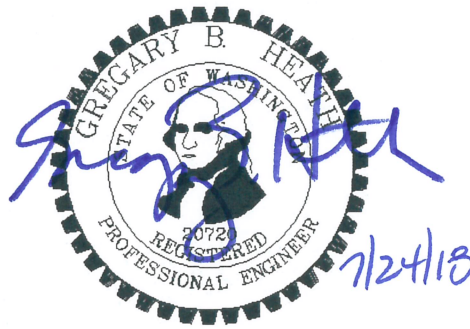




WELLINGTON HEIGHTS
TRAFFIC IMPACT ANALYSIS

CITY OF OLYMPIA, WA



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REVISED CP&D
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WELLINGTON HEIGHTS TRAFFIC IMPACT ANALYSIS

TABLE OF CONTENTS

1. Introduction	3
2. Project Description	3
3. Existing Conditions.....	3
4. Future Traffic Conditions.....	11
5. Summary & Mitigation	18
Appendix.....	19

LIST OF TABLES

1. Existing Level of Service	9
2. Accident History	12
3. Project Trip Generation	12
4. 2020 Level of Service	17

LIST OF FIGURES

1. Vicinity Map & Roadway System	4
2. Site Plan.....	5
3. Existing PM Peak Hour Volumes	8
4. PM Peak Hour Trip Distribution & Assignment	14
5. 2020 PM Peak Hour Volumes Without Project	15
6. 2020 PM Peak Hour Volumes With Project	16

WELLINGTON HEIGHTS TRAFFIC IMPACT ANALYSIS

1. INTRODUCTION

This report summarizes traffic impacts related to the Wellington Heights project. The general goals of this impact study concentrate on 1) the assessment of existing roadway conditions and intersection congestion, 2) forecasts of newly generated project traffic, 3) estimations of future delay, and 4) recommendations for mitigation. Preliminary tasks include the detailed collection of roadway information, road improvement information, and peak hour traffic counts. A level of service analysis for existing traffic conditions is then made to determine the present degree of intersection congestion. Based on this analysis, forecasts of future traffic levels on the surrounding street system are found. Following this forecast, the future service levels for the key intersections are investigated. As a final step, applicable conclusions and possible on-site or off-site mitigation measures are defined. The findings of this study are intended to ensure safe and efficient progression of vehicular and non-motorist traffic near the site.

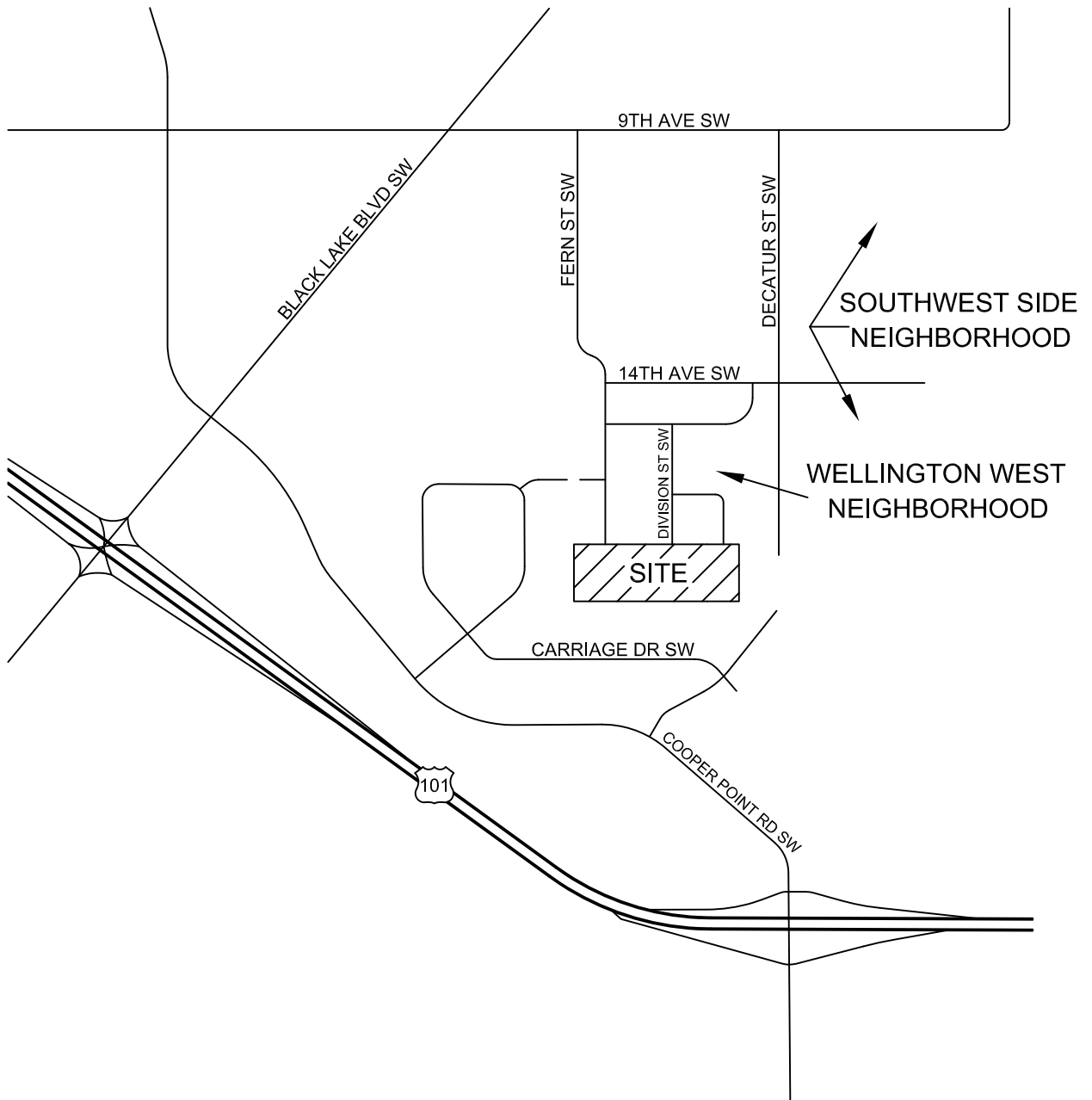
2. PROJECT DESCRIPTION

The Wellington Heights project is a residential development that proposes to construct 56 single family houses. The site is located at the southern end of Fern Street SW in the City of Olympia. Land parcels making up the site are zoned Residential 6-12 (6 to 12 units per acre). Access to the site will be provided by a new internal roadway, 18th Avenue SW, that will provide connection to Fern Street SW, Division Street SW, and Cushing Street SW. Developments surrounding the site are primarily residential with commercial land uses in the greater surrounding area. Buildout of the site is estimated around 2020, which was used as the horizon analysis year. Figure 1, on the following page, shows the site location and the primary arterials. The general configuration of the project is given in the site plan shown in Figure 2.

3. EXISTING CONDITIONS

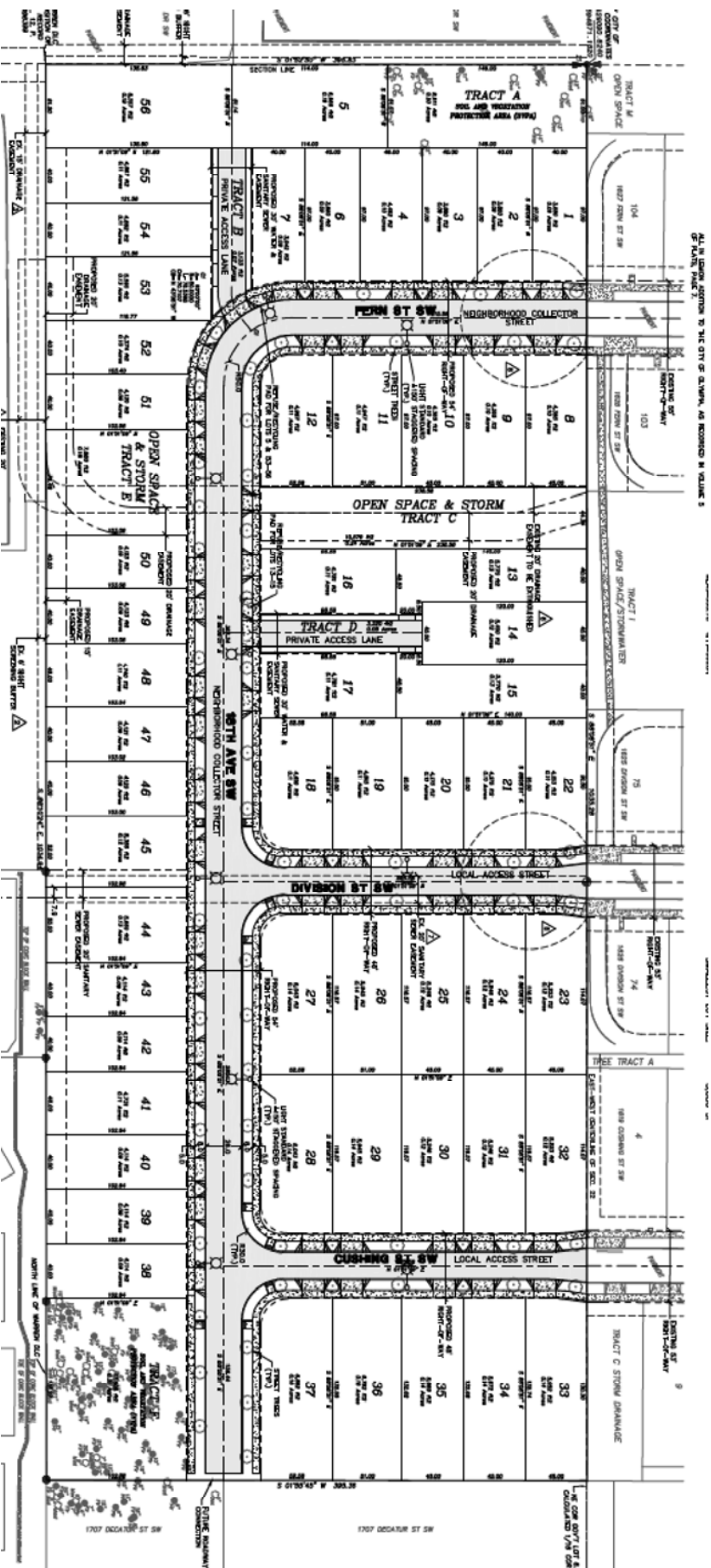
3.1 Surrounding Roadways

The street network serving the proposed project consists of a variety of roadways. Characteristics for these roadways vary with respect to lane widths, grades, speeds, and function. Differences are based on specific designations and proximity to major employment areas in the region. The major roadways and arterials surrounding the site are listed and described on page 6.



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WELLINGTON HEIGHTS
VICINITY MAP & ROADWAY SYSTEM
FIGURE 1



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WELLINGTON HEIGHTS
SITE PLAN
FIGURE 2

Fern Street SW is a two-lane, north-south Neighborhood Collector that provides access to the site. The speed limit is posted at 25 mph. Paving is asphalt and lane travel width is around 10 feet. Parking is provided in areas. Shoulders typically curb, gutter, and sidewalk with gravel shoulders in areas. Grades are level in the area.

Division Street SW is a two-lane, north-south roadway providing access to the site. Shoulders are curb gutter and sidewalk. Paving is asphalt with the westside of the roadway providing on street parking. Grades are level.

Decatur Street SW is a two-lane, north-south Major Collector located east of the site. The speed limit is posted at 25 mph. The roadway has traffic calming measures in place in the form of small traffic islands at intersections and speed humps with signs suggesting a travel speed of 15 mph. Paving is asphalt and lane travel width is around 10 feet. Typically the west side of the roadway has shoulders consisting of curb, gutter, and sidewalk. The east side of the roadway generally supports gravel shoulders. Grades are level in the area.

9th Avenue SW is a two-lane, east-west Major Collector that lies to the north of the site. The speed limit is posted at 25 mph in the vicinity of the site. Paving is asphalt with 11 foot lanes. Shoulders are typically curb and gutter with sidewalks provided along portions of the roadway. Bike lanes are provided as well. Grades range from 0 to 3 percent.

Black Lake Boulevard SW is an southwest-northeast, multilane Arterial that lies to the west of the site. North of 9th Avenue SW the speed limit is posted at 25 mph. To the south the speed limit is 30 mph. The typical cross-section of the roadway is two-lanes of travel in either direction along with a center two-way left turn lane. Additional turn lanes are provided at major intersections. Paving is asphalt with 11 foot lanes. Shoulders are curb, gutter, and sidewalk. Bike lanes are provided in the area as well. Grades are level in the area.

3.2 Roadway Improvements

A review of the Transportation 2030, Westside and Downtown map as part of Ordinance #7104 shows Fern Street SW is planned for extension. The extension will take place on the south side of the site and provide connection to Decatur Street SW. The specific alignment of the future street will be determined based a more detailed analysis. Impacts of this connection will be discussed in section 4.2, Trip Distribution of the report (see page 13).

3.3 Peak Hour Volumes

Field data that was collected for this study was taken in March of 2018. These manual traffic counts were performed at Decatur Street SW & 9th Avenue SW, Decatur Street SW & 14th Avenue SW, and Fern Street SW & 15th Avenue SW. Data for the intersections of Black Lake Boulevard SW & 9th Avenue SW and Fern Street SW & 9th Avenue SW was provided by the City of Olympia. These five intersections were identified by the City of Olympia for study during the traffic scoping process.

The traffic counts were taken during the evening peak period between the hours of 4 PM and 6 PM. This specific peak period was targeted for analysis purposes as it generally represents the worst case scenario with respect to traffic conditions for residential developments. The PM peak period typically has higher volumes than the AM peak period due to the greater number of recreation and shopping trips associated with the late afternoon period. Existing PM peak hour volumes can be found in Figure 3 on the following page.

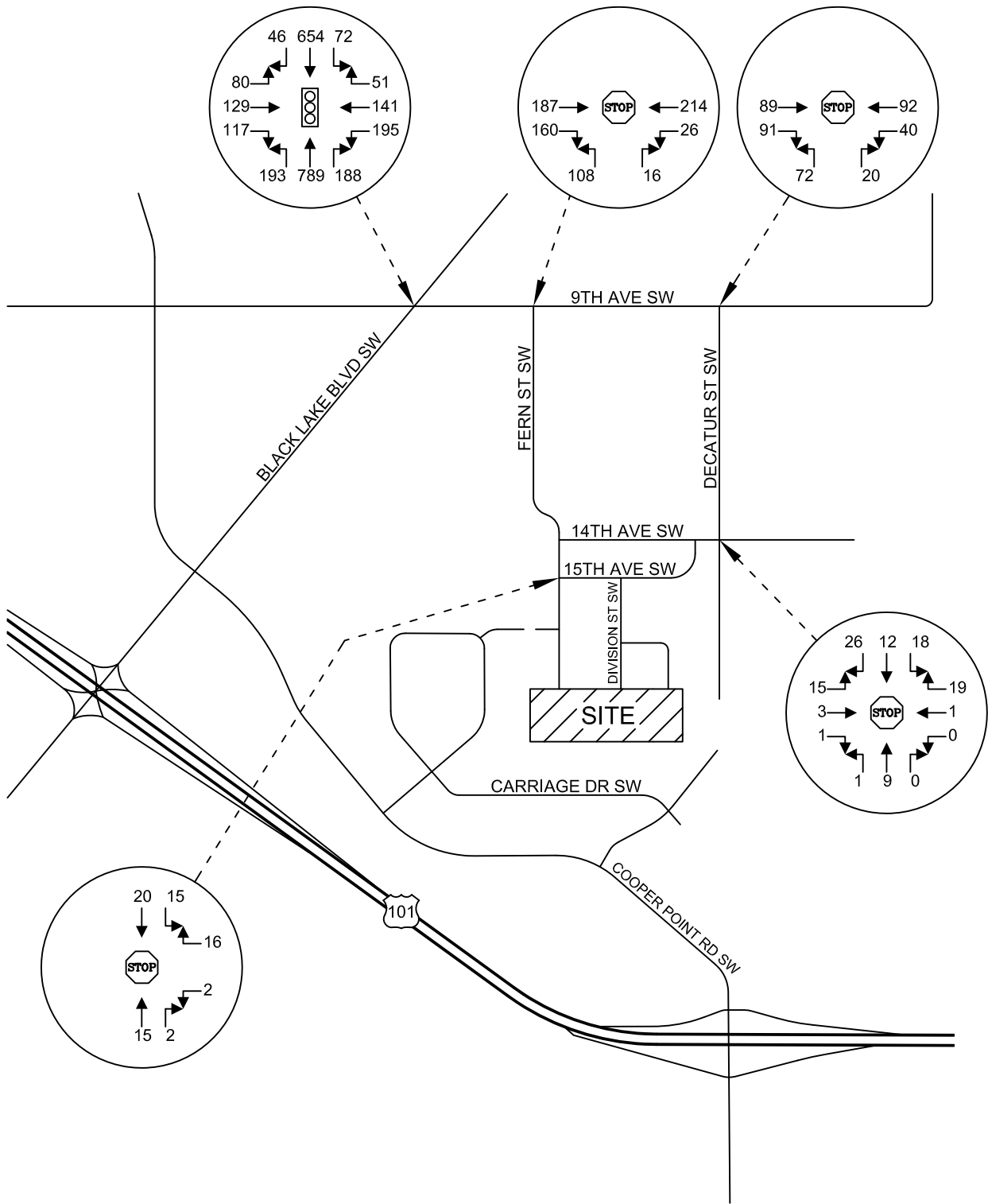
The AM peak hour and the PM peak hour at the intersection of 9th and Fern were compared and indicates that the PM peak hour is approximately 62 percent higher. A review of the intersection of Black Lake Boulevard and 9th shows the PM peak hour to be 92 percent higher. Refer to the peak hour counts attached to the appendix. For this reason the PM peak hour is focused on in this analysis. In addition, the traffic volumes from single family has a lower trip generation during the AM peak hour versus the PM peak hour based on ITE data.

3.4 Existing Level of Service

Peak hour delays were determined through the use of the *Highway Capacity Manual, 6th Edition*. Capacity analysis is used to determine level of service (LOS) which is an established measure of congestion for transportation facilities. LOS is defined for a variety of facilities including intersections, freeways, arterials, etc. A complete definition of level of service and related criteria can be found in the HCM.

The methodology for determining the LOS at signalized intersections strives to determine the volume to capacity (v/c) ratios for the various intersection movements as well as the average control delay for those movements.

The methodology for determining the LOS at unsignalized intersections strives to determine the potential capacities for the various vehicle movements and ultimately determines the average total delay for each movement. *Potential Capacity* represents the number of additional vehicles that could effectively utilize a particular movement, which is



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WELLINGTON HEIGHTS
EXISTING PM PEAK HOUR VOLUMES
FIGURE 3

essentially the equivalent of the difference between the movement capacity and the existing movement volume. *Total delay* is described as the elapsed time from when a vehicle stops at the end of a queue until the vehicle departs from the stop line. *Average total delay* is simply the mean total delay over the entire stream. A number of factors influence potential capacity and total delay including the availability/usefulness of gaps.

The range for intersection level of service is LOS A to LOS F with the former indicating the best operating conditions with low control delays and the latter indicating the worst conditions with heavy control delays. Detailed descriptions of intersection LOS are given in the Highway Capacity Manual.

Level of service calculations were made through the use of the Synchro 10 program, which follows procedures of the HCM for signalized and unsignalized intersections. Overall intersection LOS for two-way stop controlled intersections was calculated by the weighted average of each approach, per City of Olympia policy. Table 1 below summarizes results for the existing level of service analysis performed at the intersections identified in Figure 3.

Table 1
Existing Level of Service
Delays given in seconds per vehicle

Intersection	Control	Approach	LOS	Delay
Black Lake Blvd SW & 9th Ave SW	Signal	Eastbound	C	34.6
		Westbound	D	47.6
		Northbound	C	34.7
		Southbound	D	40.2
		Overall	D	38.2
9th Ave SW & Fern St SW	TWSC	Northbound	C	16.4
		Westbound LT	A	8.1
		Overall	A	3.2
9th Ave SW & Decatur St SW	AWSC	Eastbound	A	8.2
		Westbound	A	8.6
		Northbound	A	8.6
		Overall	A	8.4

(TWSC: Two-Way Stop Controlled, AWSC: All-Way Stop Controlled)

Table 1 - Continued
Existing Level of Service
Delays given in seconds per vehicle

Intersection	Control	Approach	LOS	Delay
14th Ave SW & Decatur St SW	TWSC	Eastbound	A	9.3
		Westbound	A	8.5
		Northbound LT	A	7.3
		Southbound LT	A	7.3
		Overall	A	4.5
Fern St SW & 15th Ave SW	AWSC	Westbound	A	6.6
		Northbound	A	7.0
		Southbound	A	7.3
		Overall	A	7.1

(TWSC: Two-Way Stop Controlled, AWSC: All-Way Stop Controlled)

As shown in Table 1, all stop controlled intersections operate with satisfactory delays in the LOS A to LOS C range. The signal at Black Lake Boulevard SW & 9th Avenue SW will operate at LOS D overall, which meets requirements outlined in the City of Olympia Traffic Impact Analysis (TIA) Guidelines for New Development.

Note that the Fern Street SW & 15th Avenue SW intersection was analyzed as all-way stop controlled rather than an uncontrolled (yield), as it currently functions. Given the low volumes at this intersection modeling it as yield controlled would show next to no delays.

3.5 Non-Motorist Traffic

Observations for pedestrian and bicycle activity were made at the key arterials and intersections of interest. During the peak hours moderate pedestrian volumes were observed. The area has pedestrian facilities in the form of sidewalks, crosswalks, and bike lanes that help alleviate any potential conflict between motorist and non-motorist traffic. Pedestrian volumes are summarized below. These represent the number of pedestrians observed at the given intersection during the PM peak hour.

Black Lake Boulevard SW & 9th Avenue SW:	26 Pedestrians
9th Avenue SW & Fern Street SW:	17 Pedestrians
9th Avenue SW & Decatur Street SW:	23 Pedestrians
14th Avenue SW & Decatur Street SW:	17 Pedestrians
15th Avenue SW & Fern Street SW:	13 Pedestrians

Based on discussions with the city, a portion of missing sidewalk located on the west side of Fern Street south of 9th Avenue and adjacent to the Cambridge Court Apartments will be completed by the city in 2019.

3.6 Transit Service

A review of the Intercity Transit system map shows transit service is provided at the site. Route 47 serves from the Olympia Transit Center to the Capital Medical Center between roughly 6:25 AM and 7:55 PM. The nearest stop is located about ½ mile to the north at Ferns Street SW & 9th Avenue SW.

3.7 Sight Distance at Access Driveways

Internal on site intersections must be designed and verified to meet sight distance requirements as outline in the *American Association of State Highway and Transportation Officials* (AASHTO) standards for outbound turning movements. For a 25 mph design speed 280 feet of entering sight distance is required.

3.8 Link Volumes and Link Speeds

Attached to the appendix is a figure which indicates the daily volumes along specific links of the area roadway system along with a data sheet available from Olympia for area roadways that shows historical volumes and speeds. Of particular notice is the substantial change in traffic volumes along 9th Street between Percival and Black Lake Boulevard.

3.9 Accident History

A list of the recorded accident history from 2013 through 2017 for the study intersections was requested through WSDOT. The corridors included were as follows when the accident request was made reflecting the higher volume corridors serving the area:

9th Avenue from Black Lake to Decatur

Fern Street heading south from 9th Avenue to the end of Fern

Decatur Street from 9th Avenue heading south to the end of city street

A list of the recorded accident history from 2013 through the end of 2017 for the intersections and segments identified on the following page was provided by WSDOT.

Table 2
Accident History
2013-2017 (WSDOT)

Intersection	2013	2014	2015	2016	2017
Bl Lk Blvd/9 th /Cap Mall	12	8	9	14	7
Decatur/14 th	0	0	0	1	0
Decatur/9th	1	3	1	1	0
Fern/14 th and nearby	2	0	0	3	1
9 th /Soraya	1	0	0	1	0
13 th /Decatur	1	0	0	0	0
9 th Avenue (midblock)	1	2	0	1	0

4. FUTURE TRAFFIC CONDITIONS

4.1 Trip Generation

Trip generation is used to determine the magnitude of project impacts on the surrounding street system. This is usually denoted by the quantity or specific number of new trips that enter and exit a project during a designated time period, such as a specific peak hour (AM or PM) or an entire day. Data presented in this report was taken from the Institute of Transportation Engineer's publication *Trip Generation*, Ninth Edition. The designated land use for this project is defined as Single-Family Detached Housing (LUC 210). Data for the PM peak hour was used for estimation purposes and was applied to the intersection network for future capacity analysis. Table 3 summarizes the estimated project trip generation. Included are the average weekday daily trips (ADT) and the AM and PM peak hour volumes. ITE average rates were used.

Table 3
Project Trip Generation
56 Dwelling Units

LUC	ADT	AM Peak Hour			PM Peak Hour		
		Inbound	Outbound	Total	Inbound	Outbound	Total
210	533 vpd	11 vph	31 vph	42 vpd	35 vph	21 vph	56 vph

(vpd; vehicles per day; vph; vehicles per hour)

4.2 Distribution & Assignment

Trip distribution describes the process by which project generated trips are dispersed on the street network surrounding the site. The trips generated by the project are expected to follow the general trip pattern as shown in Figure 4 on the following page. These distribution percentages are based on TAZ 335 modeling provided by Thurston County.

As mentioned previously in the report, there are future plans to extend Fern Street SW south of the site and connect to Decatur Street SW. This connection will likely not impact project distribution significantly. With 80 percent of trips destined north/west/south, Fern Street SW will remain the most direct path of travel north to reach 9th Avenue SW.

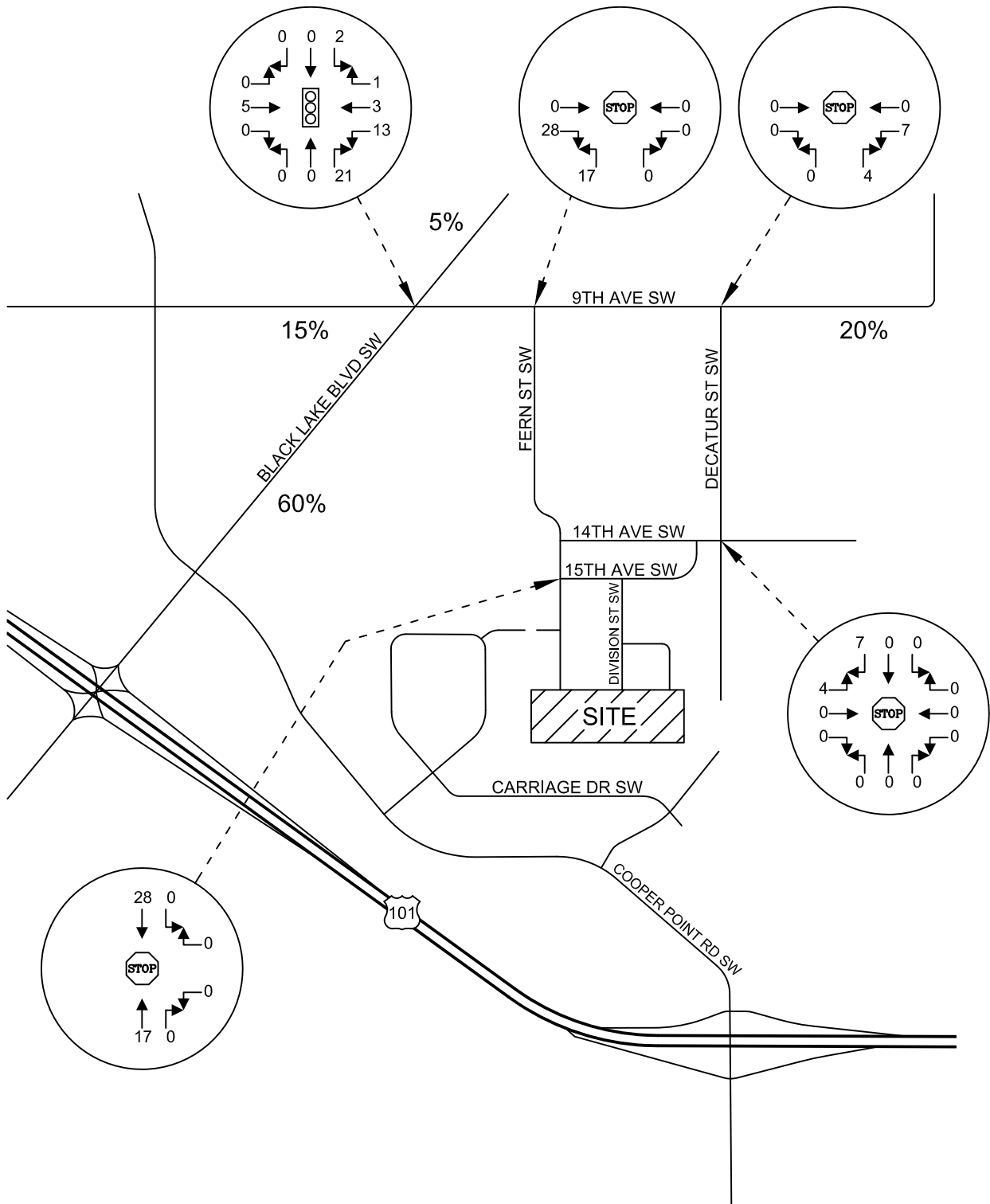
Concern by the neighborhood north and east of 9th has been expressed. North-south roads available for public travel in this vicinity include:

Cushing Street	Milroy Street
Decatur Street	Lee Street
Thomas Street	Plymouth Street
Percival Street	Rogers Street

The total PM peak trips from the project expected to travel through these streets based on trip assignment is estimated to be 11 trips during the PM peak hour. This trip generation represents approximately one trip every 5 minutes with dilution to less than this expected given the number of north-south streets in the area. The numerous routes available should prevent any concentration of project traffic.

4.3 Peak Hour Volumes

The estimated buildout year of 2020 was used in order to assess future impacts. A 2.0 percent annual background growth rate was applied to the existing volumes in Figure 3 to approximate future volumes. Figure 5 shows cumulative 2020 PM volumes without project-generated trips added. Figure 6 shows 2020 PM peak volumes with project traffic included.



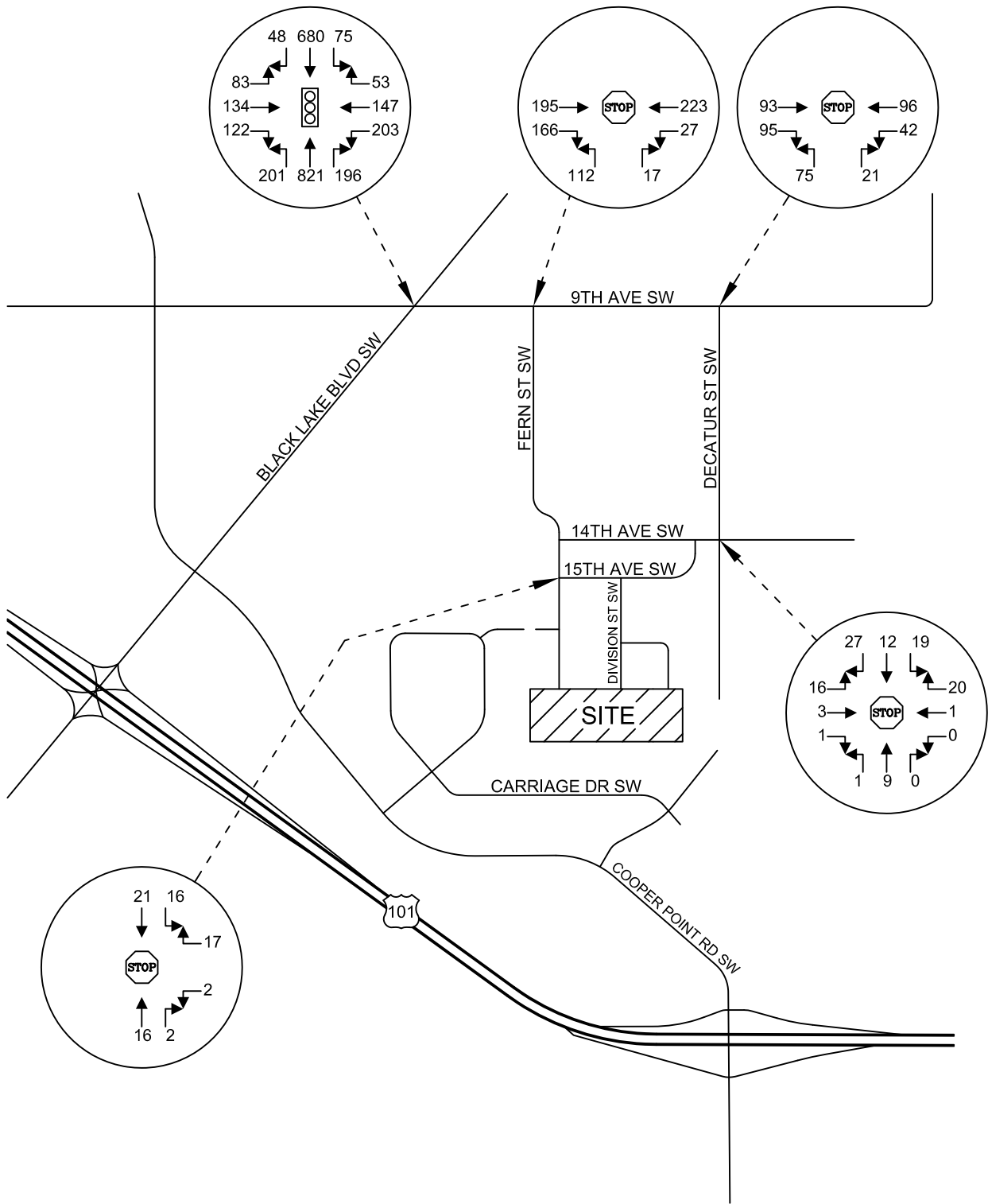
NEW PM PEAK HOUR TRIPS

INBOUND: 35 VPH

OUTBOUND: 21 VPH

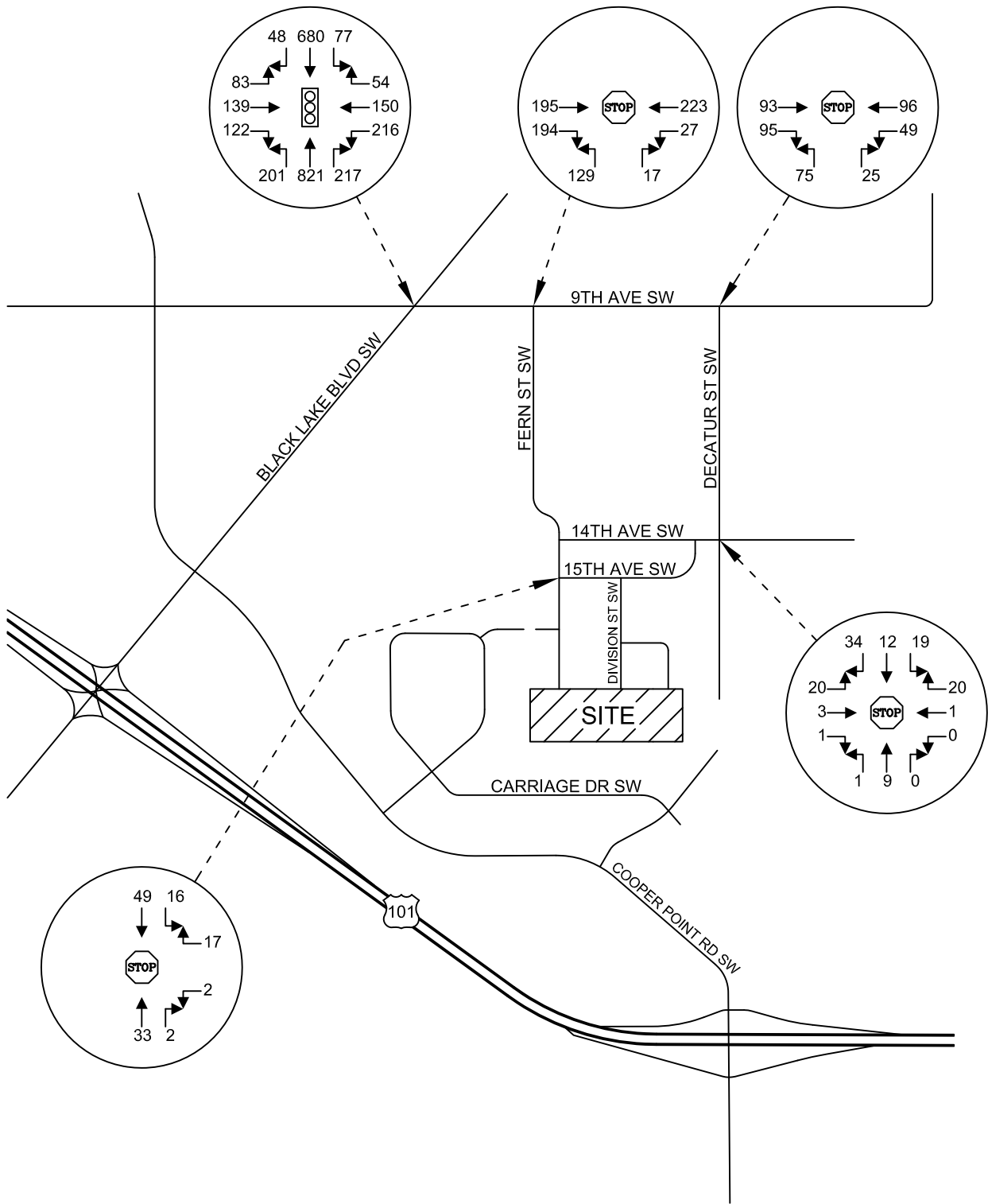
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WELLINGTON HEIGHTS
PM PEAK HOUR TRIP DISTRIBUTION & ASSIGNMENT
FIGURE 4



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WELLINGTON HEIGHTS
2020 PM PEAK HOUR VOLUMES WITHOUT PROJECT
FIGURE 5



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WELLINGTON HEIGHTS
2020 PM PEAK HOUR VOLUMES WITH PROJECT
FIGURE 6

4.4 Level of Service

Table 4 summarizes future 2020 PM peak hour LOS analysis that was done both without and with project traffic added to the local roadway system

Table 4
2020 Level of Service
Delays given in seconds per vehicle

Intersection	Control	Approach	Without Project		With Project	
			LOS	Delay	LOS	Delay
Black Lk Blvd & 9th Ave SW	Signal	Eastbound	D	35.4	D	36.1
		Westbound	D	50.2	D	50.7
		Northbound	D	36.7	D	38.5
		Southbound	D	42.7	D	43.9
		Overall	D	40.3	D	41.6
9th Ave SW & Fern St SW	TWSC	Northbound	C	17.4	C	18.9
		Westbound LT	A	8.2	A	8.3
		Overall	A	3.3	A	3.8
9th Ave SW & Decatur St SW	AWSC	Eastbound	A	8.3	A	8.4
		Westbound	A	8.8	A	8.9
		Northbound	A	8.7	A	8.7
		Overall	A	8.6	A	8.7
14th Ave SW & Decatur St SW	TWSC	Eastbound	A	9.4	A	9.4
		Westbound	A	8.5	A	8.5
		Northbound LT	A	7.3	A	7.3
		Southbound LT	A	7.3	A	7.3
		Overall	A	4.7	A	7.6
15th Ave SW & Fern St SW	TWSC	Westbound	A	6.6	A	6.8
		Northbound	A	7.0	A	7.2
		Southbound	A	7.3	A	7.5
		Overall	A	7.1	A	7.3

As shown in Table 4, future 2020 delays will operate similar to existing conditions. No stop controlled intersection shows any increase in LOS due to project traffic. The signal at Black Lake Boulevard SW & 9th Street SW shows an increase in LOS from LOS C to LOS D for the eastbound leg. Note that without conditions, are close to the 35.0 second threshold for LOS D and the associated increase in delay due to project traffic is only 0.7 seconds.

5. SUMMARY & MITIGATION

The Wellington Heights project is a residential development that proposes to construct 56 single family houses. The site is located at the southern end of Fern Street SW in the City of Olympia. Access to the site will be provided by a new internal roadway, 18th Avenue SW that will provide connection to Fern Street SW, Division Street SW, and Cushing Street SW. The site will be a mild generator of new trips in the area with roughly 533 total daily trips expected to be generated on a typical weekday with 42 trips during the AM peak hour and 56 trips during the PM peak hour.

Existing delays at the key intersections studied near the site are in the LOS A to LOS D range. Future delays will remain at LOS D or better. Overall, Project traffic was found to have no significant impact on the surrounding roadway system.

Based on the results of this report, the following mitigation is proposed for the Wellington Heights project:

1. Pay Traffic Impact Fees as outlined in the 2017 Transportation Impact Fee Rate Schedule. Exact fee calculations will be made at the time of application for building permits and is subject to rates in effect at that time and administrative fees.
2. Given the additional through volumes at the Fern Street SW & 15th Avenue SW intersection it is recommended this become a two-way stop controlled intersection with the minor, east-leg (15th Avenue SW) being the stop controlled movement.

WELLINGTON HEIGHTS
TRAFFIC IMPACT ANALYSIS

APPENDIX

LEVEL OF SERVICE

The following are excerpts from the *6th Edition of the Highway Capacity Manual*

Quality of service requires quantitative measures to characterize operational conditions within a traffic stream. Level of service (LOS) is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

Six LOS are defined for each type of facility that has analysis procedures available. Letters designate each level, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions and the driver's perception of those conditions.

Level-of-Service definitions

The following definitions generally define the various levels of service for arterials.

Level of service A represents primarily free-flow operations at average travel speeds, usually about 90 percent of the free-flow speed for the arterial classification. Vehicles are seldom impeded in their ability to maneuver in the traffic stream. Delay at signalized intersections is minimal.

Level of service B represents reasonably unimpeded operations at average travel speeds, usually about 70 percent of the free-flow speed for the arterial classification. The ability to maneuver in the traffic stream is only slightly restricted and delays are not bothersome.

Level of service C represents stable operations; however, ability to maneuver and change lanes in midblock locations may be more restricted than in LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50 percent of the average free-flow speed for the arterial classification.

Level of service D borders on a range in which small increases in flow may cause substantial increases in approach delay and hence decreases in arterial speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these. Average travel speeds are about 40 percent of free-flow speed.

Level of service E is characterized by significant delays and average travel speeds of one-third the free-flow speed or less. Such operations are caused by some combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections, and inappropriate signal timing.

Level of service F characterizes arterial flow at extremely low speeds, from less than one-third to one-quarter of the free-flow speed. Intersection congestion is likely at critical signalized locations, with long delays and extensive queuing.

These definitions are general and conceptual in nature, and they apply primarily to uninterrupted flow. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them.

For each type of facility, levels of service are defined based on one or more operational parameters that best describe operating quality for the subject facility type. While the concept of level of service attempts to address a wide range of operating conditions, limitations on data collection and availability make it impractical to treat the full range of operational parameters for every type of facility. The parameters selected to define levels of service for each facility type are called "measures of effectiveness" or "MOE's", and represent available measures that best describe the quality of operation on the subject facility type.

Each level of service represents a range of conditions, as defined by a range in the parameters given. Thus, a level of service is not a discrete condition, but rather a range of conditions for which boundaries are established.

The following tables describe levels of service for signalized and unsignalized intersections. Level of service for signalized intersections is defined in terms of average control delay. Delay is a measure of driver discomfort, frustration, fuel consumption and lost travel time, as well as time from movements at slower speeds and stops on intersection approaches as vehicles move up in queue position or slow down upstream of an intersection. Level of service for unsignalized intersections is determined by the computed or measured control delay and is determined for each minor movement.

Signalized Intersections - Level of Service

<u>Level of Service</u>	<u>Control Delay per Vehicle (sec)</u>
A	≤ 10
B	> 10 and ≤ 20
C	> 20 and ≤ 35
D	> 35 and ≤ 55
E	> 55 and ≤ 80
F	> 80

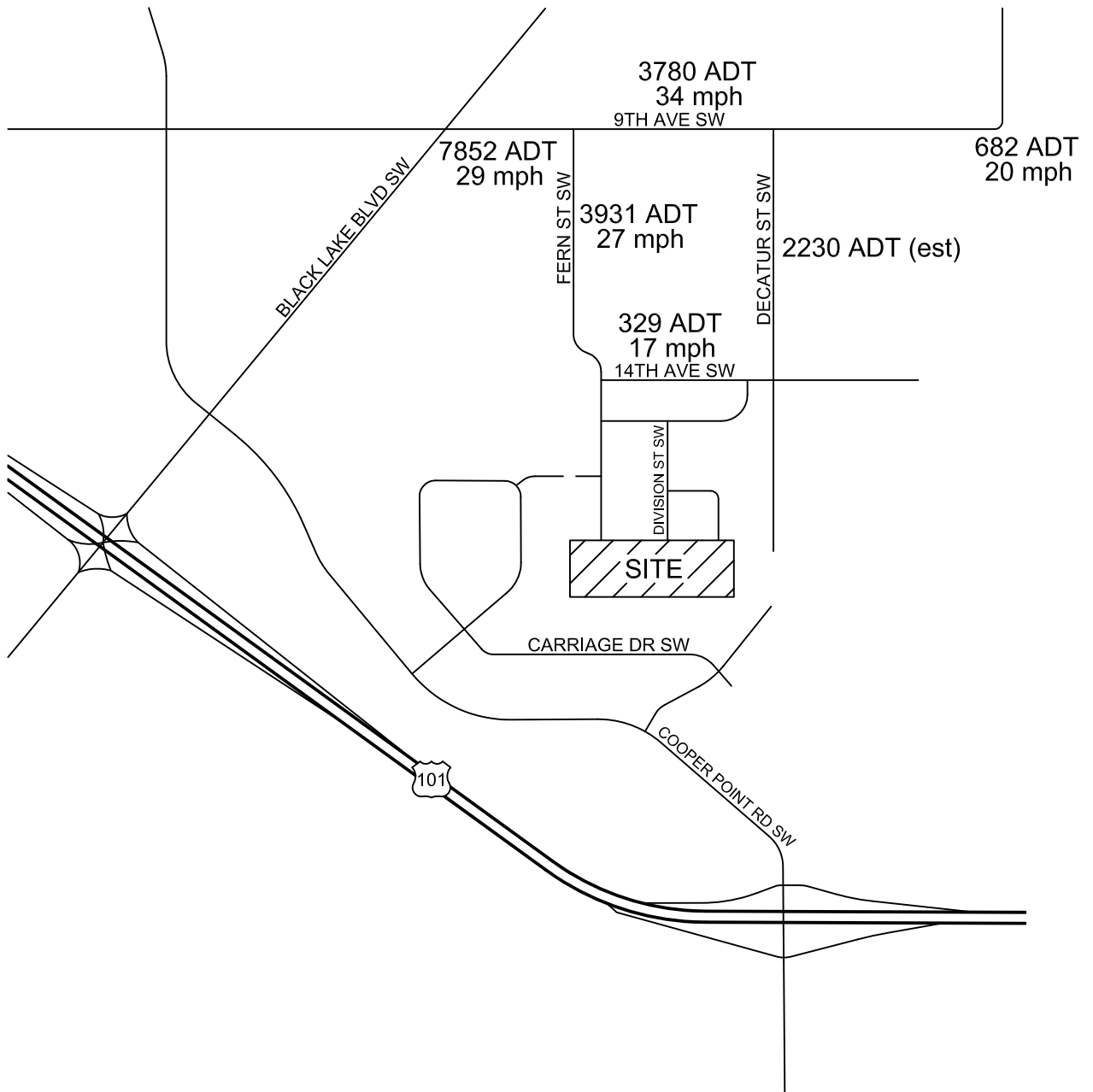
Unsignalized Intersections - Level of Service

<u>Level of Service</u>	<u>Average Total Delay per Vehicle (sec)</u>
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

As described in the Highway Capacity Manual, level of service breakpoints for all-way stop controlled (AWSC) intersections are somewhat different than the criteria used for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from distinct kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an AWSC intersection. Thus a higher level of control delay is acceptable at a signalized intersection for the same level of service.

AWSC Intersections - Level of Service

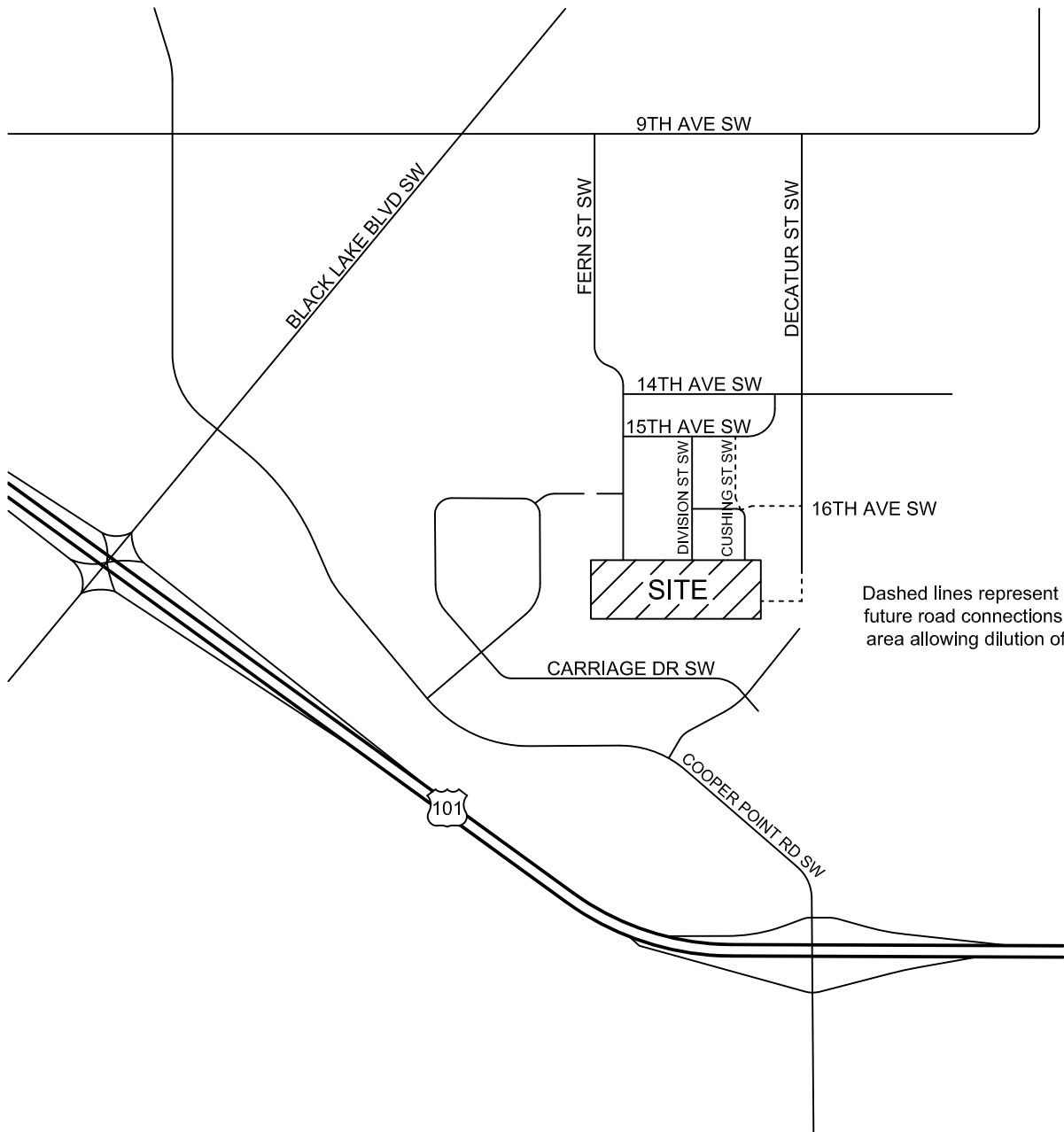
<u>Level of Service</u>	<u>Average Total Delay per Vehicle (sec)</u>
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50



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WELLINGTON HEIGHTS
SELECTED LINK VOLUMES AND 85TH PERCENTILE SPEEDS
E

IDN	Location	Year	Mo	NB	SB	Total	EB	WB	Total	85th %	Avg Spd	% PassVeh	%lt Trk	% Med Trk	% Hvy Trk
2018	2	-	-	-	-	0	0	1452	3453	22.8	19.4	98.1%	1.1%	0.3%	0.5%
2018	2	-	-	-	-	0	10025	11068	21093	21.5	17.3	96.0%	3.0%	1.0%	0.0%
2018	2	-	-	-	-	0	20	13	33	26.6	20.8	97.0%	2.0%	1.0%	0.0%
2018	2	-	-	-	-	0	31	39	70	27.9	23.4	95.6%	2.3%	1.4%	0.7%
2018	2	175	-	-	180	355	-	-	0	26.6	22.6	98.9%	1.0%	0.1%	0.0%
2018	2	-	-	-	-	0	465	233	698	33.9	30.0	97.0%	1.9%	0.8%	0.3%
2018	2	-	-	-	-	0	1710	2070	3780	26.0	22.3	97.3%	1.6%	0.5%	0.7%
2018	2	-	-	-	-	0	535	299	834	22.8	19.8	98.3%	1.4%	0.0%	0.3%
2018	2	452	-	-	264	716	-	-	0	21.5	17.0	99.0%	1.0%	0.0%	0.0%
2018	2	-	-	-	-	0	15	21	36	23.3	18.5	96.5%	1.3%	1.6%	0.6%
2018	2	-	-	-	-	0	58	47	105	24.3	19.5	96.8%	3.2%	0.0%	0.0%
2017	10	-	-	-	-	0	37	38	45	19.7	14.6	97.5%	2.5%	0.0%	0.0%
2017	10	-	-	-	-	0	41	50	91	26.0	22.3	97.3%	1.6%	0.5%	0.7%
2017	10	-	-	-	-	0	148	181	329	23.3	20.6	98.6%	1.2%	0.2%	0.0%
2017	5	-	-	-	-	0	1514	595	2109	23.3	20.6	98.6%	1.2%	0.2%	0.0%
2017	10	-	-	-	-	0	1840	1428	3268	24.8	21.4	98.7%	1.1%	0.2%	0.0%
2017	9	-	-	-	-	0	2429	2036	4465	23.8	20.2	98.2%	1.2%	0.6%	0.0%
2017	9	-	-	-	-	0	1568	1745	3713	26.0	23.2	98.2%	1.4%	0.4%	0.0%
2017	10	-	-	-	-	0	2530	2214	4744	30.6	26.4	95.1%	4.5%	0.4%	0.0%
2017	10	-	-	-	-	0	1556	1039	2595	24.8	21.9	98.7%	1.1%	0.2%	0.0%
2017	9	-	-	-	-	0	2386	1988	4374	27.9	24.9	98.6%	1.2%	0.2%	0.0%
2017	10	-	-	-	-	0	1890	1736	3626	23.3	20.6	98.6%	1.2%	0.2%	0.0%
2017	9	-	-	-	-	0	235	123	358	23.3	20.6	98.6%	1.2%	0.2%	0.0%
2017	9	-	-	-	-	0	181	178	359	26.0	21.9	97.8%	1.8%	0.4%	0.0%
2017	9	-	-	-	-	0	193	105	298	21.5	18.1	98.2%	1.6%	0.2%	0.0%
2017	9	-	-	-	-	0	227	94	321	23.3	19.2	98.2%	1.5%	0.3%	0.0%
2017	10	-	-	-	-	0	84	69	153	21.5	18.0	98.9%	1.1%	0.0%	0.0%
2016	5	-	-	-	-	0	3752	4100	7852	29.4	25.1	97.1%	1.8%	0.7%	0.4%
2017	10	-	-	-	-	0	1608	1540	3148	19.9	17.4	98.6%	1.2%	0.2%	0.0%
2017	10	-	-	-	-	0	451	231	682	24.8	21.4	98.2%	1.7%	0.1%	0.0%
2017	10	-	-	-	-	0	576	353	929	23.3	19.7	97.3%	2.2%	0.5%	0.0%
2017	10	164	-	-	226	390	-	-	0	26.0	22.3	98.3%	1.4%	0.3%	0.0%
2017	10	467	-	-	628	1095	-	-	0	27.2	23.4	98.3%	1.4%	0.3%	0.0%
2017	10	1978	-	-	1953	3931	-	-	0	23.8	28.1	97.8%	1.5%	0.4%	0.3%
2016	4	1812	-	-	1805	3617	-	-	0	23.3	20.1	97.9%	1.7%	0.4%	0.0%
2012	3	1528	-	-	1548	3076	-	-	0	25.4	21.8	97.7%	1.6%	0.7%	0.0%
2008	4	1758	-	-	1722	3480	-	-	0	23.8	20.7	97.0%	2.6%	0.4%	0.0%
2004	2	1646	-	-	1586	3232	-	-	0	24.8	21.2	97.4%	2.4%	0.2%	0.0%
1998	5	1915	-	-	1325	3240	-	-	0	25.4	21.7	97.3%	2.4%	0.3%	0.0%
2016	2	-	-	-	-	0	10247	10501	20748	21.5	18.7	97.4%	2.2%	0.4%	0.0%
2017	5	-	-	-	-	0	10106	11314	21420	20.8	17.6	98.4%	1.4%	0.2%	0.0%
2017	10	-	-	-	-	0	9793	10940	20733	23.3	19.5	97.7%	2.0%	0.3%	0.0%
2017	9	501	-	-	282	783	-	-	0	22.3	19.0	98.4%	1.4%	0.2%	0.0%
2017	9	587	-	-	306	893	-	-	0	23.3	20.1	97.9%	1.7%	0.4%	0.0%
2017	9	564	-	-	286	850	-	-	0	25.4	21.8	97.7%	1.6%	0.7%	0.0%
2017	9	471	-	-	225	696	-	-	0	23.8	20.7	97.0%	2.6%	0.4%	0.0%
2013	1	336	-	-	660	996	-	-	0	24.8	21.2	97.4%	2.4%	0.2%	0.0%
2017	10	183	-	-	183	366	-	-	0	25.4	21.7	97.3%	2.4%	0.3%	0.0%
2017	9	152	-	-	199	351	-	-	0	21.5	18.7	97.4%	2.2%	0.4%	0.0%
2017	9	208	-	-	113	321	-	-	0	20.8	17.6	98.4%	1.4%	0.2%	0.0%
2017	10	62	-	-	102	164	-	-	0	23.3	19.5	97.7%	2.0%	0.3%	0.0%
2017	10	70	-	-	132	202	-	-	0	22.3	19.0	98.4%	1.4%	0.2%	0.0%



HEATH & ASSOCIATES
TRAFFIC AND CIVIL ENGINEERING

WELLINGTON HEIGHTS
ROADWAY SYSTEM - POSSIBLE FUTURE CONNECTIONS

TRAFFIC IMPACT ANALYSIS SCOPING INFORMATION

Project Title: **Wellington Heights**
Project Description: 56 Single Family Dwelling Units
Parcels: 59000-400600, -400100, -400800, -500100, -300100, -600100,
-200100, -200600, -200900, -700300

Trip Generation:

Quantity	Land Use Code	Description	ADT Rate	AM Peak Hour Rate	PM Peak Hour Rate	Pass-By Rate
56 Units	210	Single Family	ITE Eqn. (see attached)	ITE Eqn. (see attached)	ITE Eqn. (see attached)	0%

Total AM Peak Hour Trips: 45 (11 Enter/34 Exit)
Total PM Peak Hour Trips: 58 (37 Enter/21 Exit)
Total Daily Trips: 610
Horizon Year: 2020
Ambient Growth: 2%
Pipeline Projects: As instructed by jurisdiction

Major Arterial Intersections to Study:

9th Ave SW & Fern St SW

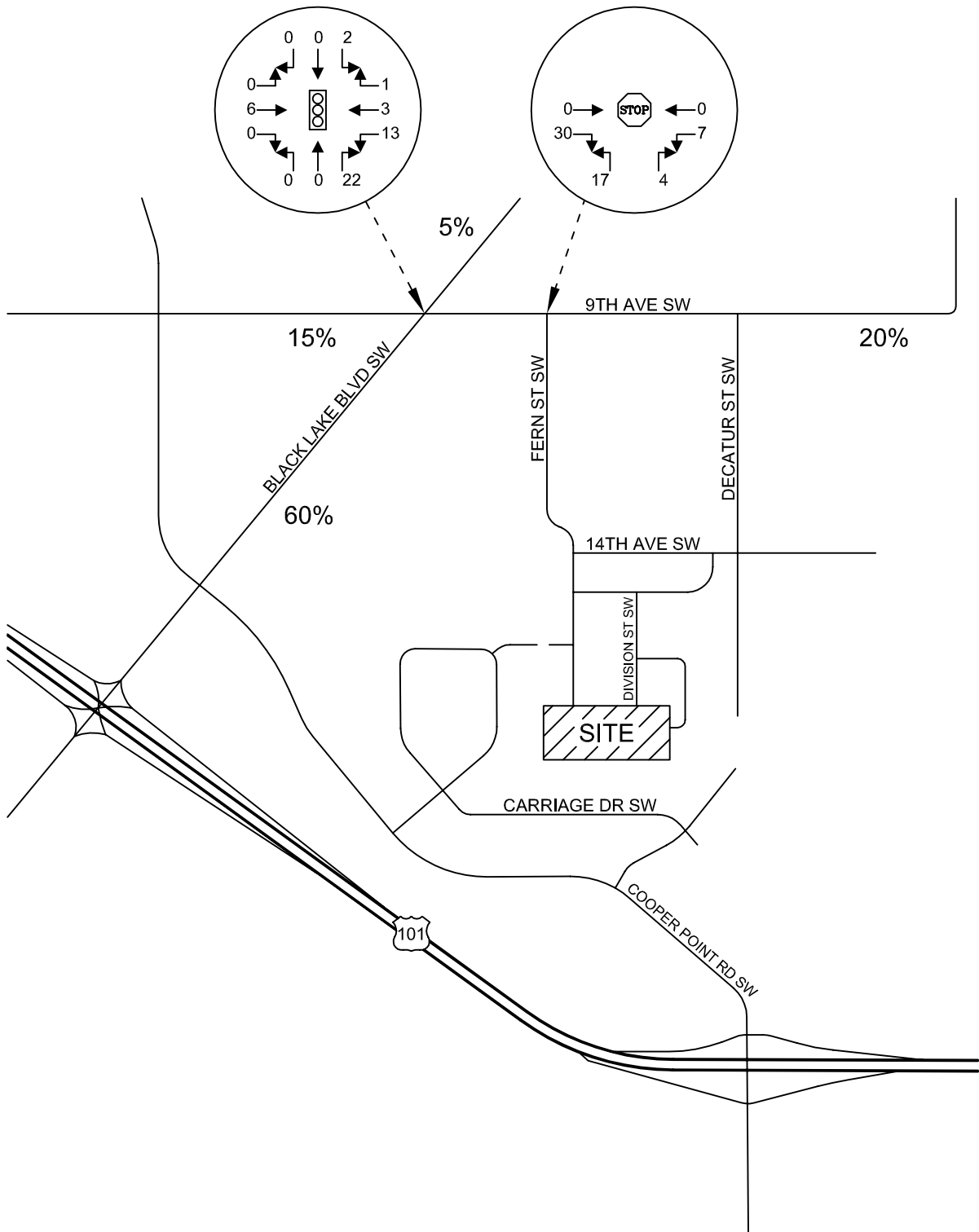
9th Ave SW & Black Lake Blvd SW

The trip distribution shown in Figure 1 is based on a TAZ 335 modeling provided by Thurston County

Traffic Consultant: Greg Heath
Heath & Associates, Inc.
2214 Tacoma Rd.
Puyallup, WA 98371
253 770-1401

Project Developers: Alex Vo
PO Box 6130
Olympia, WA 98507
360-481-3086





NEW PM PEAK HOUR TRIPS

INBOUND: 37 VPH

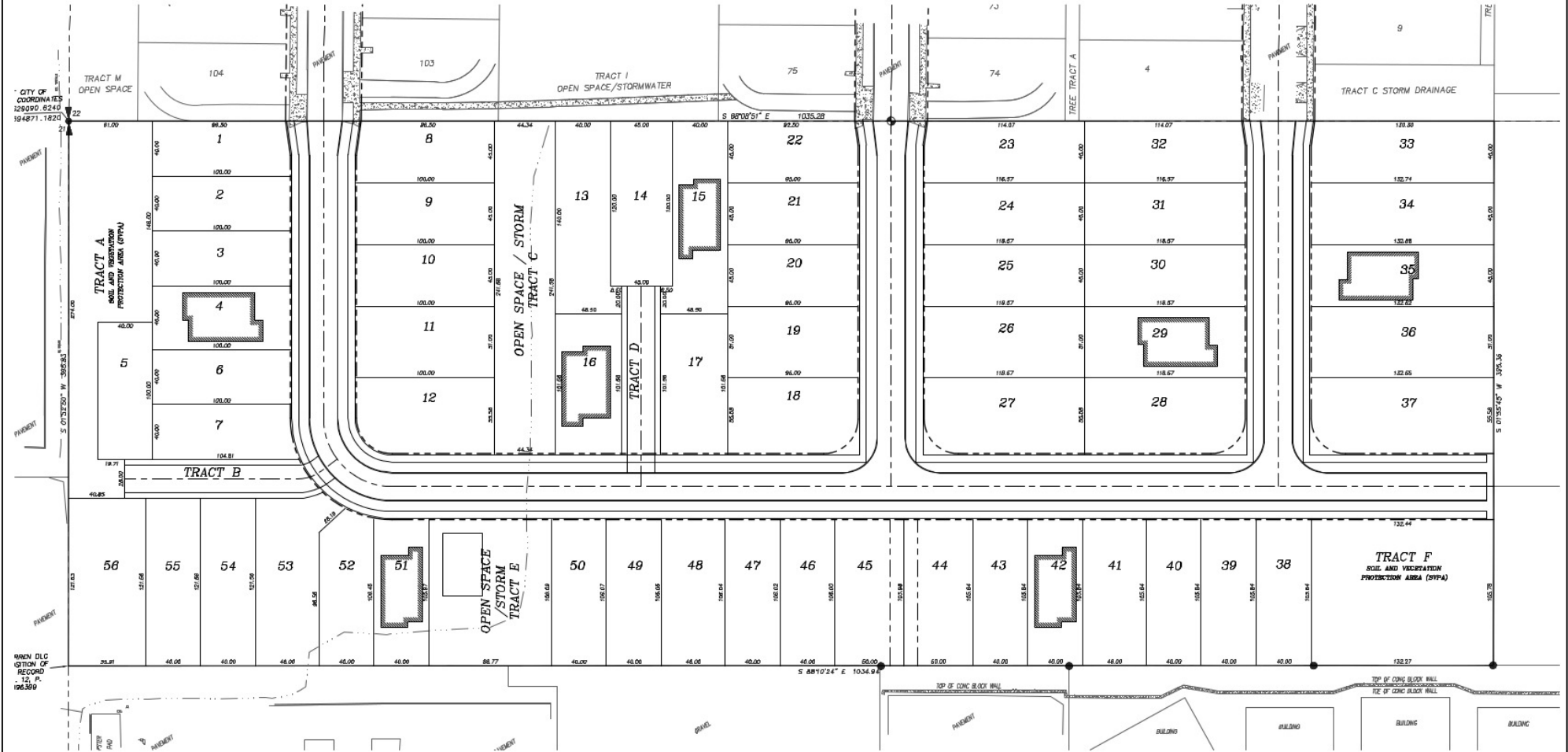
OUTBOUND: 21 VPH

HEATH & ASSOCIATES

TRAFFIC AND CIVIL ENGINEERING

WELLINGTON HEIGHTS

PM PEAK HOUR TRIP DISTRIBUTION & ASSIGNMENT
FIGURE 1



HEATH & ASSOCIATES
TRAFFIC AND CIVIL ENGINEERING

WELLINGTON HEIGHTS
SITE PLAN
FIGURE 2

Single-Family Detached Housing (210)

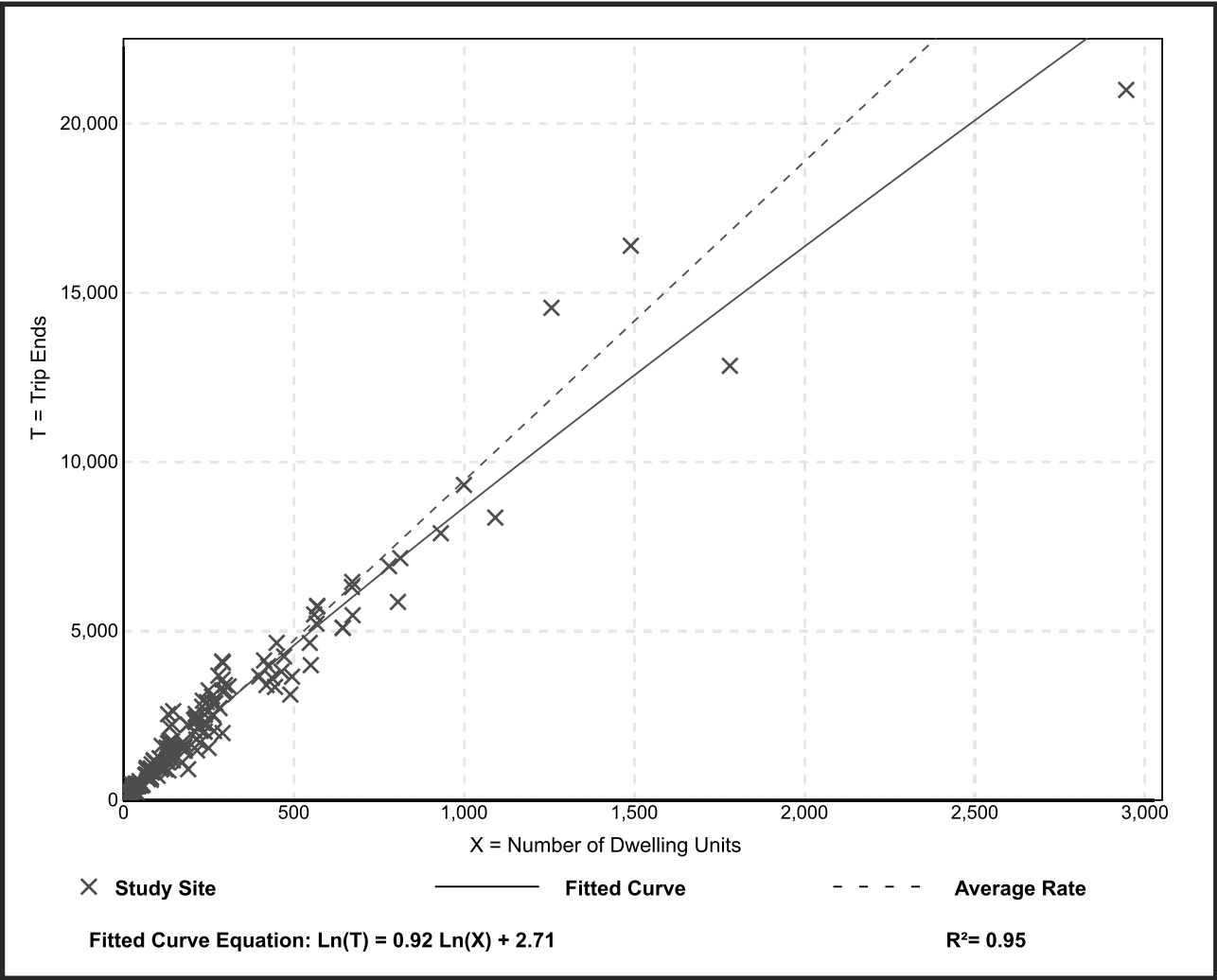
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 159
Avg. Num. of Dwelling Units: 264
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.44	4.81 - 19.39	2.10

Data Plot and Equation



Trip Generation Manual, 10th Edition • Institute of Transportation Engineers

Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,

Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Setting/Location: General Urban/Suburban

Number of Studies: 173

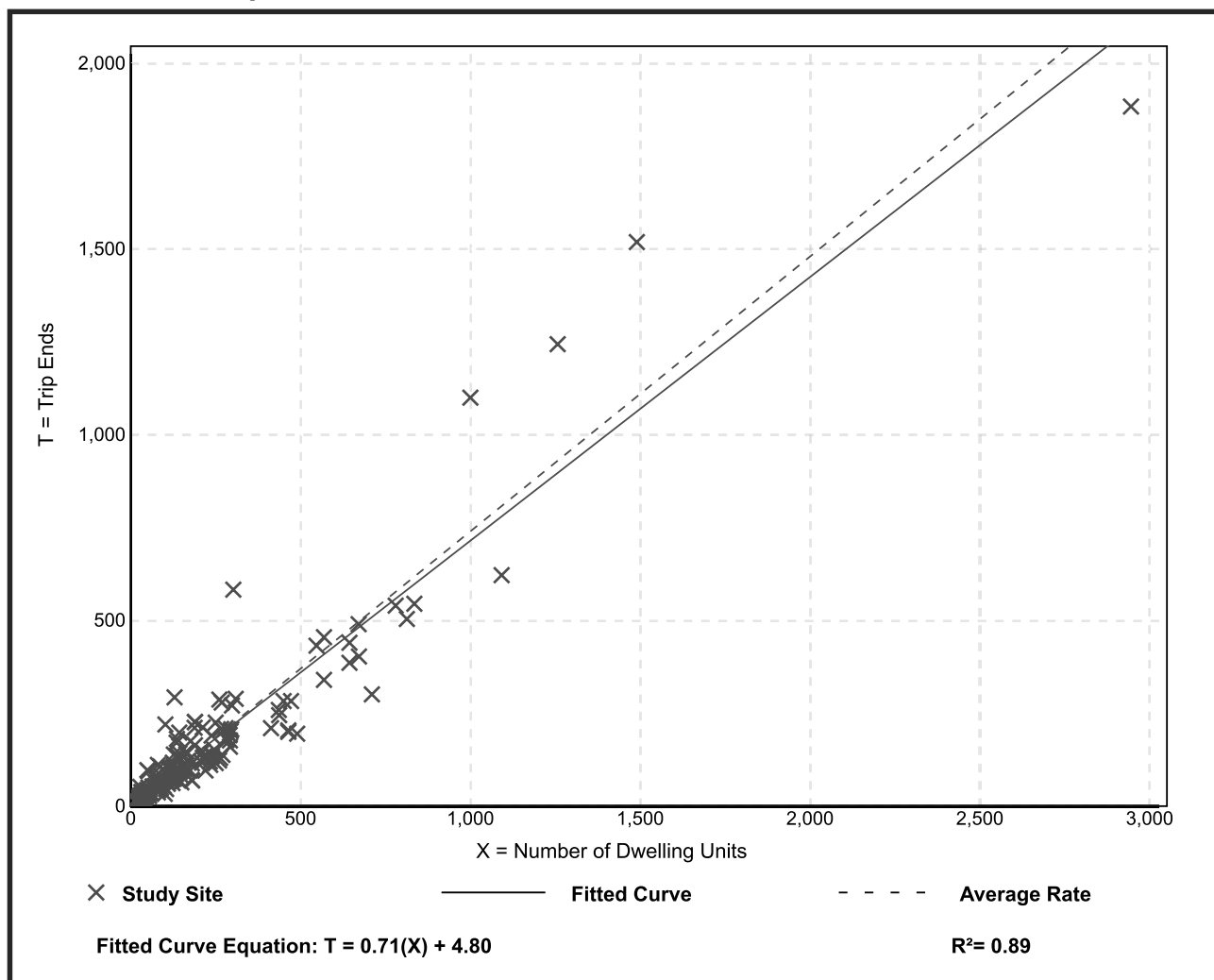
Avg. Num. of Dwelling Units: 219

Directional Distribution: 25% entering, 75% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.74	0.33 - 2.27	0.27

Data Plot and Equation



Trip Generation Manual, 10th Edition • Institute of Transportation Engineers

Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,

Peak Hour of Adjacent Street Traffic,

One Hour Between 4 and 6 p.m.

Setting/Location: General Urban/Suburban

Number of Studies: 190

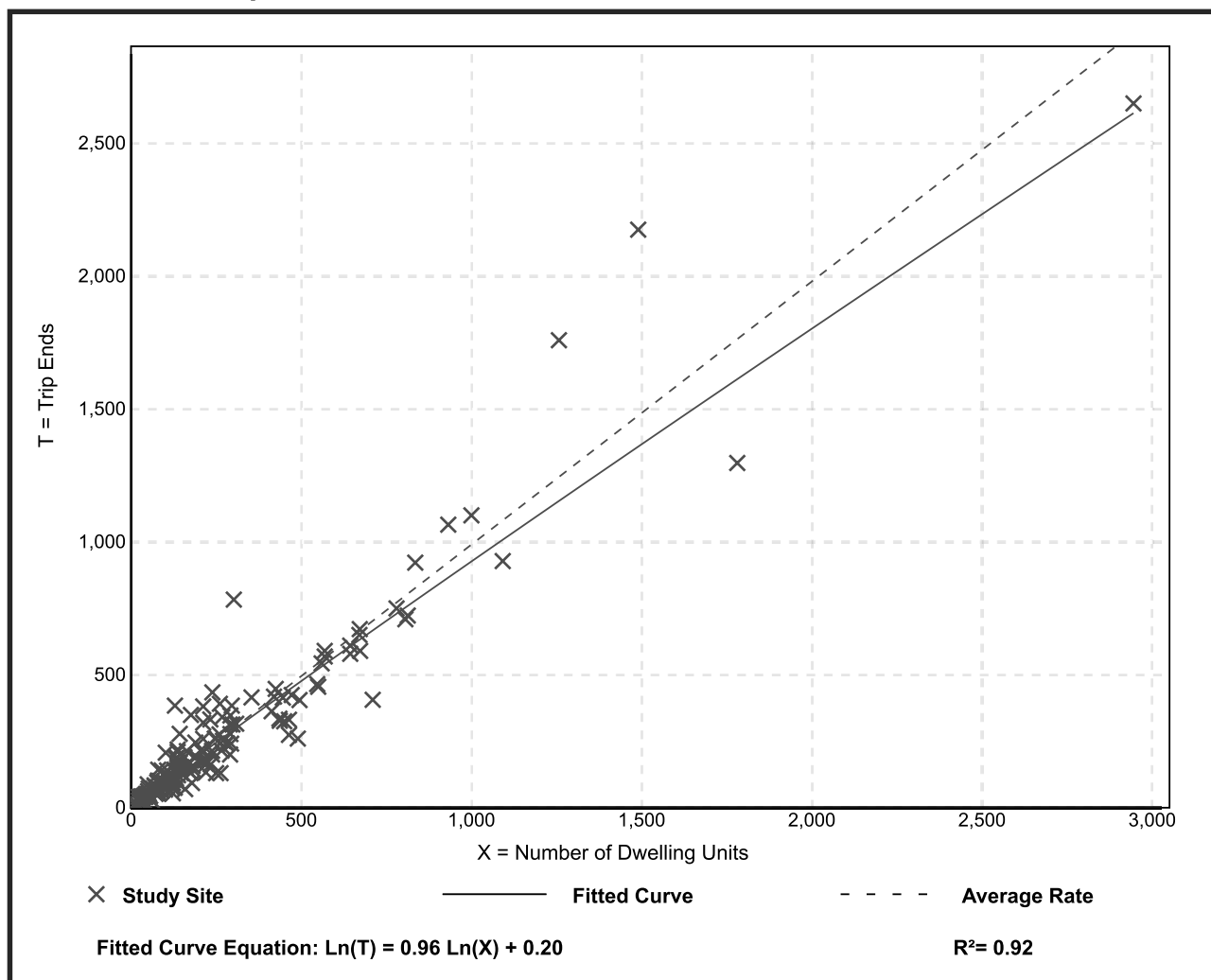
Avg. Num. of Dwelling Units: 242

Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.99	0.44 - 2.98	0.31

Data Plot and Equation



Trip Generation Manual, 10th Edition • Institute of Transportation Engineers

City of Olympia

Public Works Department
Transportation Engineering

Black Lake Boulevard
Capitol Mall Drive/9th Avenue SW
Weather: Showers, Cool
Counted by: John L

File Name : BlackLk-CapMallDr
Site Code : 00000002
Start Date : 3/15/2016
Page No : 1

Groups Printed- Cars - Bikes - Trucks Buses

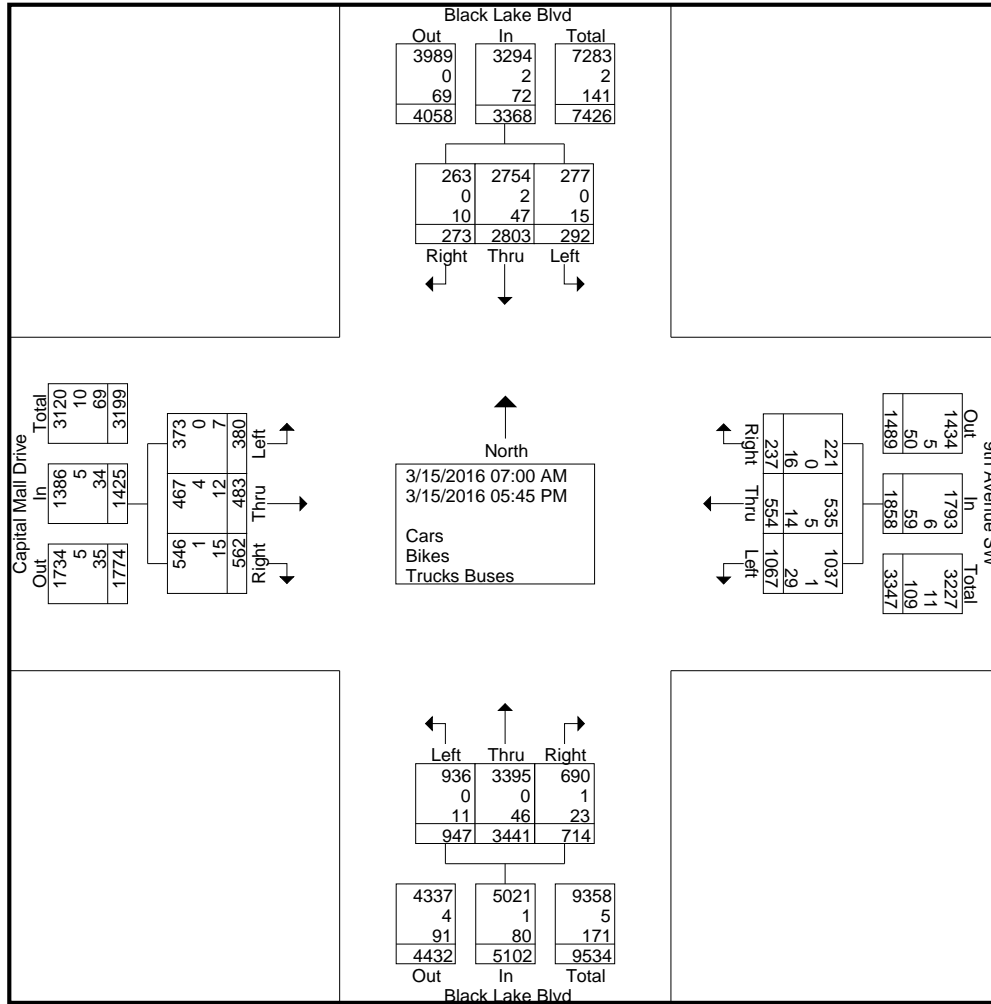
	Black Lake Blvd From North						9th Avenue SW From East						Black Lake Blvd From South						Capital Mall Drive From West								
Start Time	Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total		Exclu. Total	Inclu. Total	Int. Total
07:00 AM	4	52	5	3	61		8	8	47	0	63		27	57	10	0	94		4	4	1	0	9		3	227	230
07:15 AM	3	48	5	7	56		8	21	50	1	79		26	83	6	1	115		6	9	14	0	29		9	279	288
07:30 AM	5	102	11	0	118		16	14	64	0	94		23	124	9	0	156		2	3	9	1	14		1	382	383
07:45 AM	9	84	6	1	99		11	19	51	0	81		19	117	12	0	148		9	17	16	0	42		1	370	371
Total	21	286	27	11	334		43	62	212	1	317		95	381	37	1	513		21	33	40	1	94		14	1258	1272
08:00 AM	5	64	7	1	76		6	20	44	0	70		21	93	11	1	125		7	14	10	0	31		2	302	304
08:15 AM	6	54	6	0	66		10	17	43	0	70		25	93	6	0	124		15	15	4	0	34		0	294	294
08:30 AM	8	85	10	5	103		6	21	44	3	71		18	110	20	1	148		15	12	9	2	36		11	358	369
08:45 AM	11	89	5	0	105		8	17	49	1	74		22	109	32	0	163		16	18	14	0	48		1	390	391
Total	30	292	28	6	350		30	75	180	4	285		86	405	69	2	560		53	59	37	2	149		14	1344	1358
11:00 AM	9	111	11	6	131		4	17	34	5	55		21	127	36	1	184		19	13	18	2	50		14	420	434
11:15 AM	11	109	13	4	133		6	21	26	3	53		20	146	64	3	230		31	12	16	1	59		11	475	486
11:30 AM	16	113	14	5	143		14	24	43	0	81		19	145	46	1	210		29	23	23	4	75		10	509	519
11:45 AM	18	104	8	5	130		12	19	43	4	74		29	162	63	4	254		30	12	15	2	57		15	515	530
Total	54	437	46	20	537		36	81	146	12	263		89	580	209	9	878		109	60	72	9	241		50	1919	1969
12:00 PM	16	134	11	1	161		13	24	45	3	82		28	180	54	2	262		32	22	18	1	72		7	577	584
12:15 PM	25	123	13	1	161		12	14	44	1	70		31	165	53	1	249		45	21	20	2	86		5	566	571
12:30 PM	13	133	11	2	157		6	17	25	1	48		23	168	57	2	248		26	23	23	2	72		7	525	532
12:45 PM	11	140	13	1	164		12	28	43	1	83		35	137	63	1	235		38	18	24	1	80		4	562	566
Total	65	530	48	5	643		43	83	157	6	283		117	650	227	6	994		141	84	85	6	310		23	2230	2253
04:00 PM	17	154	24	5	195		8	24	48	3	80		43	167	47	3	257		31	28	15	1	74		12	606	618
04:15 PM	12	137	19	3	168		15	33	35	0	83		30	180	39	3	249		23	35	13	3	71		9	571	580
04:30 PM	14	153	14	2	181		8	28	46	0	82		47	180	52	0	279		23	27	21	3	71		5	613	618
04:45 PM	10	142	9	3	161		12	34	41	1	87		53	179	58	0	290		33	31	20	0	84		4	622	626
Total	53	586	66	13	705		43	119	170	4	332		173	706	196	6	1075		110	121	69	7	300		30	2412	2442
05:00 PM	9	196	19	4	224		19	42	43	1	104		47	222	47	2	316		28	41	19	3	88		10	732	742
05:15 PM	13	163	30	5	206		12	37	65	0	114		41	178	36	0	255		33	30	20	2	83		7	658	665
05:30 PM	17	145	13	3	175		3	25	61	5	89		32	155	67	1	254		29	28	17	2	74		11	592	603
05:45 PM	11	168	15	5	194		8	30	33	0	71		34	164	59	6	257		38	27	21	0	86		11	608	619
Total	50	672	77	17	799		42	134	202	6	378		154	719	209	9	1082		128	126	77	7	331		39	2590	2629
Grand Total	273	2803	292	72	3368		237	554	1067	33	1858		714	3441	947	33	5102		562	483	380	32	1425		170	11753	11923
Apprch %	8.1	83.2	8.7				12.8	29.8	57.4				14	67.4	18.6				39.4	33.9	26.7						
Total %	2.3	23.8	2.5		28.7		2	4.7	9.1		15.8		6.1	29.3	8.1		43.4		4.8	4.1	3.2		12.1		1.4	98.6	
Cars	263	2754	277		3365		221	535	1037		1824		690	3395	936		5053		546	467	373		1417		0	0	11659
% Cars	96.3	98.3	94.9	98.6	97.8		93.2	96.6	97.2	93.9	96.5		96.6	98.7	98.8	97	98.4		97.2	96.7	98.2	96.9	97.3		0	0	97.8
Bikes	0	2	0		3		0	5	1		8		1	0	0		2		1	4	0		6		0	0	19
% Bikes	0	0.1	0	1.4	0.1		0	0.9	0.1	6.1	0.4		0.1	0	0	3	0		0.2	0.8	0	3.1	0.4		0	0	0.2
Trucks Buses	10	47	15		72		16	14	29		59		23	46	11		80		15	12	7		34		0	0	245
% Trucks Buses	3.7	1.7	5.1	0	2.1		6.8	2.5	2.7	0	3.1		3.2	1.3	1.2	0	1.6		2.7	2.5	1.8	0	2.3		0	0	2.1

City of Olympia

Public Works Department
Transportation Engineering

Black Lake Boulevard
Capitol Mall Drive/9th Avenue SW
Weather: Showers, Cool
Counted by: John L

File Name : BlackLk-CapMallDr
Site Code : 00000002
Start Date : 3/15/2016
Page No : 2



City of Olympia

Public Works Department
Transportation Engineering

Black Lake Boulevard
Capital Mall Drive/9th Avenue SW
Weather: Showers, Cool
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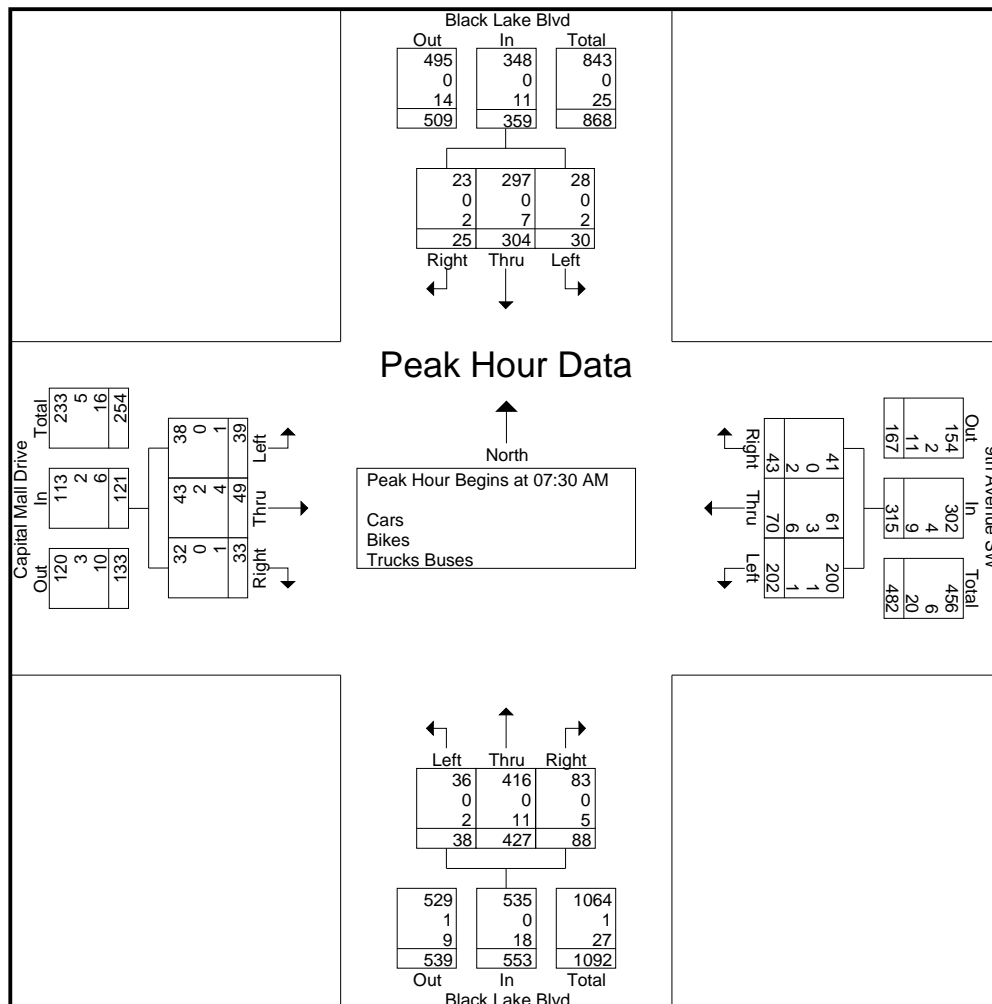
File Name : BlackLk-CapMallDr
Site Code : 00000002
Start Date : 3/15/2016
Page No : 3

	Black Lake Blvd From North				9th Avenue SW From East				Black Lake Blvd From South				Capital Mall Drive From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:30 AM

07:30 AM	5	102	11	118	16	14	64	94	23	124	9	156	2	3	9	14	382
07:45 AM	9	84	6	99	11	19	51	81	19	117	12	148	9	17	16	42	370
08:00 AM	5	64	7	76	6	20	44	70	21	93	11	125	7	14	10	31	302
08:15 AM	6	54	6	66	10	17	43	70	25	93	6	124	15	15	4	34	294
Total Volume	25	304	30	359	43	70	202	315	88	427	38	553	33	49	39	121	1348
% App. Total	7	84.7	8.4		13.7	22.2	64.1		15.9	77.2	6.9		27.3	40.5	32.2		
PHF	.694	.745	.682	.761	.672	.875	.789	.838	.880	.861	.792	.886	.550	.721	.609	.720	.882
Cars	23	297	28	348	41	61	200	302	83	416	36	535	32	43	38	113	1298
% Cars	92.0	97.7	93.3	96.9	95.3	87.1	99.0	95.9	94.3	97.4	94.7	96.7	97.0	87.8	97.4	93.4	96.3
Bikes	0	0	0	0	0	3	1	4	0	0	0	0	0	2	0	2	6
% Bikes	0	0	0	0	0	4.3	0.5	1.3	0	0	0	0	0	4.1	0	1.7	0.4
Trucks Buses	2	7	2	11	2	6	1	9	5	11	2	18	1	4	1	6	44
% Trucks Buses	8.0	2.3	6.7	3.1	4.7	8.6	0.5	2.9	5.7	2.6	5.3	3.3	3.0	8.2	2.6	5.0	3.3



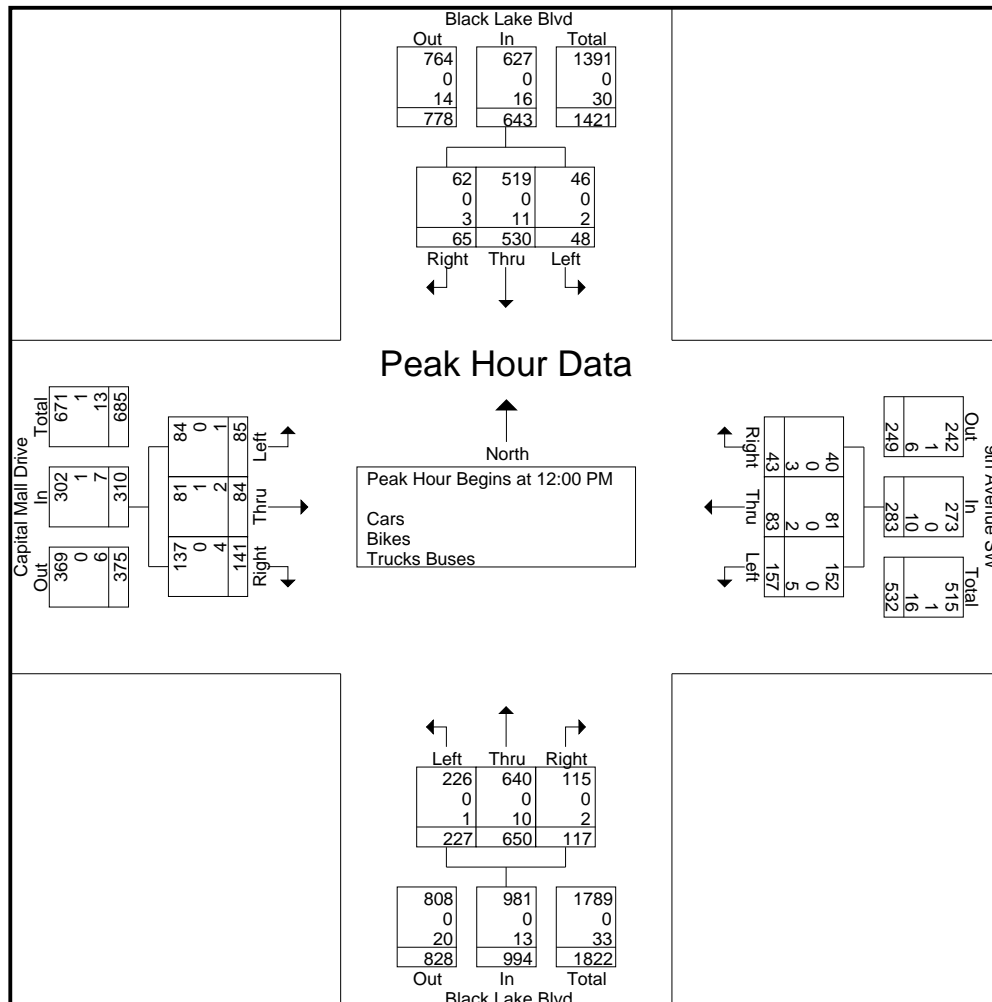
City of Olympia

Public Works Department
Transportation Engineering

Black Lake Boulevard
Capitol Mall Drive/9th Avenue SW
Weather: Showers, Cool
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File Name : BlackLk-CapMallDr
Site Code : 00000002
Start Date : 3/15/2016
Page No : 4

	Black Lake Blvd From North				9th Avenue SW From East				Black Lake Blvd From South				Capital Mall Drive From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	16	134	11	161	13	24	45	82	28	180	54	262	32	22	18	72	577
12:15 PM	25	123	13	161	12	14	44	70	31	165	53	249	45	21	20	86	566
12:30 PM	13	133	11	157	6	17	25	48	23	168	57	248	26	23	23	72	525
12:45 PM	11	140	13	164	12	28	43	83	35	137	63	235	38	18	24	80	562
Total Volume	65	530	48	643	43	83	157	283	117	650	227	994	141	84	85	310	2230
% App. Total	10.1	82.4	7.5		15.2	29.3	55.5		11.8	65.4	22.8		45.5	27.1	27.4		
PHF	.650	.946	.923	.980	.827	.741	.872	.852	.836	.903	.901	.948	.783	.913	.885	.901	.966
Cars	62	519	46	627	40	81	152	273	115	640	226	981	137	81	84	302	2183
% Cars	95.4	97.9	95.8	97.5	93.0	97.6	96.8	96.5	98.3	98.5	99.6	98.7	97.2	96.4	98.8	97.4	97.9
Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
% Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2	0	0.3	0.0
Trucks Buses	3	11	2	16	3	2	5	10	2	10	1	13	4	2	1	7	46
% Trucks Buses	4.6	2.1	4.2	2.5	7.0	2.4	3.2	3.5	1.7	1.5	0.4	1.3	2.8	2.4	1.2	2.3	2.1



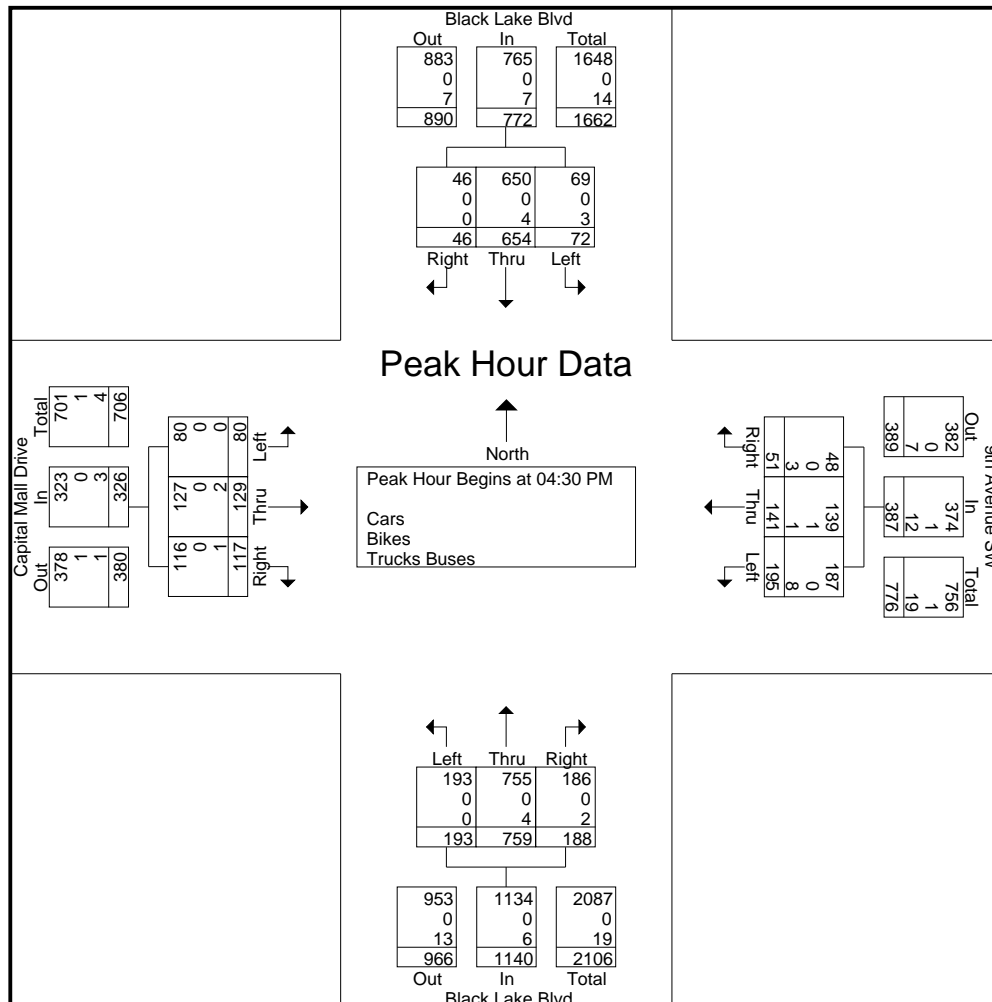
City of Olympia

Public Works Department
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Black Lake Boulevard
Capitol Mall Drive/9th Avenue SW
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Site Code : 00000002
Start Date : 3/15/2016
Page No : 5

	Black Lake Blvd From North				9th Avenue SW From East				Black Lake Blvd From South				Capital Mall Drive From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	14	153	14	181	8	28	46	82	47	180	52	279	23	27	21	71	613
04:45 PM	10	142	9	161	12	34	41	87	53	179	58	290	33	31	20	84	622
05:00 PM	9	196	19	224	19	42	43	104	47	222	47	316	28	41	19	88	732
05:15 PM	13	163	30	206	12	37	65	114	41	178	36	255	33	30	20	83	658
Total Volume	46	654	72	772	51	141	195	387	188	759	193	1140	117	129	80	326	2625
% App. Total	6	84.7	9.3		13.2	36.4	50.4		16.5	66.6	16.9		35.9	39.6	24.5		
PHF	.821	.834	.600	.862	.671	.839	.750	.849	.887	.855	.832	.902	.886	.787	.952	.926	.897
Cars	46	650	69	765	48	139	187	374	186	755	193	1134	116	127	80	323	2596
% Cars	100	99.4	95.8	99.1	94.1	98.6	95.9	96.6	98.9	99.5	100	99.5	99.1	98.4	100	99.1	98.9
Bikes	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
% Bikes	0	0	0	0	0	0.7	0	0.3	0	0	0	0	0	0	0	0	0.0
Trucks Buses	0	4	3	7	3	1	8	12	2	4	0	6	1	2	0	3	28
% Trucks Buses	0	0.6	4.2	0.9	5.9	0.7	4.1	3.1	1.1	0.5	0	0.5	0.9	1.6	0	0.9	1.1



City of Olympia

Public Works Department
Transportation Engineering

Fern Street
9th Avenue SW
Weather: Showers/Cool
Counted by: John L

File Name : Fern-9thSW
Site Code : 00000514
Start Date : 4/12/2016
Page No : 1

Groups Printed- Cars - Bikes - Trucks Buses

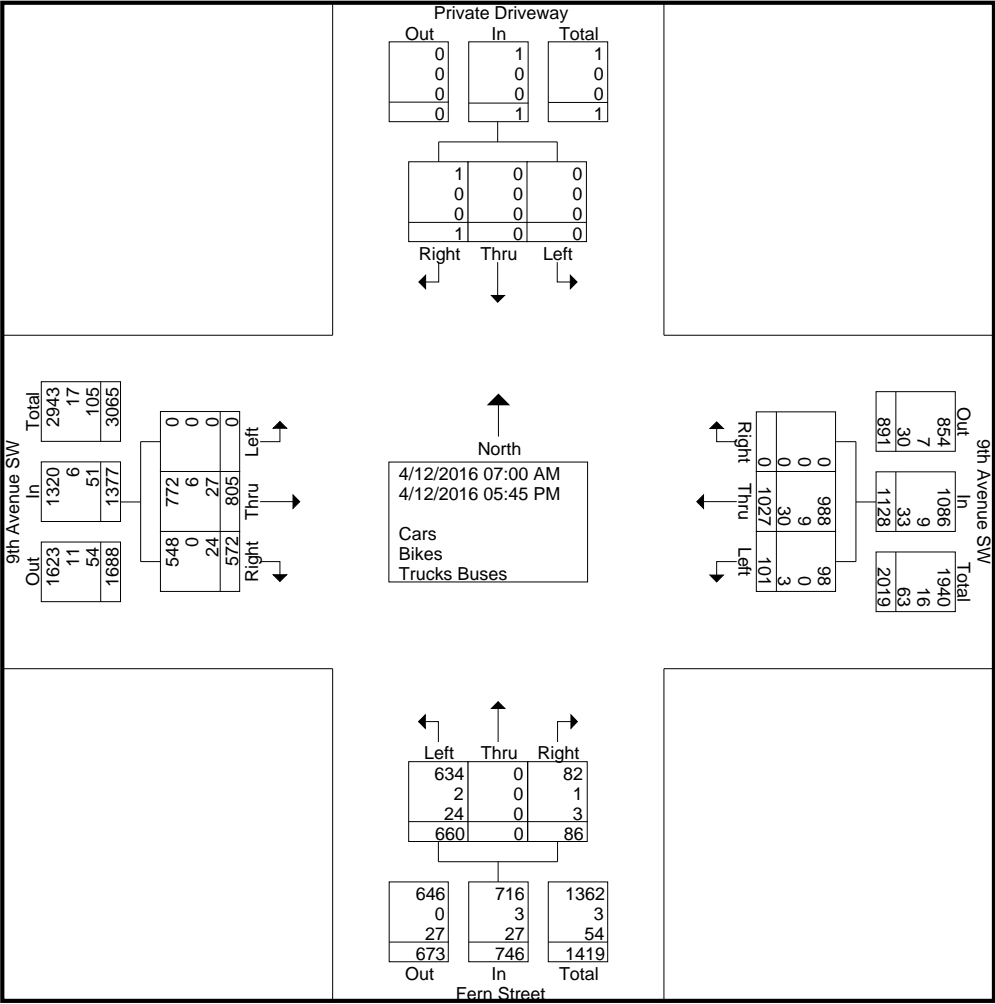
	Private Driveway From North					9th Avenue SW From East					Fern Street From South					9th Avenue SW From West					Exclu. Total	Inclu. Total	Int. Total
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total			
07:00 AM	0	0	0	0	0	0	21	0	3	21	3	0	23	0	26	9	12	0	0	21	3	68	71
07:15 AM	0	0	0	0	0	0	38	1	0	39	4	0	41	0	45	14	29	0	0	43	0	127	127
07:30 AM	1	0	0	0	1	0	44	1	0	45	8	0	47	0	55	10	27	0	0	37	0	138	138
07:45 AM	0	0	0	0	0	0	39	1	0	40	5	0	27	0	32	13	28	0	0	41	0	113	113
Total	1	0	0	0	1	0	142	3	3	145	20	0	138	0	158	46	96	0	0	142	3	446	449
08:00 AM	0	0	0	1	0	0	31	1	4	32	2	0	26	0	28	10	23	0	0	33	5	93	98
08:15 AM	0	0	0	0	0	0	39	3	0	42	5	0	29	0	34	13	15	0	0	28	0	104	104
08:30 AM	0	0	0	1	0	0	47	1	0	48	5	0	37	1	42	12	28	0	0	40	2	130	132
08:45 AM	0	0	0	2	0	0	39	1	1	40	3	0	39	1	42	16	23	0	0	39	4	121	125
Total	0	0	0	4	0	0	156	6	5	162	15	0	131	2	146	51	89	0	0	140	11	448	459
11:00 AM	0	0	0	3	0	0	34	3	0	37	2	0	20	0	22	14	31	0	0	45	3	104	107
11:15 AM	0	0	0	3	0	0	28	3	0	31	1	0	20	0	21	19	33	0	0	52	3	104	107
11:30 AM	0	0	0	0	0	0	26	2	2	28	1	0	20	1	21	14	27	0	0	41	3	90	93
11:45 AM	0	0	0	0	0	0	38	5	2	43	7	0	18	0	25	29	32	0	0	61	2	129	131
Total	0	0	0	6	0	0	126	13	4	139	11	0	78	1	89	76	123	0	0	199	11	427	438
12:00 PM	0	0	0	2	0	0	48	7	0	55	4	0	23	0	27	25	37	0	0	62	2	144	146
12:15 PM	0	0	0	1	0	0	40	5	0	45	3	0	28	0	31	27	35	0	0	62	1	138	139
12:30 PM	0	0	0	2	0	0	37	5	1	42	5	0	29	0	34	12	37	0	0	49	3	125	128
12:45 PM	0	0	0	0	0	0	52	4	1	56	2	0	22	0	24	14	25	0	0	39	1	119	120
Total	0	0	0	5	0	0	177	21	2	198	14	0	102	0	116	78	134	0	0	212	7	526	533
04:00 PM	0	0	0	0	0	0	58	5	2	63	3	0	23	1	26	41	46	0	0	87	3	176	179
04:15 PM	0	0	0	2	0	0	51	7	1	58	0	0	26	1	26	33	50	0	0	83	4	167	171
04:30 PM	0	0	0	1	0	0	66	10	1	76	4	0	19	0	23	43	35	0	1	78	3	177	180
04:45 PM	0	0	0	0	0	0	46	10	2	56	5	0	30	0	35	45	42	0	0	87	2	178	180
Total	0	0	0	3	0	0	221	32	6	253	12	0	98	2	110	162	173	0	1	335	12	698	710
05:00 PM	0	0	0	4	0	0	46	4	1	50	4	0	23	0	27	42	48	0	0	90	5	167	172
05:15 PM	0	0	0	1	0	0	65	5	0	70	2	0	23	0	25	42	47	0	0	89	1	184	185
05:30 PM	0	0	0	1	0	0	57	7	4	64	5	0	32	4	37	31	50	0	0	81	9	182	191
05:45 PM	0	0	0	0	0	0	37	10	0	47	3	0	35	0	38	44	45	0	0	89	0	174	174
Total	0	0	0	6	0	0	205	26	5	231	14	0	113	4	127	159	190	0	0	349	15	707	722
Grand Total	1	0	0	24	1	0	1027	101	25	1128	86	0	660	9	746	572	805	0	1	1377	59	3252	3311
Apprch %	100	0	0			0	91	9			11.5	0	88.5			41.5	58.5	0					
Total %	0	0	0		0	0	31.6	3.1		34.7	2.6	0	20.3		22.9	17.6	24.8	0		42.3	1.8	98.2	
Cars	1	0	0		25	0	988	98		1111	82	0	634		725	548	772	0		1321	0	0	3182
% Cars	100	0	0	100	100	0	96.2	97	100	96.4	95.3	0	96.1	100	96	95.8	95.9	0	100	95.9	0	0	96.1
Bikes	0	0	0		0	0	9	0		9	1	0	2		3	0	6	0		6	0	0	18
% Bikes	0	0	0	0	0	0	0.9	0	0	0.8	1.2	0	0.3	0	0.4	0	0.7	0	0	0.4	0	0	0.5
Trucks Buses	0	0	0		0	0	30	3		33	3	0	24		27	24	27	0		51	0	0	111
% Trucks Buses	0	0	0	0	0	0	2.9	3	0	2.9	3.5	0	3.6	0	3.6	4.2	3.4	0	0	3.7	0	0	3.4

City of Olympia

Public Works Department
Transportation Engineering

Fern Street
9th Avenue SW
Weather: Showers/Cool
Counted by: John L

File Name : Fern-9thSW
Site Code : 00000514
Start Date : 4/12/2016
Page No : 2



City of Olympia

Public Works Department
Transportation Engineering

Fern Street
9th Avenue SW
Weather: Showers/Cool
Counted by: John L

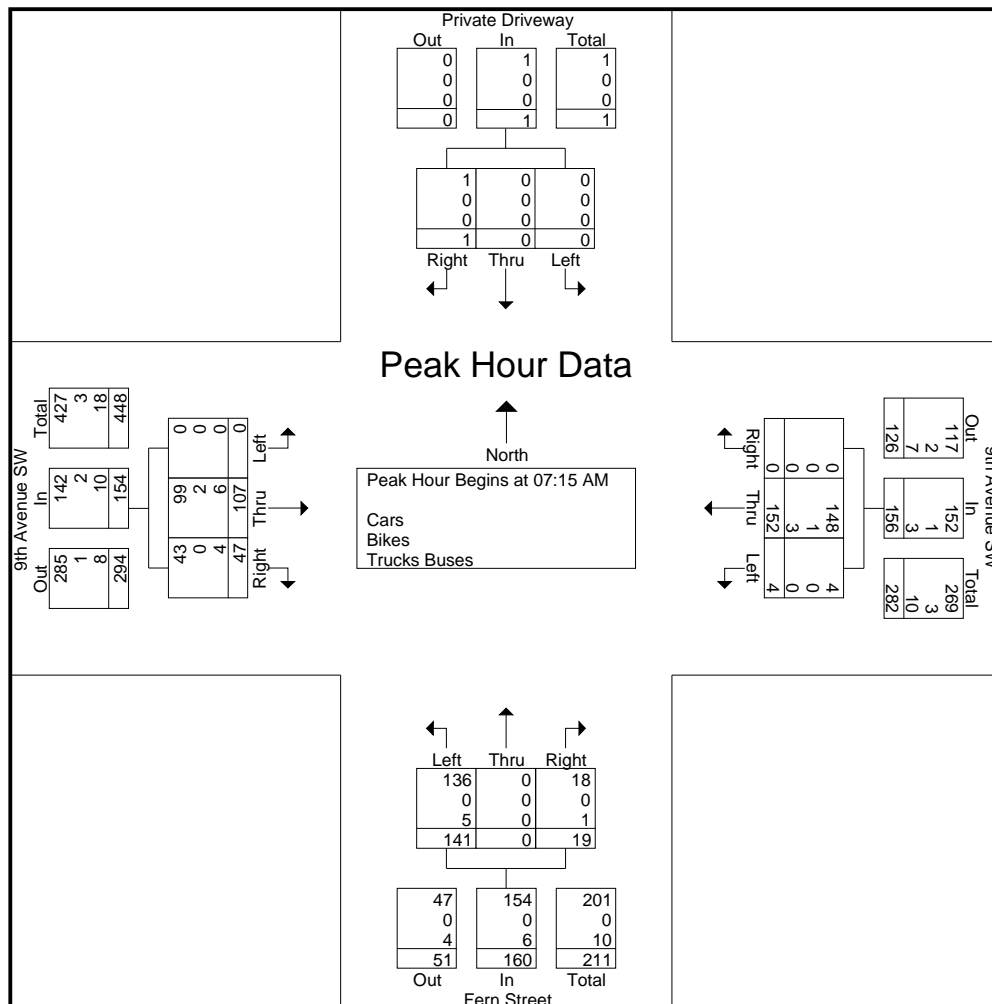
File Name : Fern-9thSW
Site Code : 00000514
Start Date : 4/12/2016
Page No : 3

	Private Driveway From North				9th Avenue SW From East				Fern Street From South				9th Avenue SW From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:15 AM

07:15 AM	0	0	0	0	0	38	1	39	4	0	41	45	14	29	0	43	127
07:30 AM	1	0	0	1	0	44	1	45	8	0	47	55	10	27	0	37	138
07:45 AM	0	0	0	0	0	39	1	40	5	0	27	32	13	28	0	41	113
08:00 AM	0	0	0	0	0	31	1	32	2	0	26	28	10	23	0	33	93
Total Volume	1	0	0	1	0	152	4	156	19	0	141	160	47	107	0	154	471
% App. Total	100	0	0		0	97.4	2.6		11.9	0	88.1		30.5	69.5	0		
PHF	.250	.000	.000	.250	.000	.864	1.000	.867	.594	.000	.750	.727	.839	.922	.000	.895	.853
Cars	1	0	0	1	0	148	4	152	18	0	136	154	43	99	0	142	449
% Cars	100	0	0	100	0	97.4	100	97.4	94.7	0	96.5	96.3	91.5	92.5	0	92.2	95.3
Bikes	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	2	3
% Bikes	0	0	0	0	0	0.7	0	0.6	0	0	0	0	0	1.9	0	1.3	0.6
Trucks Buses	0	0	0	0	0	3	0	3	1	0	5	6	4	6	0	10	19
% Trucks Buses	0	0	0	0	0	2.0	0	1.9	5.3	0	3.5	3.8	8.5	5.6	0	6.5	4.0



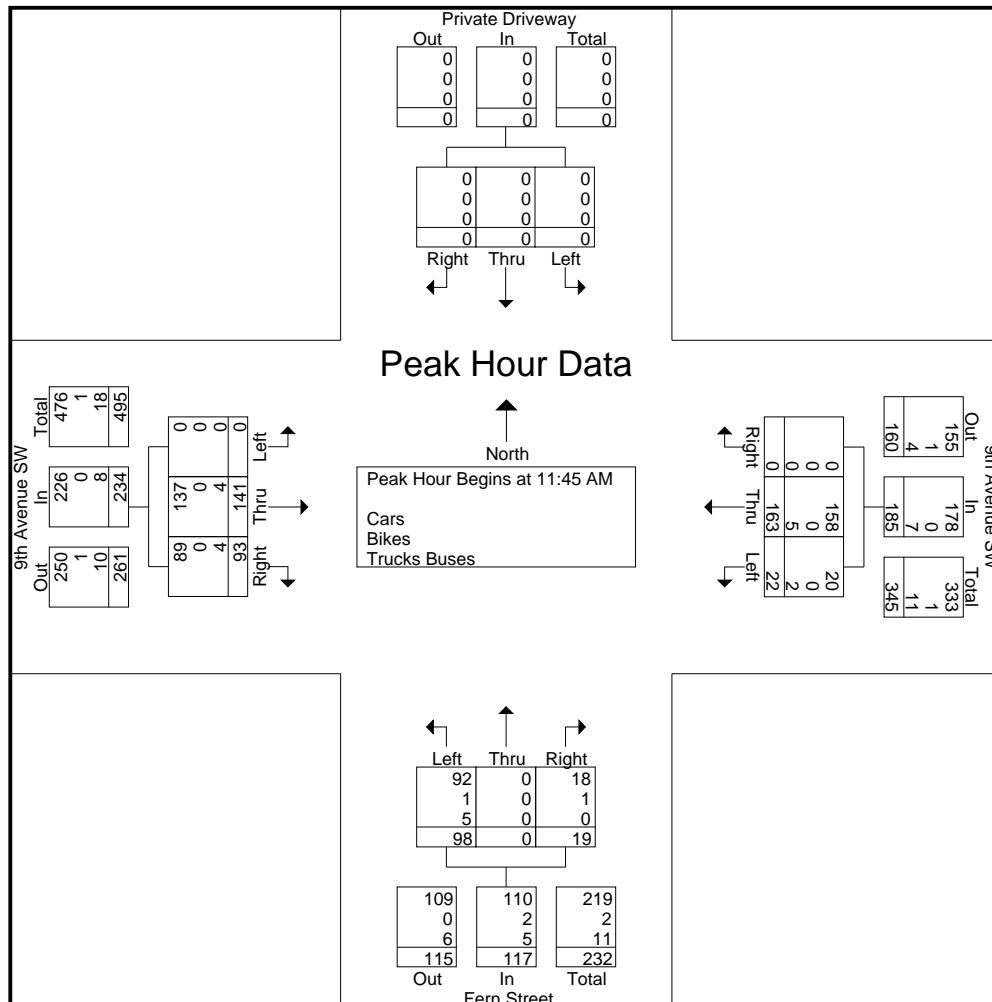
City of Olympia

Public Works Department
Transportation Engineering

Fern Street
9th Avenue SW
Weather: Showers/Cool
Counted by: John L

File Name : Fern-9thSW
Site Code : 00000514
Start Date : 4/12/2016
Page No : 4

	Private Driveway From North				9th Avenue SW From East				Fern Street From South				9th Avenue SW From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 11:45 AM																	
11:45 AM	0	0	0	0	0	38	5	43	7	0	18	25	29	32	0	61	129
12:00 PM	0	0	0	0	0	48	7	55	4	0	23	27	25	37	0	62	144
12:15 PM	0	0	0	0	0	40	5	45	3	0	28	31	27	35	0	62	138
12:30 PM	0	0	0	0	0	37	5	42	5	0	29	34	12	37	0	49	125
Total Volume	0	0	0	0	0	163	22	185	19	0	98	117	93	141	0	234	536
% App. Total	0	0	0		0	88.1	11.9		16.2	0	83.8		39.7	60.3	0		
PHF	.000	.000	.000	.000	.000	.849	.786	.841	.679	.000	.845	.860	.802	.953	.000	.944	.931
Cars	0	0	0	0	0	158	20	178	18	0	92	110	89	137	0	226	514
% Cars	0	0	0	0	0	96.9	90.9	96.2	94.7	0	93.9	94.0	95.7	97.2	0	96.6	95.9
Bikes	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	0	2
% Bikes	0	0	0	0	0	0	0	0	5.3	0	1.0	1.7	0	0	0	0	0.4
Trucks Buses	0	0	0	0	0	5	2	7	0	0	5	5	4	4	0	8	20
% Trucks Buses	0	0	0	0	0	3.1	9.1	3.8	0	0	5.1	4.3	4.3	2.8	0	3.4	3.7



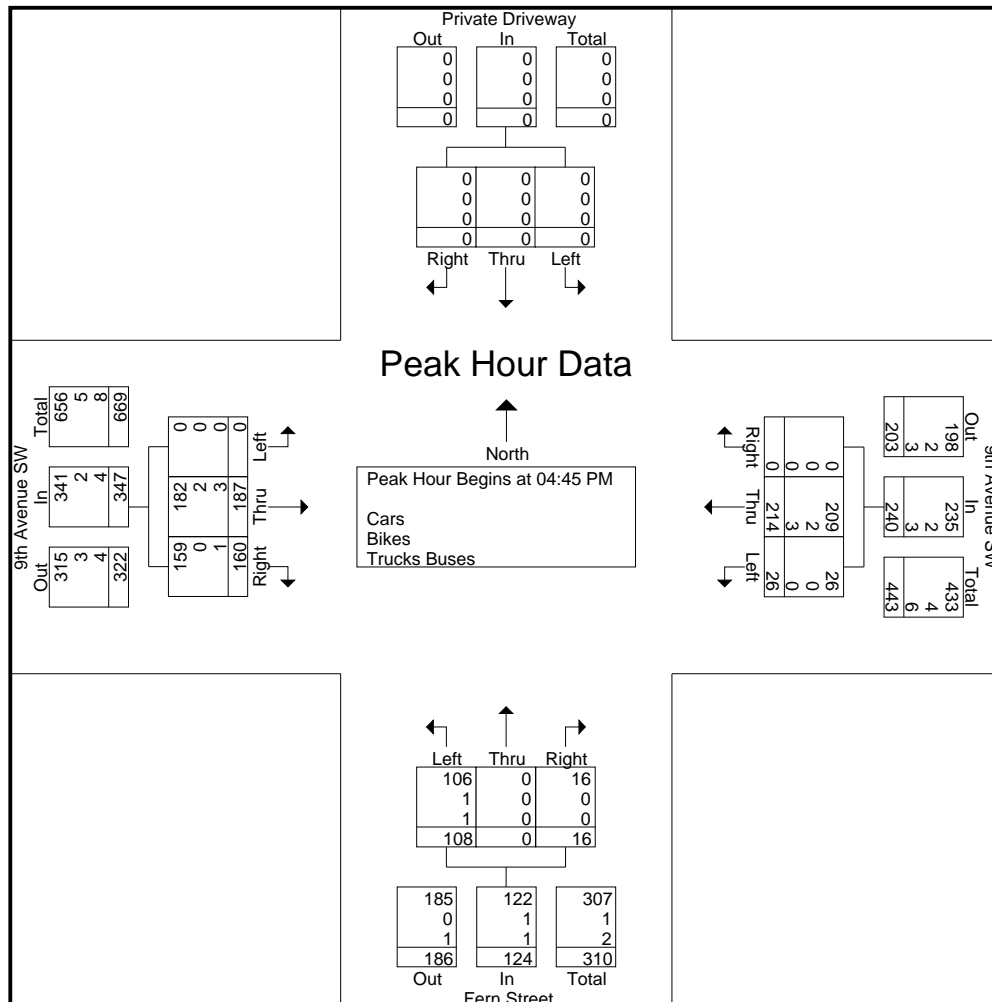
City of Olympia

Public Works Department
Transportation Engineering

Fern Street
9th Avenue SW
Weather: Showers/Cool
Counted by: John L

File Name : Fern-9thSW
Site Code : 00000514
Start Date : 4/12/2016
Page No : 5

	Private Driveway From North				9th Avenue SW From East				Fern Street From South				9th Avenue SW From West				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	0	0	0	0	46	10	56	5	0	30	35	45	42	0	87	178
05:00 PM	0	0	0	0	0	46	4	50	4	0	23	27	42	48	0	90	167
05:15 PM	0	0	0	0	0	65	5	70	2	0	23	25	42	47	0	89	184
05:30 PM	0	0	0	0	0	57	7	64	5	0	32	37	31	50	0	81	182
Total Volume	0	0	0	0	0	214	26	240	16	0	108	124	160	187	0	347	711
% App. Total	0	0	0		0	89.2	10.8		12.9	0	87.1		46.1	53.9	0		
PHF	.000	.000	.000	.000	.000	.823	.650	.857	.800	.000	.844	.838	.889	.935	.000	.964	.966
Cars	0	0	0	0	0	209	26	235	16	0	106	122	159	182	0	341	698
% Cars	0	0	0	0	0	97.7	100	97.9	100	0	98.1	98.4	99.4	97.3	0	98.3	98.2
Bikes	0	0	0	0	0	2	0	2	0	0	1	1	0	2	0	2	5
% Bikes	0	0	0	0	0	0.9	0	0.8	0	0	0.9	0.8	0	1.1	0	0.6	0.7
Trucks Buses	0	0	0	0	0	3	0	3	0	0	1	1	1	3	0	4	8
% Trucks Buses	0	0	0	0	0	1.4	0	1.3	0	0	0.9	0.8	0.6	1.6	0	1.2	1.1



Heath & Associates, Inc.
2214 Tacoma Road
Puyallup, WA 98371

Project Name: Wellington Heights

Intersection: Decatur Street SW & 9th Avenue SW

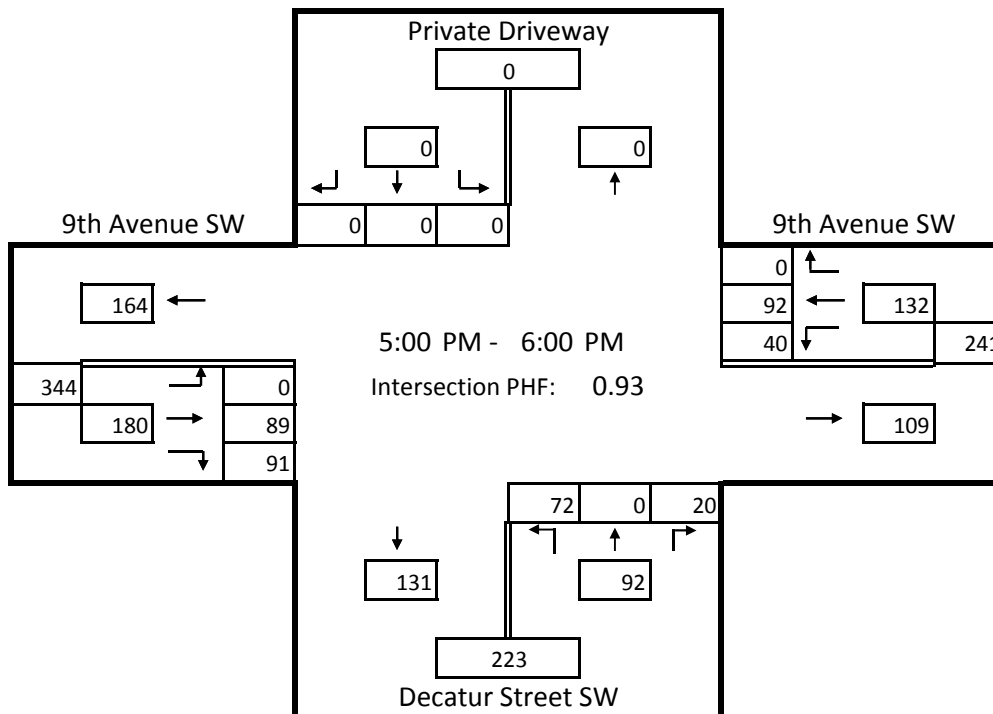
Jurisdiction: City of Olympia

Date of Count: 3/20/2018

Project Number: 4092

Time Period	Southbound Private Driveway				Westbound 9th Avenue SW				Northbound Decatur Street SW				Eastbound 9th Avenue SW				Total
	HV	R	T	L	HV	R	T	L	HV	R	T	L	HV	R	T	L	
4:00 PM	0	0	0	0	1	0	25	8	0	4	0	10	1	14	13	0	74
4:15 PM	0	0	0	0	0	0	12	5	0	1	0	17	0	24	19	0	78
4:30 PM	0	0	0	0	0	0	18	7	0	6	0	8	1	14	21	0	74
4:45 PM	0	0	0	0	2	0	22	7	0	6	0	13	1	22	20	0	90
5:00 PM	0	0	0	0	1	0	31	11	0	4	0	14	0	26	16	0	102
5:15 PM	0	0	0	0	0	0	26	11	0	3	0	22	1	19	28	0	109
5:30 PM	0	0	0	0	0	0	24	10	0	9	0	12	0	21	24	0	100
5:45 PM	0	0	0	0	0	0	11	8	0	4	0	24	0	25	21	0	93
Total	0	0	0	0	4	0	169	67	0	37	0	120	4	165	162	0	720

Peak Hour	5:00 PM to 6:00 PM																Total
Peak Total	0	0	0	0	1	0	92	40	0	20	0	72	1	91	89	0	404
Heavy Veh.	0.0%				1.7%				0.0%				1.2%				
PHF	0.00				0.79				0.82				0.96				



Heath & Associates, Inc.
2214 Tacoma Road
Puyallup, WA 98371

Project Name: Wellington Heights

Intersection: Decatur Street SW & 14th Avenue SW

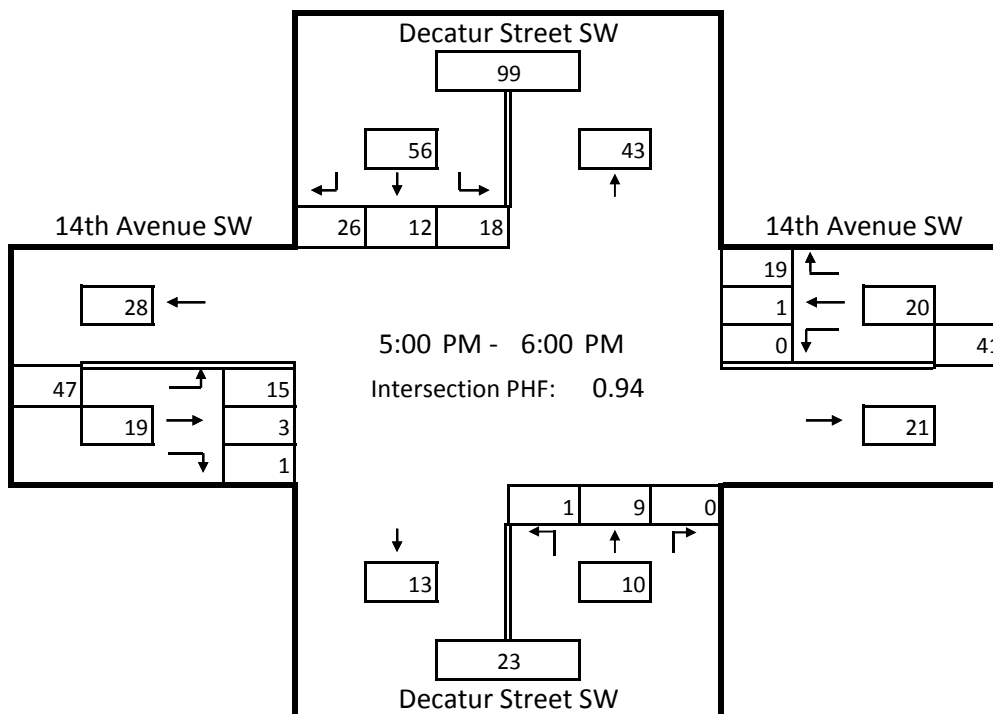
Jurisdiction: City of Olympia

Date of Count: 3/20/2018

Project Number: 4092

Time Period	Southbound Decatur Street SW				Westbound 14th Avenue SW				Northbound Decatur Street SW				Eastbound 14th Avenue SW				Total
	HV	R	T	L	HV	R	T	L	HV	R	T	L	HV	R	T	L	
4:00 PM	0	3	2	4	0	3	0	0	0	0	4	0	0	0	0	2	18
4:15 PM	0	2	1	7	0	2	0	0	0	0	2	0	0	0	0	1	15
4:30 PM	0	4	1	1	0	1	0	0	0	0	3	0	0	1	0	4	15
4:45 PM	0	5	6	2	0	1	0	0	0	0	5	0	0	0	0	1	20
5:00 PM	0	6	0	9	0	5	1	0	0	0	1	1	0	1	0	4	28
5:15 PM	0	6	2	2	0	6	0	0	0	0	3	0	0	0	1	4	24
5:30 PM	0	6	5	4	0	5	0	0	0	0	1	0	0	0	2	2	25
5:45 PM	0	8	5	3	0	3	0	0	0	0	4	0	0	0	0	5	28
Total	0	40	22	32	0	26	1	0	0	0	23	1	0	2	3	23	173

Peak Hour	5:00 PM to 6:00 PM																Total
Peak Total	0	26	12	18	0	19	1	0	0	0	9	1	0	1	3	15	105
Heavy Veh.	0.0%				0.0%				0.0%				0.0%				
PHF	0.88				0.83				0.63				0.95				



Heath & Associates, Inc.
2214 Tacoma Road
Puyallup, WA 98371

Project Name: Wellington Heights

Intersection: Fern Street SW & 15th Avenue SW

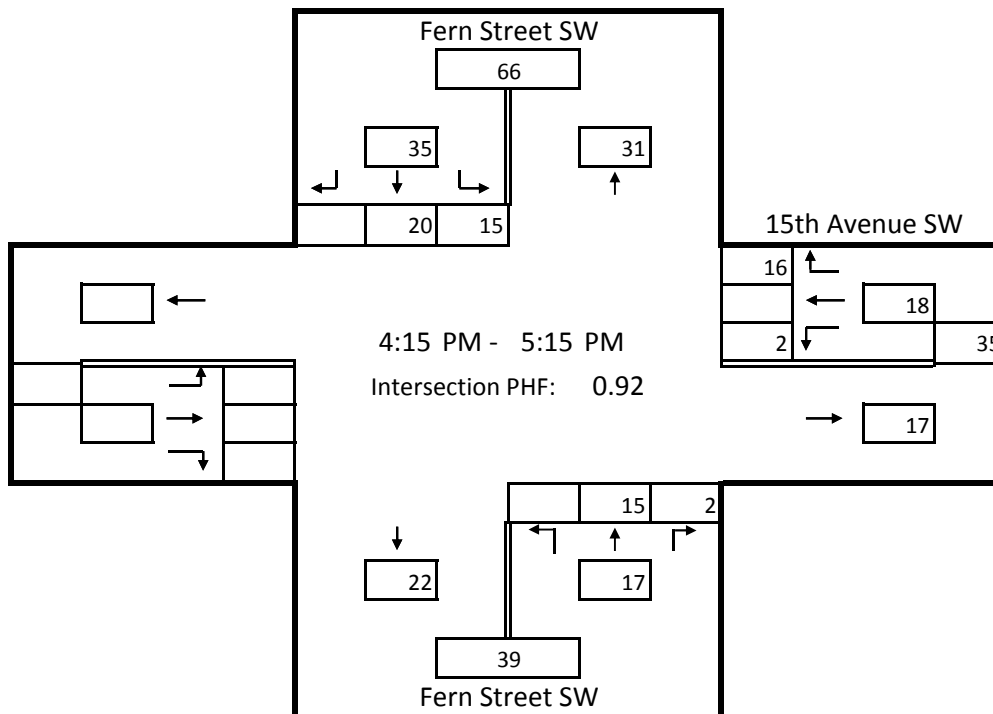
Jurisdiction: City of Olympia

Date of Count: 3/21/2018

Project Number: 4092

Time Period	Southbound Fern Street SW				Westbound 15th Avenue SW				Northbound Fern Street SW				Eastbound				Total
	HV	R	T	L	HV	R	T	L	HV	R	T	L	HV	R	T	L	
4:00 PM	0		3	4	0	3		0	0	1	4						15
4:15 PM	0		4	6	0	5		0	0	0	3						18
4:30 PM	0		4	2	0	4		1	0	0	5						16
4:45 PM	0		6	2	0	4		0	0	2	3						17
5:00 PM	0		6	5	0	3		1	0	0	4						19
5:15 PM	0		3	2	0	2		0	0	0	3						10
5:30 PM	0		5	4	0	3		0	0	1	4						17
5:45 PM	0		2	2	0	2		0	0	0	4						10
Total	0		33	27	0	26		2	0	4	30						122























Peak Hour	4:15 PM to 5:15 PM																Total
Peak Total	0		20	15	0	16		2	0	2	15						70
Heavy Veh.	0.0%				0.0%				0.0%								
PHF	0.80				0.90				0.85								



Lanes, Volumes, Timings
2: Black Lake Blvd & Capitol Mall Dr./9th Ave SW













EXISTING PM PEAK

06/22/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	83	134	122	203	147	53	201	786	194	75	680	48
Future Volume (vph)	83	134	122	203	147	53	201	786	194	75	680	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	200		0	200		0	200		0
Storage Lanes	1		1	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.960			0.970			0.990	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1652	1739	1478	1652	1669	0	1652	3204	0	1652	3270	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1652	1739	1478	1652	1669	0	1652	3204	0	1652	3270	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			138		12			23			5	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1772			1610			2077			511	
Travel Time (s)		40.3			36.6			47.2			11.6	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	92	149	136	226	163	59	223	873	216	83	756	53
Shared Lane Traffic (%)												
Lane Group Flow (vph)	92	149	136	226	222	0	223	1089	0	83	809	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		10			10			10			10	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Prot	NA	Free	Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases			Free									
Detector Phase	3	8		7	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	12.0	28.0		12.0	28.0		12.0	26.0		12.0	22.0	
Total Split (s)	29.0	28.0		29.0	28.0		34.0	43.0		34.0	43.0	
Total Split (%)	21.6%	20.9%		21.6%	20.9%		25.4%	32.1%		25.4%	32.1%	
Maximum Green (s)	24.0	23.0		24.0	23.0		29.0	38.0		29.0	38.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		-2.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)		5.0			5.0			5.0			5.0	

Lanes, Volumes, Timings
2: Black Lake Blvd & Capitol Mall Dr./9th Ave SW

EXISTING PM PEAK
06/22/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Flash Dont Walk (s)		16.0			18.0			16.0			12.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	12.8	16.0	104.7	20.5	26.9		21.2	46.4		12.2	34.4	
Actuated g/C Ratio	0.12	0.15	1.00	0.20	0.26		0.20	0.44		0.12	0.33	
v/c Ratio	0.46	0.56	0.09	0.70	0.51		0.67	0.76		0.43	0.75	
Control Delay	55.4	53.3	0.1	54.6	40.5		51.6	31.2		55.6	38.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	55.4	53.3	0.1	54.6	40.5		51.6	31.2		55.6	38.6	
LOS	E	D	A	D	D		D	C		E	D	
Approach Delay		34.6			47.6			34.7			40.2	
Approach LOS		C			D			C			D	
Queue Length 50th (ft)	58	94	0	140	123		138	330		53	255	
Queue Length 95th (ft)	130	189	0	278	248		260	530		120	421	
Internal Link Dist (ft)		1692			1530			1997			431	
Turn Bay Length (ft)	200			200			200			200		
Base Capacity (vph)	430	435	1478	430	456		513	1433		513	1313	
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.21	0.34	0.09	0.53	0.49		0.43	0.76		0.16	0.62	

Intersection Summary

Area Type: Other

Cycle Length: 134

Actuated Cycle Length: 104.7

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 38.2









Intersection LOS: D




Intersection Capacity Utilization 63.7%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 2: Black Lake Blvd & Capitol Mall Dr./9th Ave SW

 Ø1	 Ø2	 Ø3	 Ø4
34 s	43 s	29 s	28 s
 Ø5	 Ø6	 Ø7	 Ø8
34 s	43 s	29 s	28 s




Intersection						
Int Delay, s/veh	3.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	195	166	27	223	112	17
Future Vol, veh/h	195	166	27	223	112	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	86	86	84	84
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	203	173	31	259	133	20

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	376
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1182
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1182
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	16.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	468	-	-	1182	-
HCM Lane V/C Ratio	0.328	-	-	0.027	-
HCM Control Delay (s)	16.4	-	-	8.1	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.4	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	89	91	40	92	72	20
Future Vol, veh/h	89	91	40	92	72	20
Peak Hour Factor	0.96	0.96	0.79	0.79	0.82	0.82
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	93	95	51	116	88	24
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay	8.2	8.6	8.6
HCM LOS	A	A	A

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	78%	0%	30%
Vol Thru, %	0%	49%	70%
Vol Right, %	22%	51%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	92	180	132
LT Vol	72	0	40
Through Vol	0	89	92
RT Vol	20	91	0
Lane Flow Rate	112	188	167
Geometry Grp	1	1	1
Degree of Util (X)	0.147	0.213	0.207
Departure Headway (Hd)	4.727	4.089	4.459
Convergence, Y/N	Yes	Yes	Yes
Cap	760	879	807
Service Time	2.751	2.105	2.476
HCM Lane V/C Ratio	0.147	0.214	0.207
HCM Control Delay	8.6	8.2	8.6
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.5	0.8	0.8




Intersection												
Int Delay, s/veh	4.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕			↕			↕			↕		
Traffic Vol, veh/h	15	3	1	0	1	19	1	9	0	18	12	26
Future Vol, veh/h	15	3	1	0	1	19	1	9	0	18	12	26
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	83	83	83	63	63	63	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	3	1	0	1	23	2	14	0	20	14	30

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	99	87	29	89	102	14	44	0	0	14	0	0
Stage 1	69	69	-	18	18	-	-	-	-	-	-	-
Stage 2	30	18	-	71	84	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	883	803	1046	896	788	1066	1564	-	-	1604	-	-
Stage 1	941	837	-	1001	880	-	-	-	-	-	-	-
Stage 2	987	880	-	939	825	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	854	792	1046	883	777	1066	1564	-	-	1604	-	-
Mov Cap-2 Maneuver	854	792	-	883	777	-	-	-	-	-	-	-
Stage 1	940	826	-	1000	879	-	-	-	-	-	-	-
Stage 2	964	879	-	922	814	-	-	-	-	-	-	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	9.3			8.5			0.7			2.3		
HCM LOS	A			A								

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1564	-	-	852 1047	1604	-	-
HCM Lane V/C Ratio	0.001	-	-	0.023 0.023	0.013	-	-
HCM Control Delay (s)	7.3	0	-	9.3 8.5	7.3	0	-
HCM Lane LOS	A	A	-	A A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1 0.1	0	-	-

Intersection	
Intersection Delay, s/veh	7.1
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	16	15	2	15	20
Future Vol, veh/h	2	16	15	2	15	20
Peak Hour Factor	0.90	0.90	0.85	0.85	0.80	0.80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	18	18	2	19	25
Number of Lanes	1	0	1	0	0	1























Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	6.6	7	7.3
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	11%	43%
Vol Thru, %	88%	0%	57%
Vol Right, %	12%	89%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	17	18	35
LT Vol	0	2	15
Through Vol	15	0	20
RT Vol	2	16	0
Lane Flow Rate	20	20	44
Geometry Grp	1	1	1
Degree of Util (X)	0.022	0.02	0.049
Departure Headway (Hd)	3.932	3.533	4.07
Convergence, Y/N	Yes	Yes	Yes
Cap	913	1012	883
Service Time	1.944	1.56	2.078
HCM Lane V/C Ratio	0.022	0.02	0.05
HCM Control Delay	7	6.6	7.3
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.1	0.1	0.2

HCM 6th Signalized Intersection Summary
2: Black Lake Blvd & Capitol Mall Dr./9th Ave SW

2020 PM PEAK WITHOUT PROJECT

06/22/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	86	139	127	212	153	55	209	818	205	78	707	50
Future Volume (veh/h)	86	139	127	212	153	55	209	818	205	78	707	50
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	96	154	0	236	170	61	232	909	228	87	786	56
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	161	511		308	897	322	305	1511	383	150	968	69
Arrive On Green	0.09	0.27	0.00	0.17	0.36	0.34	0.17	0.34	0.33	0.08	0.25	0.24
Sat Flow, veh/h	1781	1870	-2598	1781	2522	905	1781	4463	1133	1781	3845	275
Grp Volume(v), veh/h	96	154	0	236	0	231	232	368	769	87	364	478
Grp Sat Flow(s),veh/h/ln	1781	1870	-2598	1781	0	3427	1781	1777	3818	1781	1777	2343
Q Serve(g_s), s	4.7	6.0	24.0	11.6	0.0	4.3	11.4	15.8	15.3	4.3	17.6	17.6
Cycle Q Clear(g_c), s	4.7	6.0	24.0	11.6	0.0	4.3	11.4	15.8	15.3	4.3	17.6	17.6
Prop In Lane	1.00		1.00	1.00		0.26	1.00		0.30	1.00		0.12
Lane Grp Cap(c), veh/h	161	511		308	0	1219	305	602	1293	150	447	590
V/C Ratio(X)	0.60	0.30		0.77	0.00	0.19	0.76	0.61	0.59	0.58	0.81	0.81
Avail Cap(c_a), veh/h	506	511		506	0	1219	603	777	1669	603	777	1024
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.0	26.3	0.0	36.1	0.0	20.5	36.1	25.3	25.2	40.3	32.2	32.2
Incr Delay (d2), s/veh	1.3	0.1	0.0	1.5	0.0	0.0	1.5	0.4	0.2	1.3	1.4	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	2.6	0.0	5.1	0.0	3.4	5.0	6.5	13.5	1.9	7.6	9.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.3	26.5	0.0	37.6	0.0	20.5	37.6	25.6	25.4	41.7	33.6	33.3
LnGrp LOS	D	C		D	A	C	D	C	C	D	C	C
Approach Vol, veh/h		250	A		467			1369			929	
Approach Delay, s/veh		32.2			29.1			27.5			34.2	
Approach LOS		C			C			C			C	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	10.7	34.0	11.3	35.6	18.7	26.0	18.8	28.0				
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0				
Max Green Setting (Gmax), s	29.0	38.0	24.0	23.0	29.0	38.0	24.0	23.0				
Max Q Clear Time (g_c+I1), s	6.3	17.8	6.7	6.3	13.4	19.6	13.6	26.0				
Green Ext Time (p_c), s	0.1	2.1	0.1	0.3	0.3	1.4	0.3	0.0				

Intersection Summary

HCM 6th Ctrl Delay	30.2
HCM 6th LOS	C






















Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
2: Black Lake Blvd & Capitol Mall Dr./9th Ave SW

2020 PM PEAK WITHOUT PROJECT













06/22/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	86	139	127	212	153	55	209	818	205	78	707	50
Future Volume (vph)	86	139	127	212	153	55	209	818	205	78	707	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	200		0	200		0	200		0
Storage Lanes	1		1	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.960			0.970			0.990	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1652	1739	1478	1652	1669	0	1652	3204	0	1652	3270	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1652	1739	1478	1652	1669	0	1652	3204	0	1652	3270	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			141		12			24			6	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1772			1610			2077			511	
Travel Time (s)		40.3			36.6			47.2			11.6	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	96	154	141	236	170	61	232	909	228	87	786	56
Shared Lane Traffic (%)												
Lane Group Flow (vph)	96	154	141	236	231	0	232	1137	0	87	842	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		10			10			10			10	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Prot	NA	Free	Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases			Free									
Detector Phase	3	8		7	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	12.0	28.0		12.0	28.0		12.0	26.0		12.0	22.0	
Total Split (s)	29.0	28.0		29.0	28.0		34.0	43.0		34.0	43.0	
Total Split (%)	21.6%	20.9%		21.6%	20.9%		25.4%	32.1%		25.4%	32.1%	
Maximum Green (s)	24.0	23.0		24.0	23.0		29.0	38.0		29.0	38.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		-2.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)		5.0			5.0			5.0			5.0	

Lanes, Volumes, Timings
2: Black Lake Blvd & Capitol Mall Dr./9th Ave SW

2020 PM PEAK WITHOUT PROJECT

06/22/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Flash Dont Walk (s)		16.0			18.0			16.0			12.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	13.2	16.6	107.1	21.4	24.8		22.0	47.2		12.6	34.6	
Actuated g/C Ratio	0.12	0.15	1.00	0.20	0.23		0.21	0.44		0.12	0.32	
v/c Ratio	0.47	0.57	0.10	0.72	0.58		0.68	0.80		0.45	0.79	
Control Delay	56.6	54.4	0.1	56.3	44.0		53.0	33.4		56.8	41.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	56.6	54.4	0.1	56.3	44.0		53.0	33.4		56.8	41.2	
LOS	E	D	A	E	D		D	C		E	D	
Approach Delay		35.4			50.2			36.7			42.7	
Approach LOS		D			D			D			D	
Queue Length 50th (ft)	65	103	0	156	137		154	368		59	282	
Queue Length 95th (ft)	135	193	0	#303	260		272	#576		125	444	
Internal Link Dist (ft)		1692			1530			1997			431	
Turn Bay Length (ft)	200			200			200			200		
Base Capacity (vph)	420	425	1478	420	451		501	1424		501	1283	
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.23	0.36	0.10	0.56	0.51		0.46	0.80		0.17	0.66	

Intersection Summary

Area Type: Other

Cycle Length: 134

Actuated Cycle Length: 107.1

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.80

Intersection Signal Delay: 40.3

Intersection LOS: D

Intersection Capacity Utilization 65.9%








ICU Level of Service C

Analysis Period (min) 15




95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Black Lake Blvd & Capitol Mall Dr./9th Ave SW

 Ø1	 Ø2	 Ø3	 Ø4
34 s	43 s	29 s	28 s
 Ø5	 Ø6	 Ø7	 Ø8
34 s	43 s	29 s	28 s

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A




Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	93	95	42	96	75	21
Future Vol, veh/h	93	95	42	96	75	21
Peak Hour Factor	0.96	0.96	0.79	0.79	0.82	0.82
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	97	99	53	122	91	26
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay	8.3	8.8	8.7
HCM LOS	A	A	A

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	78%	0%	30%
Vol Thru, %	0%	49%	70%
Vol Right, %	22%	51%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	96	188	138
LT Vol	75	0	42
Through Vol	0	93	96
RT Vol	21	95	0
Lane Flow Rate	117	196	175
Geometry Grp	1	1	1
Degree of Util (X)	0.155	0.224	0.218
Departure Headway (Hd)	4.762	4.112	4.483
Convergence, Y/N	Yes	Yes	Yes
Cap	754	875	802
Service Time	2.789	2.131	2.502
HCM Lane V/C Ratio	0.155	0.224	0.218
HCM Control Delay	8.7	8.3	8.8
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.5	0.9	0.8

Intersection

Int Delay, s/veh 3.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	203	176	28	232	118	18
Future Vol, veh/h	203	176	28	232	118	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	86	86	84	84
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	211	183	33	270	140	21

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	394
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1165
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1165
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	17.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	450	-	-	1165	-
HCM Lane V/C Ratio	0.36	-	-	0.028	-
HCM Control Delay (s)	17.4	-	-	8.2	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.6	-	-	0.1	-




Intersection												
Int Delay, s/veh	4.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕			↕			↕			↕		
Traffic Vol, veh/h	16	3	1	0	1	20	1	9	0	19	12	27
Future Vol, veh/h	16	3	1	0	1	20	1	9	0	19	12	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	83	83	83	63	63	63	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	3	1	0	1	24	2	14	0	22	14	31

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	105	92	30	94	107	14	45	0	0	14	0	0
Stage 1	74	74	-	18	18	-	-	-	-	-	-	-
Stage 2	31	18	-	76	89	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	875	798	1044	889	783	1066	1563	-	-	1604	-	-
Stage 1	935	833	-	1001	880	-	-	-	-	-	-	-
Stage 2	986	880	-	933	821	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	844	786	1044	876	771	1066	1563	-	-	1604	-	-
Mov Cap-2 Maneuver	844	786	-	876	771	-	-	-	-	-	-	-
Stage 1	934	821	-	1000	879	-	-	-	-	-	-	-
Stage 2	961	879	-	915	810	-	-	-	-	-	-	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	9.4			8.5			0.7			2.4		
HCM LOS	A			A								

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1563	-	-	843 1047	1604	-	-
HCM Lane V/C Ratio	0.001	-	-	0.025 0.024	0.013	-	-
HCM Control Delay (s)	7.3	0	-	9.4 8.5	7.3	0	-
HCM Lane LOS	A	A	-	A A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1 0.1	0	-	-

Intersection	
Intersection Delay, s/veh	7.1
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	17	16	2	16	21
Future Vol, veh/h	2	17	16	2	16	21
Peak Hour Factor	0.90	0.90	0.85	0.85	0.80	0.80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	19	19	2	20	26
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	6.6	7	7.3
HCM LOS	A	A	A






















Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	11%	43%
Vol Thru, %	89%	0%	57%
Vol Right, %	11%	89%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	18	19	37
LT Vol	0	2	16
Through Vol	16	0	21
RT Vol	2	17	0
Lane Flow Rate	21	21	46
Geometry Grp	1	1	1
Degree of Util (X)	0.023	0.021	0.052
Departure Headway (Hd)	3.939	3.534	4.074
Convergence, Y/N	Yes	Yes	Yes
Cap	911	1011	883
Service Time	1.952	1.563	2.081
HCM Lane V/C Ratio	0.023	0.021	0.052
HCM Control Delay	7	6.6	7.3
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.1	0.1	0.2

Lanes, Volumes, Timings













2020 PM PEAK WITH PROJECT

2: Black Lake Blvd & Capitol Mall Dr./9th Ave SW

06/22/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	86	144	127	225	156	56	209	818	226	80	707	50
Future Volume (vph)	86	144	127	225	156	56	209	818	226	80	707	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	200		0	200		0	200		0
Storage Lanes	1		1	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.960			0.968			0.990	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1652	1739	1478	1652	1669	0	1652	3198	0	1652	3270	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1652	1739	1478	1652	1669	0	1652	3198	0	1652	3270	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			141		12			27			6	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1772			1610			2077			511	
Travel Time (s)		40.3			36.6			47.2			11.6	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	96	160	141	250	173	62	232	909	251	89	786	56
Shared Lane Traffic (%)												
Lane Group Flow (vph)	96	160	141	250	235	0	232	1160	0	89	842	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		10			10			10			10	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Prot	NA	Free	Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases			Free									
Detector Phase	3	8		7	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	12.0	28.0		12.0	28.0		12.0	26.0		12.0	22.0	
Total Split (s)	29.0	28.0		29.0	28.0		34.0	43.0		34.0	43.0	
Total Split (%)	21.6%	20.9%		21.6%	20.9%		25.4%	32.1%		25.4%	32.1%	
Maximum Green (s)	24.0	23.0		24.0	23.0		29.0	38.0		29.0	38.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		-2.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)		5.0			5.0			5.0			5.0	

2: Black Lake Blvd & Capitol Mall Dr./9th Ave SW

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Flash Dont Walk (s)		16.0			18.0			16.0			12.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	13.3	17.0	108.6	22.3	26.1		22.1	47.1		12.8	34.6	
Actuated g/C Ratio	0.12	0.16	1.00	0.21	0.24		0.20	0.43		0.12	0.32	
v/c Ratio	0.48	0.59	0.10	0.74	0.57		0.69	0.83		0.46	0.81	
Control Delay	57.4	55.0	0.1	57.5	43.4		54.0	35.4		57.6	42.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	57.4	55.0	0.1	57.5	43.4		54.0	35.4		57.6	42.5	
LOS	E	E	A	E	D		D	D		E	D	
Approach Delay		36.1			50.7			38.5			43.9	
Approach LOS		D			D			D			D	
Queue Length 50th (ft)	67	110	0	169	141		158	394		62	292	
Queue Length 95th (ft)	136	200	0	#337	264		274	#632		127	447	
Internal Link Dist (ft)		1692			1530			1997			431	
Turn Bay Length (ft)	200			200			200			200		
Base Capacity (vph)	414	419	1478	414	453		493	1402		493	1264	
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.23	0.38	0.10	0.60	0.52		0.47	0.83		0.18	0.67	

Intersection Summary

Area Type: Other

Cycle Length: 134

Actuated Cycle Length: 108.6

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.83

Intersection Signal Delay: 41.6

Intersection LOS: D

Intersection Capacity Utilization 67.6%









ICU Level of Service C

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Black Lake Blvd & Capitol Mall Dr./9th Ave SW

 Ø1	 Ø2	 Ø3	 Ø4
34 s	43 s	29 s	28 s
 Ø5	 Ø6	 Ø7	 Ø8
34 s	43 s	29 s	28 s




HCM 6th TWSC
3: Fern St SW & 9th Ave SW

2020 PM PEAK WITH PROJECT
06/22/2018

Intersection						
Int Delay, s/veh	4.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↱	
Traffic Vol, veh/h	203	204	28	232	135	18
Future Vol, veh/h	203	204	28	232	135	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	86	86	84	84
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	211	213	33	270	161	21
Major/Minor	Major1	Major2		Minor1		
Conflicting Flow All	0	0	424	0	654	318
Stage 1	-	-	-	-	318	-
Stage 2	-	-	-	-	336	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1135	-	431	723
Stage 1	-	-	-	-	738	-
Stage 2	-	-	-	-	724	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1135	-	416	723
Mov Cap-2 Maneuver	-	-	-	-	416	-
Stage 1	-	-	-	-	713	-
Stage 2	-	-	-	-	724	-
Approach	EB	WB		NB		
HCM Control Delay, s	0	0.9		18.9		
HCM LOS	C					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	438	-	-	1135	-	
HCM Lane V/C Ratio	0.416	-	-	0.029	-	
HCM Control Delay (s)	18.9	-	-	8.3	0	
HCM Lane LOS	C	-	-	A	A	
HCM 95th %tile Q(veh)	2	-	-	0.1	-	

Intersection

Intersection Delay, s/veh	8.7
Intersection LOS	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	93	95	49	96	75	25
Future Vol, veh/h	93	95	49	96	75	25
Peak Hour Factor	0.96	0.96	0.79	0.79	0.82	0.82
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	97	99	62	122	91	30
Number of Lanes	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	1	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	1	0	1
HCM Control Delay	8.4	8.9	8.7
HCM LOS	A	A	A

Lane	NBLn1	EBLn1	WBLn1
Vol Left, %	75%	0%	34%
Vol Thru, %	0%	49%	66%
Vol Right, %	25%	51%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	100	188	145
LT Vol	75	0	49
Through Vol	0	93	96
RT Vol	25	95	0
Lane Flow Rate	122	196	184
Geometry Grp	1	1	1
Degree of Util (X)	0.161	0.225	0.23
Departure Headway (Hd)	4.761	4.136	4.503
Convergence, Y/N	Yes	Yes	Yes
Cap	754	870	798
Service Time	2.788	2.154	2.522
HCM Lane V/C Ratio	0.162	0.225	0.231
HCM Control Delay	8.7	8.4	8.9
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.6	0.9	0.9

HCM 6th TWSC
10: Decatur St SW & 14th Ave SW

2020 PM PEAK WITH PROJECT

03/21/2018

Intersection

Int Delay, s/veh 4.4




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕			↕			↕			↕		
Traffic Vol, veh/h	20	3	1	0	1	20	1	9	0	19	12	34
Future Vol, veh/h	20	3	1	0	1	20	1	9	0	19	12	34
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	83	83	83	63	63	63	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	3	1	0	1	24	2	14	0	22	14	39

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	109	96	34	98	115	14	53	0	0	14	0	0
Stage 1	78	78	-	18	18	-	-	-	-	-	-	-
Stage 2	31	18	-	80	97	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	870	794	1039	884	775	1066	1553	-	-	1604	-	-
Stage 1	931	830	-	1001	880	-	-	-	-	-	-	-
Stage 2	986	880	-	929	815	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	840	782	1039	871	763	1066	1553	-	-	1604	-	-
Mov Cap-2 Maneuver	840	782	-	871	763	-	-	-	-	-	-	-
Stage 1	930	818	-	1000	879	-	-	-	-	-	-	-
Stage 2	961	879	-	912	804	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.4	8.5	0.7	2.1
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1553	-	-	839	1046	1604	-	-
HCM Lane V/C Ratio	0.001	-	-	0.03	0.024	0.013	-	-
HCM Control Delay (s)	7.3	0	-	9.4	8.5	7.3	0	-
HCM Lane LOS	A	A	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0	-	-

Intersection	
Intersection Delay, s/veh	7.3
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	17	33	2	16	49
Future Vol, veh/h	2	17	33	2	16	49
Peak Hour Factor	0.90	0.90	0.85	0.85	0.80	0.80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	19	39	2	20	61
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	6.8	7.2	7.5
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	11%	25%
Vol Thru, %	94%	0%	75%
Vol Right, %	6%	89%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	35	19	65
LT Vol	0	2	16
Through Vol	33	0	49
RT Vol	2	17	0
Lane Flow Rate	41	21	81
Geometry Grp	1	1	1
Degree of Util (X)	0.046	0.021	0.091
Departure Headway (Hd)	3.998	3.628	4.052
Convergence, Y/N	Yes	Yes	Yes
Cap	896	978	887
Service Time	2.018	1.682	2.063
HCM Lane V/C Ratio	0.046	0.021	0.091
HCM Control Delay	7.2	6.8	7.5
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.1	0.1	0.3

Note:

FOR TOTAL INTERSECTION DELAY

Major Approach: Left-Through-Right Shared is added together and entered as the left movement with the LT delay.
 In Olympia drivers do not pass a queued left-turn and are assigned delay.
 HCS assumes there is no delay for the TH movement. (See HCS2000 manual equation 17-40 and 17-41 text)
 If there is an exclusive Left-turn lane enter the Through and the Right volume without delay
 Delay max 1000 sec.

Decatur St SW & 14th Ave SW

Unsignalized Intersection Calculation

Weighted Average

Existing PM Peak Hour Volumes

	NB			SB			WB			EB		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement	1	2	3	4	5	6	7	8	9	10	11	12
Volume (HFR)	1	9	0	18	12	29	20	0	0	19	0	0
Control Delay	7.3	0	0	7.3	0	0	8.5	0	0	9.3	0	0
Intersection Delay	4.5	A										

2020 PM Peak Hour Volumes Without Project

	NB			SB			WB			EB		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement	1	2	3	4	5	6	7	8	9	10	11	12
Volume	1	9	0	19	12	27	21	0	0	20	0	0
Control Delay	7.3	0	0	7.3	0	0	8.5	0	0	9.4	0	0
Intersection Delay	4.7	A										

2020 PM Peak Hour Volumes With Project

	NB			SB			WB			EB		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement	1	2	3	4	5	6	7	8	9	10	11	12
Volume	1	9	0	19	12	34	21	0	0	24	0	0
Control Delay	7.3	0	0	7.3	0	0	8.5	0	0	9.4	0	0
Intersection Delay	4.6	A										

Note:

FOR TOTAL INTERSECTION DELAY

Major Approach: Left-Through-Right Shared is added together and entered as the left movement with the LT delay.
 In Olympia drivers do not pass a queued left-turn and are assigned delay.
 HCS assumes there is no delay for the TH movement. (See HCS2000 manual equation 17-40 and 17-41 text)
 If there is an exclusive Left-turn lane enter the Through and the Right volume without delay
 Delay max 1000 sec.

Fern St SW & 9th Ave SW

Unsignalized Intersection Calculation

Weighted Average

Existing PM Peak Hour Volumes

	NB			SB			WB			EB		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement	1	2	3	4	5	6	7	8	9	10	11	12
Volume (HFR)	129	0	0	0	0	0	27	223	0	0	195	166
Control Delay	16.4	0	0	0	0	0	8.1	0	0	0	0	0
Intersection Delay	3.2	A										

2020 PM Peak Hour Volumes Without Project

	NB			SB			WB			EB		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement	1	2	3	4	5	6	7	8	9	10	11	12
Volume	136	0	0	0	0	0	28	232	0	0	203	176
Control Delay	17.4	0	0	0	0	0	8.2	0	0	0	0	0
Intersection Delay	3.3	A										

2020 PM Peak Hour Volumes With Project

	NB			SB			WB			EB		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement	1	2	3	4	5	6	7	8	9	10	11	12
Volume	154	0	0	0	0	0	28	232	0	0	203	204
Control Delay	18.9	0	0	0	0	0	8.3	0	0	0	0	0
Intersection Delay	3.8	A										