA				Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3					5	2		1 4		6
Permitted Phases						Free			2			6
Actuated Green, G (s)		2.2				140.0	7.0	80.5	80.5	42.8	106.8	106.8
Effective Green, g (s)		2.2				140.0	7.0	80.5	80.5	39.3	106.8	106.8
Actuated g/C Ratio		0.02				1.00	0.05	0.58	0.58	0.28	0.76	0.76
Clearance Time (s)		4.5					5.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)		3.0					0.2	0.2	0.2		0.2	0.2
Lane Grp Cap (vph)		20				1436	83	1801	837	882	2316	1083
v/s Ratio Prot		0.01					0.03	0.27		c0.14	c0.64	
v/s Ratio Perm						c0.22			0.01			0.02
v/c Ratio		0.50				0.22	0.63	0.47	0.01	0.48	0.84	0.03
Uniform Delay, d1		68.4				0.0	65.2	17.3	12.7	41.9	11.0	4.0
Progression Factor		1.00				1.00	1.00	1.00	1.00	1.00	0.93	16.47
Incremental Delay, d2		18.6				0.4	10.2	0.9	0.0	0.3	3.2	0.0
Delay (s)		86.9				0.4	75.4	18.2	12.8	42.0	13.4	66.3
Level of Service		F				A	E	B	B	D	B	E
Approach Delay (s)		86.9			0.4			21.3			19.3	
Approach LOS		F			A			C			B	
Intersection Summary												
HCM 2000 Control Delay			18.4									B
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			140.0							18.0		
Intersection Capacity Utilization			74.5%									D

HCM Signalized Intersection Capacity Analysis

5: NB Off-Ramp

10/24/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	395	250	0	0	131	85	151	20	26	0	0	0
Future Volume (vph)	395	250	0	0	131	85	151	20	26	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5				
Lane Util. Factor		0.95			0.95		1.00	1.00				
Frbp, ped/bikes		1.00			0.93		1.00	0.98				
Flpb, ped/bikes		1.00			1.00		1.00	1.00				
Frt		1.00			0.94		1.00	0.92				
Flt Protected		0.97			1.00		0.95	1.00				
Satd. Flow (prot)		3401			3145		1583	1502				
Flt Permitted		0.63			1.00		0.95	1.00				
Satd. Flow (perm)		2202			3145		1583	1502				
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
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	429	272	0	0	142	92	164	22	28	0	0	0
RTOR Reduction (vph)	0	0	0	0	83	0	0	22	0	0	0	0
Lane Group Flow (vph)	0	701	0	0	151	0	164	28	0	0	0	0
Confl. Peds. (#/hr)	31		38	38		31			8	8		
Confl. Bikes (#/hr)			3			6			2			
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	14%	14%	14%	0%	0%	0%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		4 3			7			2				
Permitted Phases	4 3						2					
Actuated Green, G (s)		55.9			10.3		20.3	20.3				
Effective Green, g (s)		55.9			10.3		20.3	20.3				
Actuated g/C Ratio		0.56			0.10		0.20	0.20				
Clearance Time (s)					4.5		4.5	4.5				
Vehicle Extension (s)					2.0		2.0	2.0				
Lane Grp Cap (vph)		1230			323		321	304				
v/s Ratio Prot					c0.05			0.02				
v/s Ratio Perm		c0.32					c0.10					
v/c Ratio		5.80dl			0.47		0.51	0.09				
Uniform Delay, d1		14.3			42.3		35.4	32.4				
Progression Factor		0.20			1.00		1.00	1.00				
Incremental Delay, d2		1.4			0.4		5.7	0.6				
Delay (s)		4.3			42.7		41.1	33.0				
Level of Service		A			D		D	C				
Approach Delay (s)		4.3			42.7			39.2			0.0	
Approach LOS		A			D			D			A	
Intersection Summary												
HCM 2000 Control Delay			18.6				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			18.0		
Intersection Capacity Utilization			55.6%				ICU Level of Service			B		
Analysis Period (min)			15									
dl Defacto Left Lane. Recode with 1 though lane as a left lane.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: 15th Ave W/SB Off-Ramp & W Dravus St

10/24/2019



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑						↑	↑
Traffic Volume (vph)	0	560	251	56	221	0	0	0	0	95	20	300
Future Volume (vph)	0	560	251	56	221	0	0	0	0	95	20	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5						4.5	4.5
Lane Util. Factor		0.95			0.95						1.00	1.00
Frb, ped/bikes		0.94			1.00						1.00	0.96
Flpb, ped/bikes		1.00			0.99						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.96	1.00
Satd. Flow (prot)		3158			3340						1659	1406
Flt Permitted		1.00			0.70						0.96	1.00
Satd. Flow (perm)		3158			2363						1659	1406
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
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	609	273	61	240	0	0	0	0	103	22	326
RTOR Reduction (vph)	0	53	0	0	0	0	0	0	0	0	0	158
Lane Group Flow (vph)	0	829	0	0	301	0	0	0	0	0	125	168
Confl. Peds. (#/hr)	35		38	38		35	44					44
Confl. Bikes (#/hr)			3			6						13
Heavy Vehicles (%)	3%	3%	3%	6%	6%	6%	0%	0%	0%	10%	10%	10%
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4!			7 2						3 4!	4
Permitted Phases				7 2						3 4!		3
Actuated Green, G (s)		33.9			35.1						55.9	51.4
Effective Green, g (s)		33.9			35.1						55.9	51.4
Actuated g/C Ratio		0.34			0.35						0.56	0.51
Clearance Time (s)		4.5										4.5
Vehicle Extension (s)		2.0										2.0
Lane Grp Cap (vph)		1070			829						927	785
v/s Ratio Prot		c0.26										c0.07
v/s Ratio Perm					c0.13						0.08	0.05
v/c Ratio		0.77			0.36						0.13	0.21
Uniform Delay, d1		29.6			24.1						10.5	13.3
Progression Factor		1.00			0.22						1.00	1.00
Incremental Delay, d2		5.5			0.1						0.3	0.6
Delay (s)		35.1			5.3						10.8	13.9
Level of Service		D			A						B	B
Approach Delay (s)		35.1			5.3			0.0			13.0	
Approach LOS		D			A			A			B	
Intersection Summary												
HCM 2000 Control Delay			23.5									C
HCM 2000 Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			100.0							18.0		
Intersection Capacity Utilization			63.4%									B
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: W Dravus St & 20th Ave W

10/24/2019

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	5	523	5	110	293	93	5	35	175	173	60	10	
Future Volume (vph)	5	523	5	110	293	93	5	35	175	173	60	10	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.5			4.5			4.5	4.5	4.5	4.5		
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00		
Frb, ped/bikes		1.00			0.99			1.00	0.98	1.00	0.99		
Flpb, ped/bikes		1.00			1.00			1.00	1.00	1.00	1.00		
Frt		1.00			0.97			1.00	0.85	1.00	0.98		
Flt Protected		1.00			0.99			0.99	1.00	0.95	1.00		
Satd. Flow (prot)		3532			3279			1781	1497	1752	1791		
Flt Permitted		0.95			0.70			0.95	1.00	0.95	1.00		
Satd. Flow (perm)		3358			2327			1695	1497	1752	1791		
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	
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Adj. Flow (vph)	5	568	5	120	318	101	5	38	190	188	65	11	
RTOR Reduction (vph)	0	1	0	0	28	0	0	0	87	0	8	0	
Lane Group Flow (vph)	0	577	0	0	511	0	0	43	103	188	68	0	
Confl. Peds. (#/hr)	9		15	15		9	5		1	1		5	
Confl. Bikes (#/hr)						8			18			49	
Heavy Vehicles (%)	2%	2%	2%	5%	5%	5%	6%	6%	6%	3%	3%	3%	
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	pm+ov	Prot	NA		
Protected Phases		2		1	6			4	1	3	8		
Permitted Phases	2			6			4		4				
Actuated Green, G (s)		16.5			25.0			2.9	6.9	6.6	14.0		
Effective Green, g (s)		16.5			25.0			2.9	6.9	6.6	14.0		
Actuated g/C Ratio		0.34			0.52			0.06	0.14	0.14	0.29		
Clearance Time (s)		4.5			4.5			4.5	4.5	4.5	4.5		
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)		1154			1291			102	355	240	522		
v/s Ratio Prot					c0.03				c0.02	c0.11	0.04		
v/s Ratio Perm		c0.17			0.17			0.03	0.04				
v/c Ratio		0.50			0.40			0.42	0.29	0.78	0.13		
Uniform Delay, d1		12.5			6.9			21.7	18.4	20.0	12.5		
Progression Factor		1.00			1.00			1.00	1.00	1.00	1.00		
Incremental Delay, d2		0.3			0.2			2.8	0.5	15.3	0.1		
Delay (s)		12.8			7.1			24.5	18.8	35.3	12.6		
Level of Service		B			A			C	B	D	B		
Approach Delay (s)		12.8			7.1			19.9			28.8		
Approach LOS		B			A			B			C		
Intersection Summary													
HCM 2000 Control Delay			14.6									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57										
Actuated Cycle Length (s)			48.0									Sum of lost time (s)	18.0
Intersection Capacity Utilization			58.1%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
1: 15th & W Garfield St

PM Existing
One Cruise

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	150	5	379	5	5	15	30	1539	5	5	1493	181	
Future Volume (vph)	150	5	379	5	5	15	30	1539	5	5	1493	181	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	10	12	12	12	12	11	10	12	11	10	12	
Grade (%)		-7%			0%			-1%			0%		
Total Lost time (s)		4.5	4.0		4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00	
Frbp, ped/bikes		1.00	0.98		0.99		1.00	1.00	0.96	1.00	1.00	0.88	
Flpb, ped/bikes		0.99	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85		0.92		1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected		0.95	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)		1674	1572		1705		1719	3320	1535	1694	3271	1379	
Flt Permitted		0.71	1.00		0.95		0.13	1.00	1.00	0.12	1.00	1.00	
Satd. Flow (perm)		1253	1572		1635		231	3320	1535	213	3271	1379	
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)	158	5	399	5	5	16	32	1620	5	5	1572	191	
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	1	0	0	32	
Lane Group Flow (vph)	0	163	399	0	13	0	32	1620	4	5	1572	159	
Confl. Peds. (#/hr)	3		2	2		3	17		2	2		17	
Confl. Bikes (#/hr)			3						8			8	
Heavy Vehicles (%)	4%	4%	4%	0%	0%	0%	2%	2%	2%	3%	3%	3%	
Turn Type	Perm	NA	Free	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	
Protected Phases		4			4			2			2		
Permitted Phases	4		Free	4			2		2	2		2	
Actuated Green, G (s)		22.6	140.0		22.6		108.4	108.4	108.4	108.4	108.4	108.4	
Effective Green, g (s)		22.6	140.0		22.6		108.4	108.4	108.4	108.4	108.4	108.4	
Actuated g/C Ratio		0.16	1.00		0.16		0.77	0.77	0.77	0.77	0.77	0.77	
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		2.0			2.0		1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		202	1572		263		178	2570	1188	164	2532	1067	
v/s Ratio Prot								c0.49			0.48		
v/s Ratio Perm		c0.13	0.25		0.01		0.14		0.00	0.02		0.12	
v/c Ratio		0.81	0.25		0.05		0.18	0.63	0.00	0.03	0.62	0.15	
Uniform Delay, d1		56.6	0.0		49.6		4.1	7.0	3.6	3.7	6.9	4.0	
Progression Factor		1.00	1.00		1.00		0.10	0.15	0.02	1.00	1.00	1.00	
Incremental Delay, d2		19.5	0.4		0.0		1.7	0.9	0.0	0.3	1.2	0.3	
Delay (s)		76.1	0.4		49.6		2.2	2.0	0.1	4.0	8.0	4.3	
Level of Service		E	A		D		A	A	A	A	A	A	
Approach Delay (s)		22.3			49.6			2.0			7.6		
Approach LOS		C			D			A			A		
Intersection Summary													
HCM 2000 Control Delay			7.6									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.66										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	9.0
Intersection Capacity Utilization			65.5%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

2: Elliott & W Galer St Flyover

PM Existing
One Cruise



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖↗	↖	↕↕	↖	↖	↕↕
Traffic Volume (vph)	58	39	1510	712	23	1869
Future Volume (vph)	58	39	1510	712	23	1869
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	14	16	10	13	9	10
Total Lost time (s)	5.0	5.0	5.5	5.0	5.0	5.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00	0.95	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3557	1658	3303	1632	1562	3240
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3557	1658	3303	1632	1562	3240
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	59	40	1541	727	23	1907
RTOR Reduction (vph)	0	36	0	28	0	0
Lane Group Flow (vph)	59	4	1541	699	23	1907
Confl. Peds. (#/hr)		12		10	10	
Confl. Bikes (#/hr)		8		12		
Heavy Vehicles (%)	5%	5%	2%	2%	4%	4%
Turn Type	Prot	Perm	NA	custom	Prot	NA
Protected Phases	4		1	4 7	2	1 2
Permitted Phases		4		2		
Actuated Green, G (s)	15.4	15.4	99.1	129.5	10.0	114.6
Effective Green, g (s)	15.4	15.4	99.1	129.5	10.0	114.6
Actuated g/C Ratio	0.11	0.11	0.71	0.92	0.07	0.82
Clearance Time (s)	5.0	5.0	5.5		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	391	182	2338	1567	111	2652
v/s Ratio Prot	0.02		0.47	c0.38	0.01	c0.59
v/s Ratio Perm		0.00		0.05		
v/c Ratio	0.15	0.02	0.66	0.45	0.21	0.72
Uniform Delay, d1	56.4	55.6	11.2	0.7	61.3	5.6
Progression Factor	1.00	1.00	0.62	2.23	0.88	0.76
Incremental Delay, d2	0.2	0.1	1.0	0.1	3.6	1.5
Delay (s)	56.6	55.6	7.9	1.6	57.2	5.7
Level of Service	E	E	A	A	E	A
Approach Delay (s)	56.2		5.9			6.3
Approach LOS	E		A			A

Intersection Summary

HCM 2000 Control Delay	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: Elliott & W Roy St/W Mercer PI

PM Existing
 One Cruise

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	20	15	0	0	552	10	1645	25	540	1377	10
Future Volume (vph)	30	20	15	0	0	552	10	1645	25	540	1377	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	10	12	10	10	12
Grade (%)		5%			0%			1%			0%	
Total Lost time (s)		4.5				4.0	5.5	4.5	4.5	5.5	4.5	4.5
Lane Util. Factor		1.00				1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frbp, ped/bikes		0.99				0.98	1.00	1.00	0.96	1.00	1.00	0.90
Flpb, ped/bikes		1.00				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.97				0.86	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1729				1563	1761	3287	1513	3143	3037	1402
Flt Permitted		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1729				1563	1761	3287	1513	3143	3037	1402
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)	31	21	16	0	0	575	10	1714	26	562	1434	10
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	11	0	0	4
Lane Group Flow (vph)	0	60	0	0	0	575	10	1714	15	563	1434	6
Confl. Peds. (#/hr)			7	7			25		13	13		25
Confl. Bikes (#/hr)			1			2			13			5
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	2%	2%	2%	4%	4%	4%
Parking (#/hr)											5	
Turn Type	custom	NA				Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3					5	2		14	6	
Permitted Phases	3					Free			2			6
Actuated Green, G (s)		6.5				140.0	1.0	83.3	83.3	35.7	87.3	87.3
Effective Green, g (s)		6.5				140.0	1.0	83.3	83.3	32.2	87.3	87.3
Actuated g/C Ratio		0.05				1.00	0.01	0.59	0.59	0.23	0.62	0.62
Clearance Time (s)		4.5					5.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)		3.0					0.2	0.2	0.2		0.2	0.2
Lane Grp Cap (vph)		80				1563	12	1955	900	722	1893	874
v/s Ratio Prot		c0.03					0.01	c0.52		c0.18	0.47	
v/s Ratio Perm						c0.37			0.01			0.00
v/c Ratio		0.75				0.37	0.83	0.88	0.02	0.78	0.76	0.01
Uniform Delay, d1		66.0				0.0	69.4	24.0	11.6	50.6	18.8	10.0
Progression Factor		1.00				1.00	1.00	1.00	1.00	0.84	1.44	1.00
Incremental Delay, d2		32.6				0.7	163.6	5.9	0.0	3.5	2.1	0.0
Delay (s)		98.6				0.7	233.0	29.9	11.6	46.1	29.2	10.0
Level of Service		F				A	F	C	B	D	C	A
Approach Delay (s)		98.6			0.7			30.8			33.8	
Approach LOS		F			A			C			C	
Intersection Summary												
HCM 2000 Control Delay			29.3			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			140.0			Sum of lost time (s)			18.0			
Intersection Capacity Utilization			77.1%			ICU Level of Service			D			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

5: NB Off-Ramp/15th Ave W

PM Existing
One Cruise



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔		↔	↔				
Traffic Volume (vph)	415	350	0	0	256	100	220	30	60	0	0	0
Future Volume (vph)	415	350	0	0	256	100	220	30	60	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5				
Lane Util. Factor		0.95			0.95		1.00	1.00				
Frbp, ped/bikes		1.00			0.93		1.00	0.96				
Flpb, ped/bikes		1.00			1.00		1.00	1.00				
Frt		1.00			0.96		1.00	0.90				
Flt Protected		0.97			1.00		0.95	1.00				
Satd. Flow (prot)		3515			3210		1703	1541				
Flt Permitted		0.61			1.00		0.95	1.00				
Satd. Flow (perm)		2189			3210		1703	1541				
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)	428	361	0	0	264	103	227	31	62	0	0	0
RTOR Reduction (vph)	0	0	0	0	38	0	0	53	0	0	0	0
Lane Group Flow (vph)	0	789	0	0	329	0	227	40	0	0	0	0
Confl. Peds. (#/hr)	51		13	13		51			23	23		
Confl. Bikes (#/hr)			25			3			6			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	6%	6%	0%	0%	0%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		4 3			7			2				
Permitted Phases	4 3						2					
Actuated Green, G (s)		65.5			15.3		15.7	15.7				
Effective Green, g (s)		65.5			15.3		15.7	15.7				
Actuated g/C Ratio		0.60			0.14		0.14	0.14				
Clearance Time (s)					4.5		4.5	4.5				
Vehicle Extension (s)					2.0		2.0	2.0				
Lane Grp Cap (vph)		1303			446		243	219				
v/s Ratio Prot					c0.10			0.03				
v/s Ratio Perm		c0.36					c0.13					
v/c Ratio		6.20dl			0.74		0.93	0.18				
Uniform Delay, d1		14.1			45.4		46.6	41.5				
Progression Factor		1.07			1.00		1.00	1.00				
Incremental Delay, d2		0.4			5.4		42.9	1.8				
Delay (s)		15.5			50.9		89.6	43.3				
Level of Service		B			D		F	D				
Approach Delay (s)		15.5			50.9			76.1			0.0	
Approach LOS		B			D			E			A	

Intersection Summary

HCM 2000 Control Delay	37.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: 15th Ave W/SB Off-Ramp

PM Existing
One Cruise



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑						↑	↑
Traffic Volume (vph)	0	570	196	51	425	0	0	0	0	200	15	435
Future Volume (vph)	0	570	196	51	425	0	0	0	0	200	15	435
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5						4.5	4.5
Lane Util. Factor		0.95			0.95						1.00	1.00
Frb, ped/bikes		0.97			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.96			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.96	1.00
Satd. Flow (prot)		3344			3583						1780	1496
Flt Permitted		1.00			0.79						0.96	1.00
Satd. Flow (perm)		3344			2834						1780	1496
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	594	204	53	443	0	0	0	0	208	16	453
RTOR Reduction (vph)	0	29	0	0	0	0	0	0	0	0	0	36
Lane Group Flow (vph)	0	769	0	0	496	0	0	0	0	0	224	417
Confl. Peds. (#/hr)	95		13	13		95	37					37
Confl. Bikes (#/hr)			23			5						3
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	0%	0%	0%	2%	2%	2%
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4!			7 2						3 4!	4
Permitted Phases				7 2						3 4!		3
Actuated Green, G (s)		31.3			35.5						65.5	61.0
Effective Green, g (s)		31.3			35.5						65.5	61.0
Actuated g/C Ratio		0.28			0.32						0.60	0.55
Clearance Time (s)		4.5										4.5
Vehicle Extension (s)		2.0										2.0
Lane Grp Cap (vph)		951			914						1059	890
v/s Ratio Prot		c0.23										c0.13
v/s Ratio Perm					c0.17						0.13	0.15
v/c Ratio		0.81			0.54						0.21	0.47
Uniform Delay, d1		36.6			30.6						10.3	14.7
Progression Factor		1.00			0.60						1.00	1.00
Incremental Delay, d2		7.4			0.2						0.0	0.1
Delay (s)		43.9			18.4						10.3	14.9
Level of Service		D			B						B	B
Approach Delay (s)		43.9			18.4			0.0			13.4	
Approach LOS		D			B			A			B	

Intersection Summary

HCM 2000 Control Delay	27.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: W Dravus St & 20th Ave W

PM Existing
One Cruise



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔			↕	↗	↘	↖	↗
Traffic Volume (vph)	5	366	5	180	505	185	10	60	145	175	45	10
Future Volume (vph)	5	366	5	180	505	185	10	60	145	175	45	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5			3.5			3.5	3.5	3.5	3.5	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frb, ped/bikes		1.00			0.99			1.00	0.91	1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00	1.00	1.00	1.00	
Frt		1.00			0.97			1.00	0.85	1.00	0.97	
Flt Protected		1.00			0.99			0.99	1.00	0.95	1.00	
Satd. Flow (prot)		3562			3399			1865	1457	1787	1814	
Flt Permitted		0.94			0.68			0.97	1.00	0.95	1.00	
Satd. Flow (perm)		3367			2319			1823	1457	1787	1814	
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	0.93
Adj. Flow (vph)	5	394	5	194	543	199	11	65	156	188	48	11
RTOR Reduction (vph)	0	1	0	0	40	0	0	0	98	0	6	0
Lane Group Flow (vph)	0	403	0	0	896	0	0	76	58	188	53	0
Confl. Peds. (#/hr)	20		29	29		20	11		10	10		11
Confl. Bikes (#/hr)						9			130			38
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	pm+ov	Prot	NA	
Protected Phases		2		1	6			4	1	3	8	
Permitted Phases	2			6			4		4			
Actuated Green, G (s)		18.1			25.2			16.6	20.2	8.4	28.5	
Effective Green, g (s)		18.1			25.2			16.6	20.2	8.4	28.5	
Actuated g/C Ratio		0.30			0.42			0.27	0.33	0.14	0.47	
Clearance Time (s)		3.5			3.5			3.5	3.5	3.5	3.5	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1003			1026			498	568	247	851	
v/s Ratio Prot					c0.05				0.01	c0.11	0.03	
v/s Ratio Perm		0.12			c0.31			c0.04	0.03			
v/c Ratio		0.40			0.87			0.15	0.10	0.76	0.06	
Uniform Delay, d1		17.0			16.3			16.7	14.0	25.2	8.8	
Progression Factor		1.00			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.2			8.3			0.6	0.1	12.9	0.1	
Delay (s)		18.2			24.6			17.4	14.1	38.1	8.9	
Level of Service		B			C			B	B	D	A	
Approach Delay (s)		18.2			24.6			15.1			31.1	
Approach LOS		B			C			B			C	

Intersection Summary

HCM 2000 Control Delay	22.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	60.7	Sum of lost time (s)	14.0
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

2019 – Two Ship Day

HCM Signalized Intersection Capacity Analysis

1: 15th & W Garfield St

10/24/2019

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	132	5	873	0	5	5	35	766	5	15	1600	117	
Future Volume (vph)	132	5	873	0	5	5	35	766	5	15	1600	117	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	10	12	12	12	12	11	10	12	11	10	12	
Grade (%)		-7%			0%			-1%			0%		
Total Lost time (s)		4.5	4.5		4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00	
Frbp, ped/bikes		1.00	0.98		1.00		1.00	1.00	0.96	1.00	1.00	0.90	
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85		0.93		1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected		0.95	1.00		1.00		0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)		1717	1612		1772		1654	3195	1471	1670	3240	1392	
Flt Permitted		0.73	1.00		1.00		0.11	1.00	1.00	0.33	1.00	1.00	
Satd. Flow (perm)		1307	1612		1772		195	3195	1471	585	3240	1392	
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	
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Adj. Flow (vph)	139	5	919	0	5	5	37	806	5	16	1684	123	
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	1	0	0	18	
Lane Group Flow (vph)	0	144	919	0	6	0	37	806	4	16	1684	105	
Confl. Peds. (#/hr)			3	3			14		3	3		14	
Confl. Bikes (#/hr)			8						4			9	
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	6%	6%	6%	4%	4%	4%	
Turn Type	Perm	NA	custom		NA		Perm	NA	Perm	Perm	NA	Perm	
Protected Phases		4	4		4			2			2		
Permitted Phases	4		2	4			2		2	2		2	
Actuated Green, G (s)		20.8	131.0		20.8		110.2	110.2	110.2	110.2	110.2	110.2	
Effective Green, g (s)		20.8	131.0		20.8		110.2	110.2	110.2	110.2	110.2	110.2	
Actuated g/C Ratio		0.15	0.94		0.15		0.79	0.79	0.79	0.79	0.79	0.79	
Clearance Time (s)		4.5	4.5		4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		2.0	2.0		2.0		1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		194	1612		263		153	2514	1157	460	2550	1095	
v/s Ratio Prot			0.08		0.00			0.25			c0.52		
v/s Ratio Perm		c0.11	0.49				0.19		0.00	0.03		0.08	
v/c Ratio		0.74	0.57		0.02		0.24	0.32	0.00	0.03	0.66	0.10	
Uniform Delay, d1		57.0	0.6		50.9		3.9	4.2	3.2	3.3	6.6	3.4	
Progression Factor		1.00	1.00		1.00		0.33	0.19	0.02	1.00	1.00	1.00	
Incremental Delay, d2		12.5	0.3		0.0		3.5	0.3	0.0	0.1	1.4	0.2	
Delay (s)		69.6	0.9		50.9		4.8	1.1	0.1	3.4	8.0	3.6	
Level of Service		E	A		D		A	A	A	A	A	A	
Approach Delay (s)		10.2			50.9			1.3			7.6		
Approach LOS		B			D			A			A		
Intersection Summary													
HCM 2000 Control Delay			7.0									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.67										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	9.0
Intersection Capacity Utilization			114.0%									ICU Level of Service	H
Analysis Period (min)			15										

HCM Signalized Intersection Capacity Analysis

2: Elliott & W Galer St Flyover

10/24/2019



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	285	111	725	583	100	2348
Future Volume (vph)	285	111	725	583	100	2348
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	14	16	10	13	9	10
Total Lost time (s)	5.0	5.0	5.5	5.0	5.0	5.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.91
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2767	1334	3120	1545	1577	4700
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2767	1334	3120	1545	1577	4700
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Growth Factor (vph)	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	294	114	747	601	103	2421
RTOR Reduction (vph)	0	93	0	204	0	0
Lane Group Flow (vph)	294	21	747	397	103	2421
Confl. Peds. (#/hr)		1		4	4	
Confl. Bikes (#/hr)		2		4		
Heavy Vehicles (%)	35%	35%	8%	8%	3%	3%
Turn Type	Prot	Perm	NA	custom	Prot	NA
Protected Phases	4		1	4 7	2	1 2
Permitted Phases		4				
Actuated Green, G (s)	25.5	25.5	88.0	85.5	11.0	104.5
Effective Green, g (s)	25.5	25.5	88.0	85.5	11.0	104.5
Actuated g/C Ratio	0.18	0.18	0.63	0.61	0.08	0.75
Clearance Time (s)	5.0	5.0	5.5		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	503	242	1961	943	123	3508
v/s Ratio Prot	c0.11		0.24	0.26	0.07	c0.52
v/s Ratio Perm		0.02				
v/c Ratio	0.58	0.09	0.38	0.42	0.84	0.69
Uniform Delay, d1	52.4	47.6	12.7	14.3	63.6	9.3
Progression Factor	1.00	1.00	1.01	0.64	0.91	0.51
Incremental Delay, d2	1.7	0.2	0.5	0.3	30.0	0.5
Delay (s)	54.1	47.7	13.3	9.5	88.1	5.2
Level of Service	D	D	B	A	F	A
Approach Delay (s)	52.3		11.6			8.5
Approach LOS	D		B			A

Intersection Summary

HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Elliott & W Roy St/W Mercer PI

10/24/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	5	5	0	0	335	50	968	20	443	2090	40
Future Volume (vph)	5	5	5	0	0	335	50	968	20	443	2090	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	10	12	10	10	12
Grade (%)		5%			0%			1%			0%	
Total Lost time (s)		4.5				4.0	5.5	4.5	4.5	5.5	4.5	4.5
Lane Util. Factor		1.00				1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frbp, ped/bikes		0.89				0.99	1.00	1.00	0.97	1.00	1.00	0.91
Flpb, ped/bikes		1.00				1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.95				0.86	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1287				1436	1678	3133	1456	3143	3037	1420
Flt Permitted		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1287				1436	1678	3133	1456	3143	3037	1420
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
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	5	5	5	0	0	345	52	998	21	457	2155	41
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	9	0	0	10
Lane Group Flow (vph)	0	10	0	0	0	345	52	998	12	457	2155	31
Confl. Peds. (#/hr)	1		24	24		1	20		10	10		20
Confl. Bikes (#/hr)						3			2			13
Heavy Vehicles (%)	20%	20%	20%	13%	13%	13%	7%	7%	7%	4%	4%	4%
Parking (#/hr)												5
Turn Type	Split	NA				Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3					5	2		1 4		6
Permitted Phases						Free			2			6
Actuated Green, G (s)		2.2				140.0	7.0	80.5	80.5	42.8	106.8	106.8
Effective Green, g (s)		2.2				140.0	7.0	80.5	80.5	39.3	106.8	106.8
Actuated g/C Ratio		0.02				1.00	0.05	0.58	0.58	0.28	0.76	0.76
Clearance Time (s)		4.5					5.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)		3.0					0.2	0.2	0.2		0.2	0.2
Lane Grp Cap (vph)		20				1436	83	1801	837	882	2316	1083
v/s Ratio Prot		0.01					0.03	0.32		c0.15	c0.71	
v/s Ratio Perm						c0.24			0.01			0.02
v/c Ratio		0.50				0.24	0.63	0.55	0.01	0.52	0.93	0.03
Uniform Delay, d1		68.4				0.0	65.2	18.6	12.7	42.4	13.6	4.0
Progression Factor		1.00				1.00	1.00	1.00	1.00	1.05	1.06	12.35
Incremental Delay, d2		18.6				0.4	10.2	1.2	0.0	0.4	6.3	0.0
Delay (s)		86.9				0.4	75.4	19.8	12.8	45.0	20.7	49.8
Level of Service		F				A	E	B	B	D	C	D
Approach Delay (s)		86.9			0.4			22.4			25.3	
Approach LOS		F			A			C			C	
Intersection Summary												
HCM 2000 Control Delay			22.7									C
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			140.0							18.0		
Intersection Capacity Utilization			80.0%									D

HCM Signalized Intersection Capacity Analysis

5: NB Off-Ramp

10/24/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 		 					
Traffic Volume (vph)	395	250	0	0	143	85	167	20	42	0	0	0
Future Volume (vph)	395	250	0	0	143	85	167	20	42	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5				
Lane Util. Factor		0.95			0.95		1.00	1.00				
Frbp, ped/bikes		1.00			0.94		1.00	0.98				
Flpb, ped/bikes		1.00			1.00		1.00	1.00				
Frt		1.00			0.94		1.00	0.90				
Flt Protected		0.97			1.00		0.95	1.00				
Satd. Flow (prot)		3401			3167		1583	1468				
Flt Permitted		0.63			1.00		0.95	1.00				
Satd. Flow (perm)		2201			3167		1583	1468				
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
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	429	272	0	0	155	92	182	22	46	0	0	0
RTOR Reduction (vph)	0	0	0	0	82	0	0	37	0	0	0	0
Lane Group Flow (vph)	0	701	0	0	165	0	182	31	0	0	0	0
Confl. Peds. (#/hr)	31		38	38		31			8	8		
Confl. Bikes (#/hr)			3			6			2			
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	14%	14%	14%	0%	0%	0%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		4 3			7			2				
Permitted Phases	4 3						2					
Actuated Green, G (s)		56.0			10.5		20.0	20.0				
Effective Green, g (s)		56.0			10.5		20.0	20.0				
Actuated g/C Ratio		0.56			0.10		0.20	0.20				
Clearance Time (s)					4.5		4.5	4.5				
Vehicle Extension (s)					2.0		2.0	2.0				
Lane Grp Cap (vph)		1232			332		316	293				
v/s Ratio Prot					c0.05			0.02				
v/s Ratio Perm		c0.32					c0.11					
v/c Ratio		5.88dl			0.50		0.58	0.11				
Uniform Delay, d1		14.2			42.3		36.2	32.7				
Progression Factor		0.19			1.00		1.00	1.00				
Incremental Delay, d2		1.4			0.4		7.4	0.7				
Delay (s)		4.2			42.7		43.6	33.4				
Level of Service		A			D		D	C				
Approach Delay (s)		4.2			42.7			40.8			0.0	
Approach LOS		A			D			D			A	
Intersection Summary												
HCM 2000 Control Delay			19.8				HCM 2000 Level of Service		B			
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)		18.0			
Intersection Capacity Utilization			55.7%				ICU Level of Service		B			
Analysis Period (min)			15									
dl Defacto Left Lane. Recode with 1 though lane as a left lane.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
6: 15th Ave W/SB Off-Ramp & W Dravus St

10/24/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑						↑	↑
Traffic Volume (vph)	0	560	263	68	237	0	0	0	0	95	20	300
Future Volume (vph)	0	560	263	68	237	0	0	0	0	95	20	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5						4.5	4.5
Lane Util. Factor		0.95			0.95						1.00	1.00
Frb, ped/bikes		0.94			1.00						1.00	0.96
Flpb, ped/bikes		1.00			0.99						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.96	1.00
Satd. Flow (prot)		3147			3334						1659	1406
Flt Permitted		1.00			0.67						0.96	1.00
Satd. Flow (perm)		3147			2253						1659	1406
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
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adj. Flow (vph)	0	609	286	74	258	0	0	0	0	103	22	326
RTOR Reduction (vph)	0	57	0	0	0	0	0	0	0	0	0	148
Lane Group Flow (vph)	0	838	0	0	332	0	0	0	0	0	125	178
Confl. Peds. (#/hr)	35		38	38		35	44					44
Confl. Bikes (#/hr)			3			6						13
Heavy Vehicles (%)	3%	3%	3%	6%	6%	6%	0%	0%	0%	10%	10%	10%
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4!			7 2						3 4!	4
Permitted Phases				7 2						3 4!		3
Actuated Green, G (s)		34.0			35.0						56.0	51.5
Effective Green, g (s)		34.0			35.0						56.0	51.5
Actuated g/C Ratio		0.34			0.35						0.56	0.52
Clearance Time (s)		4.5										4.5
Vehicle Extension (s)		2.0										2.0
Lane Grp Cap (vph)		1069			788						929	787
v/s Ratio Prot		c0.27										c0.08
v/s Ratio Perm					c0.15						0.08	0.05
v/c Ratio		0.78			0.42						0.13	0.23
Uniform Delay, d1		29.7			24.8						10.5	13.3
Progression Factor		1.00			0.23						1.00	1.00
Incremental Delay, d2		5.8			0.1						0.3	0.7
Delay (s)		35.5			5.9						10.8	14.0
Level of Service		D			A						B	B
Approach Delay (s)		35.5			5.9			0.0			13.1	
Approach LOS		D			A			A			B	
Intersection Summary												
HCM 2000 Control Delay			23.6		HCM 2000 Level of Service					C		
HCM 2000 Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			100.0		Sum of lost time (s)					18.0		
Intersection Capacity Utilization			64.1%		ICU Level of Service					C		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

7: W Dravus St & 20th Ave W

10/24/2019

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	5	529	5	110	301	101	5	35	175	179	60	10	
Future Volume (vph)	5	529	5	110	301	101	5	35	175	179	60	10	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.5			4.5			4.5	4.5	4.5	4.5		
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00		
Frb, ped/bikes		1.00			0.99			1.00	0.98	1.00	0.99		
Flpb, ped/bikes		1.00			1.00			1.00	1.00	1.00	1.00		
Frt		1.00			0.97			1.00	0.85	1.00	0.98		
Flt Protected		1.00			0.99			0.99	1.00	0.95	1.00		
Satd. Flow (prot)		3532			3274			1781	1497	1752	1791		
Flt Permitted		0.95			0.70			0.95	1.00	0.95	1.00		
Satd. Flow (perm)		3357			2320			1695	1497	1752	1791		
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	
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Adj. Flow (vph)	5	575	5	120	327	110	5	38	190	195	65	11	
RTOR Reduction (vph)	0	1	0	0	30	0	0	0	87	0	8	0	
Lane Group Flow (vph)	0	584	0	0	527	0	0	43	103	195	68	0	
Confl. Peds. (#/hr)	9		15	15		9	5		1	1		5	
Confl. Bikes (#/hr)						8			18			49	
Heavy Vehicles (%)	2%	2%	2%	5%	5%	5%	6%	6%	6%	3%	3%	3%	
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	pm+ov	Prot	NA		
Protected Phases		2		1	6			4	1	3	8		
Permitted Phases	2			6			4		4				
Actuated Green, G (s)		16.4			24.9			2.9	6.9	6.7	14.1		
Effective Green, g (s)		16.4			24.9			2.9	6.9	6.7	14.1		
Actuated g/C Ratio		0.34			0.52			0.06	0.14	0.14	0.29		
Clearance Time (s)		4.5			4.5			4.5	4.5	4.5	4.5		
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)		1146			1283			102	355	244	526		
v/s Ratio Prot					c0.03				c0.02	c0.11	0.04		
v/s Ratio Perm		c0.17			0.18			0.03	0.04				
v/c Ratio		0.51			0.41			0.42	0.29	0.80	0.13		
Uniform Delay, d1		12.6			7.1			21.7	18.4	20.0	12.4		
Progression Factor		1.00			1.00			1.00	1.00	1.00	1.00		
Incremental Delay, d2		0.4			0.2			2.8	0.5	16.5	0.1		
Delay (s)		13.0			7.3			24.5	18.8	36.5	12.6		
Level of Service		B			A			C	B	D	B		
Approach Delay (s)		13.0			7.3			19.9			29.8		
Approach LOS		B			A			B			C		
Intersection Summary													
HCM 2000 Control Delay			14.8									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.58										
Actuated Cycle Length (s)			48.0									Sum of lost time (s)	18.0
Intersection Capacity Utilization			58.8%									ICU Level of Service	B
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

1: 15th & W Garfield St

10/24/2019



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↕	↗		↔		↖	↕	↗	↖	↕	↗	
Traffic Volume (vph)	151	5	387	5	5	15	30	1548	5	5	1491	180	
Future Volume (vph)	151	5	387	5	5	15	30	1548	5	5	1491	180	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	10	12	12	12	12	11	10	12	11	10	12	
Grade (%)		-7%			0%			-1%			0%		
Total Lost time (s)		4.5	4.0		4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00	
Frbp, ped/bikes		1.00	0.98		0.99		1.00	1.00	0.96	1.00	1.00	0.88	
Flpb, ped/bikes		0.99	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85		0.92		1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected		0.95	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)		1674	1572		1705		1719	3320	1535	1694	3271	1379	
Flt Permitted		0.71	1.00		0.95		0.13	1.00	1.00	0.12	1.00	1.00	
Satd. Flow (perm)		1253	1572		1635		232	3320	1535	210	3271	1379	
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)	159	5	407	5	5	16	32	1629	5	5	1569	189	
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	1	0	0	31	
Lane Group Flow (vph)	0	164	407	0	13	0	32	1629	4	5	1569	158	
Confl. Peds. (#/hr)	3		2	2		3	17		2	2		17	
Confl. Bikes (#/hr)			3						8			8	
Heavy Vehicles (%)	4%	4%	4%	0%	0%	0%	2%	2%	2%	3%	3%	3%	
Turn Type	Perm	NA	Free	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	
Protected Phases		4			4			2			2		
Permitted Phases	4		Free	4			2		2	2		2	
Actuated Green, G (s)		22.7	140.0		22.7		108.3	108.3	108.3	108.3	108.3	108.3	
Effective Green, g (s)		22.7	140.0		22.7		108.3	108.3	108.3	108.3	108.3	108.3	
Actuated g/C Ratio		0.16	1.00		0.16		0.77	0.77	0.77	0.77	0.77	0.77	
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)		2.0			2.0		1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		203	1572		265		179	2568	1187	162	2530	1066	
v/s Ratio Prot								c0.49			0.48		
v/s Ratio Perm		c0.13	0.26		0.01		0.14		0.00	0.02		0.11	
v/c Ratio		0.81	0.26		0.05		0.18	0.63	0.00	0.03	0.62	0.15	
Uniform Delay, d1		56.5	0.0		49.5		4.2	7.0	3.6	3.7	6.9	4.1	
Progression Factor		1.00	1.00		1.00		0.09	0.12	0.00	1.00	1.00	1.00	
Incremental Delay, d2		19.5	0.4		0.0		1.7	0.9	0.0	0.4	1.2	0.3	
Delay (s)		76.0	0.4		49.5		2.1	1.8	0.0	4.0	8.1	4.3	
Level of Service		E	A		D		A	A	A	A	A	A	
Approach Delay (s)		22.1			49.5			1.8			7.6		
Approach LOS		C			D			A			A		
Intersection Summary													
HCM 2000 Control Delay			7.6									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.66										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	9.0
Intersection Capacity Utilization			65.8%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

2: Elliott & W Galer St Flyover

10/24/2019



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	83	48	1510	705	21	1877
Future Volume (vph)	83	48	1510	705	21	1877
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	14	16	10	13	9	10
Total Lost time (s)	5.0	5.0	5.5	5.0	5.0	5.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes	1.00	0.95	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3557	1659	3303	1632	1562	3240
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3557	1659	3303	1632	1562	3240
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	85	49	1541	719	21	1915
RTOR Reduction (vph)	0	43	0	27	0	0
Lane Group Flow (vph)	85	6	1541	692	21	1915
Confl. Peds. (#/hr)		12		10	10	
Confl. Bikes (#/hr)		8		12		
Heavy Vehicles (%)	5%	5%	2%	2%	4%	4%
Turn Type	Prot	Perm	NA	custom	Prot	NA
Protected Phases	4		1	4 7	2	1 2
Permitted Phases		4		2		
Actuated Green, G (s)	16.3	16.3	98.2	129.5	10.0	113.7
Effective Green, g (s)	16.3	16.3	98.2	129.5	10.0	113.7
Actuated g/C Ratio	0.12	0.12	0.70	0.92	0.07	0.81
Clearance Time (s)	5.0	5.0	5.5		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	414	193	2316	1567	111	2631
v/s Ratio Prot	0.02		0.47	c0.38	0.01	c0.59
v/s Ratio Perm		0.00		0.05		
v/c Ratio	0.21	0.03	0.67	0.44	0.19	0.73
Uniform Delay, d1	56.0	54.8	11.7	0.7	61.2	6.0
Progression Factor	1.00	1.00	0.61	2.18	0.88	0.73
Incremental Delay, d2	0.2	0.1	1.0	0.1	3.2	1.5
Delay (s)	56.2	54.9	8.1	1.6	56.7	5.9
Level of Service	E	D	A	A	E	A
Approach Delay (s)	55.7		6.0			6.5
Approach LOS	E		A			A

Intersection Summary

HCM 2000 Control Delay	7.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Elliott & W Roy St/W Mercer PI

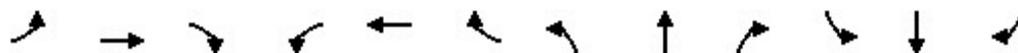
10/24/2019

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	30	20	15	0	0	551	10	1639	25	545	1405	10	
Future Volume (vph)	30	20	15	0	0	551	10	1639	25	545	1405	10	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	12	12	12	12	12	12	10	12	10	10	12	
Grade (%)		5%			0%			1%			0%		
Total Lost time (s)		4.5				4.0	5.5	4.5	4.5	5.5	4.5	4.5	
Lane Util. Factor		1.00				1.00	1.00	0.95	1.00	0.97	0.95	1.00	
Frbp, ped/bikes		0.99				0.98	1.00	1.00	0.96	1.00	1.00	0.90	
Flpb, ped/bikes		1.00				1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.97				0.86	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)		1729				1563	1761	3287	1513	3143	3037	1402	
Flt Permitted		0.98				1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)		1729				1563	1761	3287	1513	3143	3037	1402	
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)	31	21	16	0	0	574	10	1707	26	568	1464	10	
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	11	0	0	4	
Lane Group Flow (vph)	0	60	0	0	0	574	10	1707	15	568	1464	6	
Confl. Peds. (#/hr)			7	7			25		13	13		25	
Confl. Bikes (#/hr)			1			2			13			5	
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	2%	2%	2%	4%	4%	4%	
Parking (#/hr)												5	
Turn Type	custom	NA				Free	Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	3	3					5	2		14		6	
Permitted Phases	3					Free			2			6	
Actuated Green, G (s)		6.5				140.0	1.0	83.2	83.2	35.8	87.2	87.2	
Effective Green, g (s)		6.5				140.0	1.0	83.2	83.2	32.3	87.2	87.2	
Actuated g/C Ratio		0.05				1.00	0.01	0.59	0.59	0.23	0.62	0.62	
Clearance Time (s)		4.5					5.5	4.5	4.5		4.5	4.5	
Vehicle Extension (s)		3.0					0.2	0.2	0.2		0.2	0.2	
Lane Grp Cap (vph)		80				1563	12	1953	899	725	1891	873	
v/s Ratio Prot		c0.03					0.01	c0.52		c0.18	0.48		
v/s Ratio Perm						c0.37			0.01			0.00	
v/c Ratio		0.75				0.37	0.83	0.87	0.02	0.78	0.77	0.01	
Uniform Delay, d1		66.0				0.0	69.4	24.0	11.6	50.6	19.2	10.0	
Progression Factor		1.00				1.00	1.00	1.00	1.00	0.85	1.42	1.00	
Incremental Delay, d2		32.6				0.7	163.6	5.8	0.0	3.7	2.3	0.0	
Delay (s)		98.6				0.7	233.0	29.8	11.7	46.5	29.6	10.0	
Level of Service		F				A	F	C	B	D	C	B	
Approach Delay (s)		98.6			0.7			30.7			34.2		
Approach LOS		F			A			C			C		
Intersection Summary													
HCM 2000 Control Delay			29.5									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.85										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	18.0
Intersection Capacity Utilization			77.1%									ICU Level of Service	D
Analysis Period (min)			15										

HCM Signalized Intersection Capacity Analysis

5: NB Off-Ramp/15th Ave W

10/24/2019



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕				
Traffic Volume (vph)	415	350	0	0	255	100	222	30	62	0	0	0
Future Volume (vph)	415	350	0	0	255	100	222	30	62	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5				
Lane Util. Factor		0.95			0.95		1.00	1.00				
Frbp, ped/bikes		1.00			0.93		1.00	0.95				
Flpb, ped/bikes		1.00			1.00		1.00	1.00				
Frt		1.00			0.96		1.00	0.90				
Flt Protected		0.97			1.00		0.95	1.00				
Satd. Flow (prot)		3515			3209		1703	1538				
Flt Permitted		0.61			1.00		0.95	1.00				
Satd. Flow (perm)		2189			3209		1703	1538				
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)	428	361	0	0	263	103	229	31	64	0	0	0
RTOR Reduction (vph)	0	0	0	0	38	0	0	55	0	0	0	0
Lane Group Flow (vph)	0	789	0	0	328	0	229	40	0	0	0	0
Confl. Peds. (#/hr)	51		13	13		51			23	23		
Confl. Bikes (#/hr)			25			3			6			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	6%	6%	0%	0%	0%
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		4 3			7			2				
Permitted Phases	4 3						2					
Actuated Green, G (s)		65.5			15.3		15.7	15.7				
Effective Green, g (s)		65.5			15.3		15.7	15.7				
Actuated g/C Ratio		0.60			0.14		0.14	0.14				
Clearance Time (s)					4.5		4.5	4.5				
Vehicle Extension (s)					2.0		2.0	2.0				
Lane Grp Cap (vph)		1303			446		243	219				
v/s Ratio Prot					c0.10			0.03				
v/s Ratio Perm		c0.36					c0.13					
v/c Ratio		6.20dl			0.74		0.94	0.18				
Uniform Delay, d1		14.1			45.4		46.7	41.5				
Progression Factor		1.07			1.00		1.00	1.00				
Incremental Delay, d2		0.4			5.4		44.6	1.8				
Delay (s)		15.5			50.8		91.3	43.3				
Level of Service		B			D		F	D				
Approach Delay (s)		15.5			50.8			77.2			0.0	
Approach LOS		B			D			E			A	

Intersection Summary

HCM 2000 Control Delay	37.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: 15th Ave W/SB Off-Ramp

10/24/2019



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑						↑	↑
Traffic Volume (vph)	0	570	195	50	427	0	0	0	0	200	15	435
Future Volume (vph)	0	570	195	50	427	0	0	0	0	200	15	435
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5						4.5	4.5
Lane Util. Factor		0.95			0.95						1.00	1.00
Frbp, ped/bikes		0.97			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.96			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.96	1.00
Satd. Flow (prot)		3344			3584						1780	1496
Flt Permitted		1.00			0.79						0.96	1.00
Satd. Flow (perm)		3344			2848						1780	1496
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	594	203	52	445	0	0	0	0	208	16	453
RTOR Reduction (vph)	0	29	0	0	0	0	0	0	0	0	0	35
Lane Group Flow (vph)	0	768	0	0	497	0	0	0	0	0	224	418
Confl. Peds. (#/hr)	95		13	13		95	37					37
Confl. Bikes (#/hr)			23			5						3
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	0%	0%	0%	2%	2%	2%
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4!			7 2						3 4!	4
Permitted Phases				7 2						3 4!		3
Actuated Green, G (s)		31.3			35.5						65.5	61.0
Effective Green, g (s)		31.3			35.5						65.5	61.0
Actuated g/C Ratio		0.28			0.32						0.60	0.55
Clearance Time (s)		4.5										4.5
Vehicle Extension (s)		2.0										2.0
Lane Grp Cap (vph)		951			919						1059	890
v/s Ratio Prot		c0.23										c0.13
v/s Ratio Perm					c0.17						0.13	0.15
v/c Ratio		0.81			0.54						0.21	0.47
Uniform Delay, d1		36.5			30.6						10.3	14.8
Progression Factor		1.00			0.60						1.00	1.00
Incremental Delay, d2		7.3			0.2						0.0	0.1
Delay (s)		43.9			18.5						10.3	14.9
Level of Service		D			B						B	B
Approach Delay (s)		43.9			18.5			0.0			13.4	
Approach LOS		D			B			A			B	

Intersection Summary

HCM 2000 Control Delay	27.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: W Dravus St & 20th Ave W

10/24/2019

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Traffic Volume (vph)	5	365	5	180	506	186	10	60	145	175	45	10		
Future Volume (vph)	5	365	5	180	506	186	10	60	145	175	45	10		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Total Lost time (s)		3.5			3.5			3.5	3.5	3.5	3.5			
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00			
Frbp, ped/bikes		1.00			0.99			1.00	0.91	1.00	0.99			
Flpb, ped/bikes		1.00			1.00			1.00	1.00	1.00	1.00			
Frt		1.00			0.97			1.00	0.85	1.00	0.97			
Flt Protected		1.00			0.99			0.99	1.00	0.95	1.00			
Satd. Flow (prot)		3562			3399			1865	1457	1787	1814			
Flt Permitted		0.94			0.68			0.97	1.00	0.95	1.00			
Satd. Flow (perm)		3366			2323			1823	1457	1787	1814			
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	0.93		
Adj. Flow (vph)	5	392	5	194	544	200	11	65	156	188	48	11		
RTOR Reduction (vph)	0	1	0	0	40	0	0	0	99	0	6	0		
Lane Group Flow (vph)	0	401	0	0	898	0	0	76	57	188	53	0		
Confl. Peds. (#/hr)	20		29	29		20	11		10	10		11		
Confl. Bikes (#/hr)						9			130			38		
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	1%	1%	1%	1%	1%	1%		
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	pm+ov	Prot	NA			
Protected Phases		2		1	6			4	1	3	8			
Permitted Phases	2			6			4		4					
Actuated Green, G (s)		18.1			25.2			16.6	20.2	8.4	28.5			
Effective Green, g (s)		18.1			25.2			16.6	20.2	8.4	28.5			
Actuated g/C Ratio		0.30			0.42			0.27	0.33	0.14	0.47			
Clearance Time (s)		3.5			3.5			3.5	3.5	3.5	3.5			
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)		1003			1028			498	568	247	851			
v/s Ratio Prot					c0.05				0.01	c0.11	0.03			
v/s Ratio Perm		0.12			c0.31			c0.04	0.03					
v/c Ratio		0.40			0.87			0.15	0.10	0.76	0.06			
Uniform Delay, d1		17.0			16.3			16.7	14.0	25.2	8.8			
Progression Factor		1.00			1.00			1.00	1.00	1.00	1.00			
Incremental Delay, d2		1.2			8.3			0.6	0.1	12.9	0.1			
Delay (s)		18.2			24.6			17.4	14.1	38.1	8.9			
Level of Service		B			C			B	B	D	A			
Approach Delay (s)		18.2			24.6			15.1			31.1			
Approach LOS		B			C			B			C			
Intersection Summary														
HCM 2000 Control Delay			22.9									HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio			0.66											
Actuated Cycle Length (s)			60.7								14.0		Sum of lost time (s)	
Intersection Capacity Utilization			65.3%										ICU Level of Service	C
Analysis Period (min)			15											
c Critical Lane Group														