

MEMORANDUM

DATE: June 19, 2017

TO: Robert Eichelsdoerfer
King County DOT

FROM: Jeff Schramm / Amy Wasserman
TENW

SUBJECT: Level 1 Traffic Impact Analysis for the proposed
Lakeside Industries SR 169 Development (PREA16-0193)
TENW Project #5390

This memorandum documents the Level 1 traffic impact analysis (TIA) conducted for the proposed Lakeside Industries SR 169 development. The proposed project is located at 18825 SE Renton Maple Valley Road (SR 169) on the south side of SR 169 in King County as shown in the Figure 1 site vicinity map.

Executive Summary

Proposal. The proposed Lakeside Industries development would accommodate the manufacturing of hot mix asphalt paving materials for construction purposes and commercial sales. Operations will include an asphalt drum mix plant, raw material import and storage/stockpiling, and business services including an administrative office and truck and equipment parking. Vehicular access to the site is proposed via a new full access driveway located approximately 360 feet east (centerline to centerline) of the existing access driveway on SR 169. The existing driveway would be removed as part of the proposed project. Full project buildout is expected in 2019.

Trip Generation. The proposed project is estimated to generate a total of 460 weekday daily trips, with 45 trips occurring during the weekday AM peak hour and 32 trips occurring during the weekday PM peak hour. With credits for the existing use applied, the proposed Lakeside Industries project is estimated to generate approximately 295 new weekday daily trips, with 23 new trips occurring during the AM peak hour (7 in, 16 out), and 16 new trips occurring during the PM peak hour (4 in, 12 out).

Concurrency. The proposed project is located within the Soos Creek travel shed which currently passes the King County concurrency standard.

Site Access Operations Analysis. The results of the LOS analyses conducted at the proposed new site access driveway on SR 169 show that all controlled movements are expected to operate at LOS C or better in 2019 during the AM and PM peak hour with the proposed project, except for the northbound (exiting site) movement during the PM peak hour which is anticipated to operate at LOS E. Also, all 95th percentile queues for controlled movements at the proposed site access driveway are anticipated to be 1 vehicle or less during the AM and PM peak hours with the project.

Sight Distance Assessment. Intersection and stopping sight distances were evaluated at the proposed new site access driveway on SE Renton Maple Valley Road (SR 169) and were verified to meet applicable minimum WSDOT standards.

Parking Demand. Based on information provided by the project applicant, the proposed Lakeside Industries project estimates a maximum on-site parking demand of 54 vehicles. The maximum parking demand of 54 vehicles would be accommodated by the proposed on-site parking supply of 54 stalls.

Frontage and Right-of-Way. Since SR 169 has 150 to 160 feet of existing right-of-way (ROW) along the proposed Lakeside Industries property frontage, no additional ROW dedication is expected to be required by WSDOT.

Mitigation. The traffic impacts of the proposed Lakeside Industries SR 169 project are not expected to create a significant adverse impact to the site or adjacent street network. As a result, there is no identified traffic mitigation anticipated for this project.



Figure 1: Project Site Vicinity



Introduction

Consistent with comments provided by County staff at the project pre-application meeting on December 20, 2016, the following items are addressed in this Level 1 traffic impact analysis:

- Project description
- Existing roadway network
- Collision history
- Planned transportation improvements
- Trip generation
- Transportation concurrency
- Trip distribution and assignment
- Existing and future year traffic volumes at proposed site access
- Traffic operational (LOS) analysis at proposed site access
- Entering and stopping sight distance at proposed site access
- Parking demand
- Frontage improvements
- Mitigation

Project Description

The proposed project is located at 18825 SE Renton Maple Valley Road (SR 169) on the south side of SR 169, and includes redevelopment of the site to accommodate the manufacturing of hot mix asphalt paving materials for construction purposes and commercial sales. Operations will include an asphalt drum mix plant, raw material import and storage/stockpiling, and business services including an administrative office and truck and equipment parking. The site is zoned Industrial (I) and contains several structures that were occupied until recently by Sunset Materials. The existing buildings would be removed with the proposed project.

Vehicular access to the site is proposed via a new full access driveway located approximately 360 feet east (centerline to centerline) of the existing access driveway on SR 169. The existing driveway would be removed as part of the proposed project. Full project buildout is expected in 2019. A preliminary site plan is provided in Figure 2.

Existing Roadway Network

SE Renton Maple Valley Road (SR 169) is an east-west state route that provides access between Interstate 405 in Renton and the City of Enumclaw. In the project vicinity, the roadway is classified as a rural principal arterial based on the King County Functional Classification Arterial Map, and the roadway consists of 5 lanes with 2 travel lanes in each direction and a center two-way-left-turn lane. The posted speed limit on SR 169 is 50 miles per hour (mph) adjacent to the site and no sidewalks or bicycle lanes on SR 169 along the project frontage.

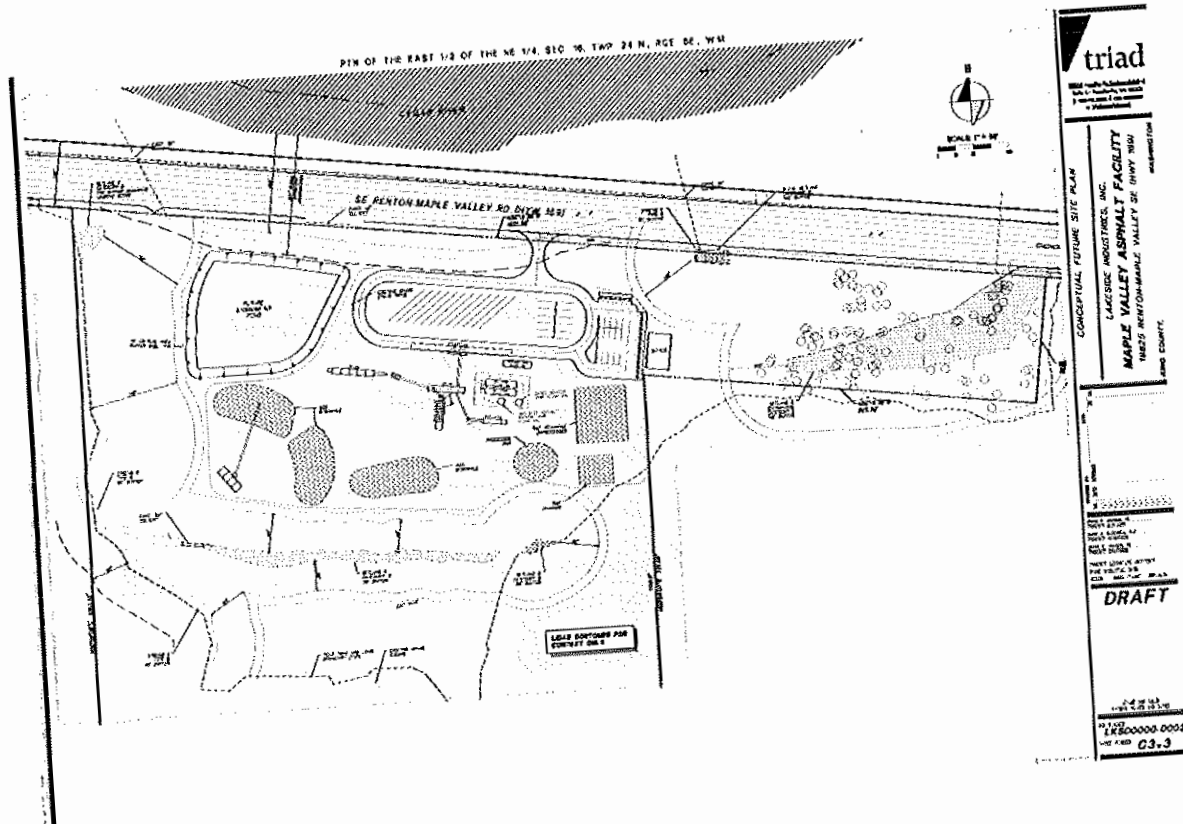


Figure 2: Preliminary Site Plan

Collision History

Collision records in the study area were reviewed for the three-year period from January 1, 2013 to December 31, 2015. Collision data was provided by the Washington State Department of Transportation (WSDOT). The detailed collision data is included in Attachment A. As shown in Attachment A, there were no driveway-related collisions at the existing driveway on SE Renton Maple Valley Road (SR 169) within the most recent three years of available data.

Planned Transportation Improvements

Based on a review of King County's 2017-2022 *Capital Improvement Program* (CIP) and WSDOT's 2017-2020 *Statewide Transportation Improvement Program* (STIP), there are no planned improvements on SR 169 in the vicinity of the proposed project.

Trip Generation

Proposed Trip Generation

Based on the information provided by the applicant, the proposed use is not consistent with any Institute of Transportation Engineers (ITE) *Trip Generation* manual land use category since the proposed use is highly specialized and will not cater to the general public.

To estimate trip generation from the proposed project, the project applicant provided detailed forecasts of employee trips, trucks trips, and other miscellaneous trips based on their proposed operation. The trip estimates are summarized in Attachment B and are described as follows:

Employee Trips – The facility is planned to have 30 total employees arriving at the site between 6:00 and 9:00 AM and leaving the site between 3:00 and 6:00 PM.

Truck Trips – The facility estimates a total of 380 asphalt paving truck trips per day (190 in, 190 out) between 6:00 AM and 6:00 PM.

Other Trips – Miscellaneous other trips associated with the proposed facility may include up to 20 trips per day (10 in, 10 out) for pick-ups and deliveries, mail trips, etc. These other trips would occur outside of the typical AM and PM peak periods to avoid traffic congestion.

As shown in Attachment B, the proposed Lakeside SR 169 project would generate a total of 460 daily trips, with 45 trips occurring during the AM peak hour (23 in, 22 out), and 32 trips occurring during the PM peak hour (10 in, 22 out).

Existing Trip Generation

The existing 12.5-acre site is used by Sunset Materials and includes material stockpiles, office, and equipment shop use in multiple buildings. Weekday daily traffic counts were conducted at the existing driveway to the site on SE Renton Maple Valley Road on January 24 and 25, 2017. Based on the counts, the 2-day average trip generation of the existing site was 53 weekday daily trips with 8 trips occurring during the AM peak hour and 5 trips occurring during the PM peak hour.

Based on information provided by Sunset Materials, at the time of the counts, the site was running 9 trucks per day as it was in the process of moving its operations to a different location. Typical operations at the site included 28 trucks per day. Therefore, the existing observed trip generation was factored up to account for the trip generation of the existing site at the level of typical operations. The detailed existing trip generation counts and forecasts for typical operation are included in Attachment C.

As shown in Attachment C, at typical operation levels, the existing site is estimated to generate a total of 165 daily trips, with 22 trips occurring in the AM peak hour (16 in, 6 out), and 16 trips occurring during the PM peak hour (6 in, 16 out).

Net Trip Generation

The net new trips associated with the proposed Lakeside SR 169 development were determined by subtracting the trips generated by the existing use (Sunset Materials at typical operations) from the total trips generated by the proposed project. The resulting net new trip generation is summarized in Table 1.

Table 1
Trip Generation Summary

Time Period	Trips Generated		
	In	Out	Total
Weekday Daily			
Proposed Use	230	230	460
Less Existing Use	-82	-83	-165
New Daily Trips	148	147	295
Weekday AM Peak Hour			
Proposed Use	23	22	45
Less Existing Use	-16	-6	-22
New AM Peak Hour Trips	7	16	23
Weekday PM Peak Hour			
Proposed Use	10	22	32
Less Existing Use	-6	-10	-16
New PM Peak Hour Trips	4	12	16

As shown in Table 1, with credits for the existing use applied, the proposed Lakeside Industries project is estimated to generate a net of 295 new weekday daily trips, with 23 new trips occurring during the AM peak hour (7 in, 16 out), and 16 new trips occurring during the PM peak hour (4 in, 12 out).

Transportation Concurrency

The proposed project is located within the Soos Creek travel shed which currently passes the King County concurrency standard.

Trip Distribution and Assignment

The general distribution of peak hour project generated trips was estimated separately for non-truck vehicles and trucks based on existing travel patterns and truck routing information provided by the project applicant. The weekday project-generated trips were distributed separately generally distributed as follows:

Non-Truck Trips

- 50 percent to/from the west on SE Renton Maple Valley Road (SR 169)
- 50 percent to/from the east on SE Renton Maple Valley Road (SR 169)

Truck Trips

- 40 percent to/from the west on SE Renton Maple Valley Road (SR 169)
- 60 percent to/from the east on SE Renton Maple Valley Road (SR 169)

The estimated trip distribution patterns and assignment of the AM peak hour trips is illustrated in Figure 3 and the trip distribution and assignment of the PM peak hour project trips is illustrated in Figure 4.

Existing and Future Year Traffic Volumes

Existing weekday AM and PM peak hour traffic counts at the current access driveway on SE Renton Maple Valley Road (SR 169) were conducted on Tuesday, January 24, 2017 by All Traffic Data, Inc. The existing peak hour traffic volumes represent the highest hour between 7:00-9:00 AM and 4:00-6:00 PM. The existing count sheets are included in Attachment D.

To estimate future 2019 baseline traffic volumes without the project, an annual growth rate of two percent was applied to the existing through volumes on SE Renton Maple Valley Rd (SR 169). Future 2019 with-project traffic volumes were estimated by adding the peak hour trip assignment to the year 2019 without-project volumes.

The 2017 peak hour existing traffic volumes, 2019 without-project traffic volumes, project trip assignments, and 2019 with-project volumes at the site access driveway on SE Renton Maple Valley Road (SR 169) are summarized in Figure 3 for the AM peak hour and Figure 4 for the PM peak hour. Note that the project trips shown on Figures 3 and 4 are gross trips and do not reflect credit for the existing use to be removed.

Site Access Operations Analysis

Future year 2019 With-Project AM and PM peak hour level of service (LOS) and queue analyses were conducted at the proposed (relocated) site access driveway on SE Renton Maple Valley Road (SR 169) based on the methodology and procedures outlined in the 6th Edition of the *Highway Capacity Manual* (HCM) using the *Synchro 10* software program. LOS serves as an indicator of the quality of traffic flow and degree of congestion at an intersection or roadway segment. It is a measure of vehicle operating speed, travel time, travel delays, and driving comfort. The LOS methodology is described in Attachment E. The 2019 With-Project AM and PM peak hour volumes at the site driveway used in the LOS analyses are as shown on Figures 3 and 4.

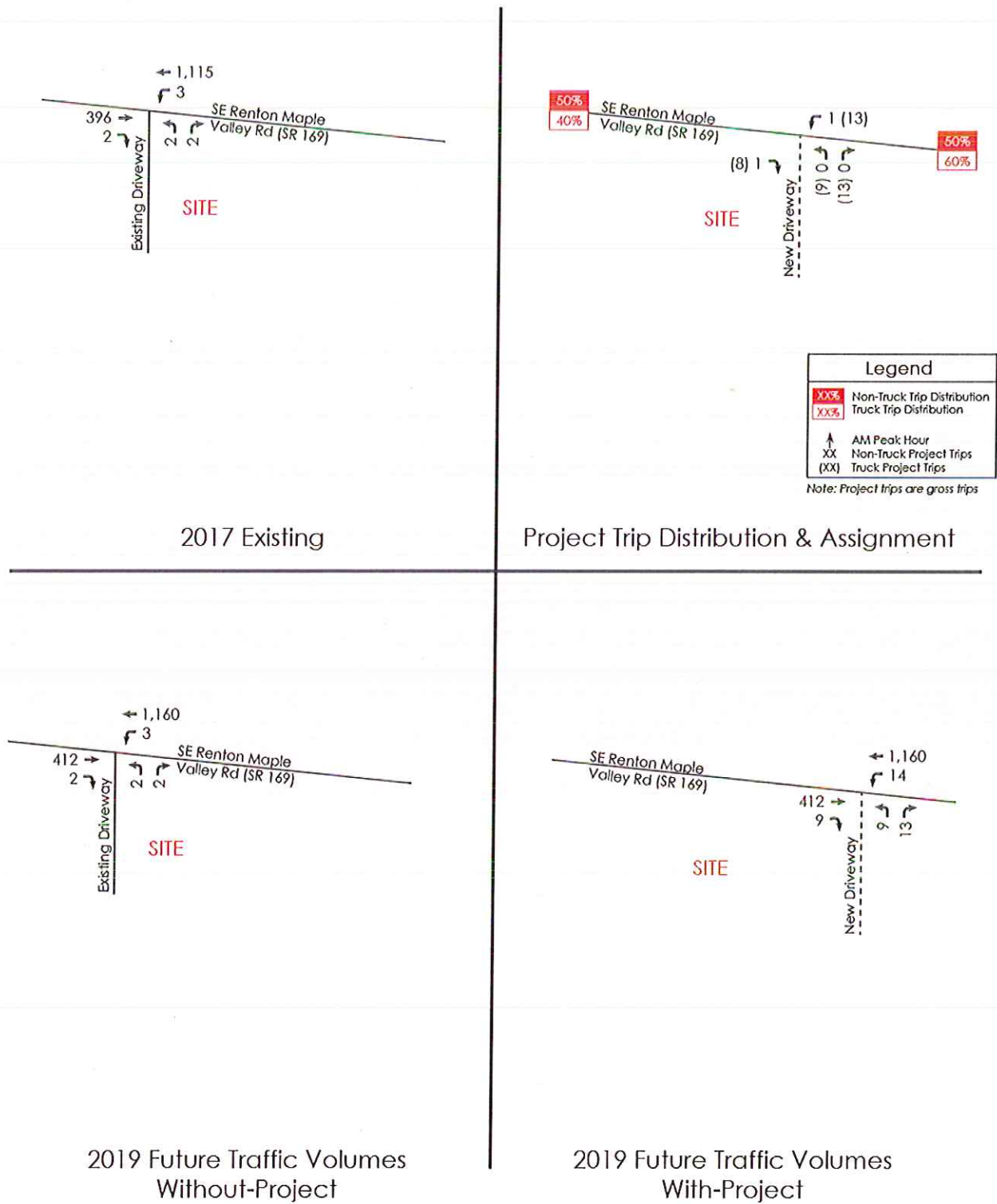


Figure 3: AM Peak Hour Traffic Volumes



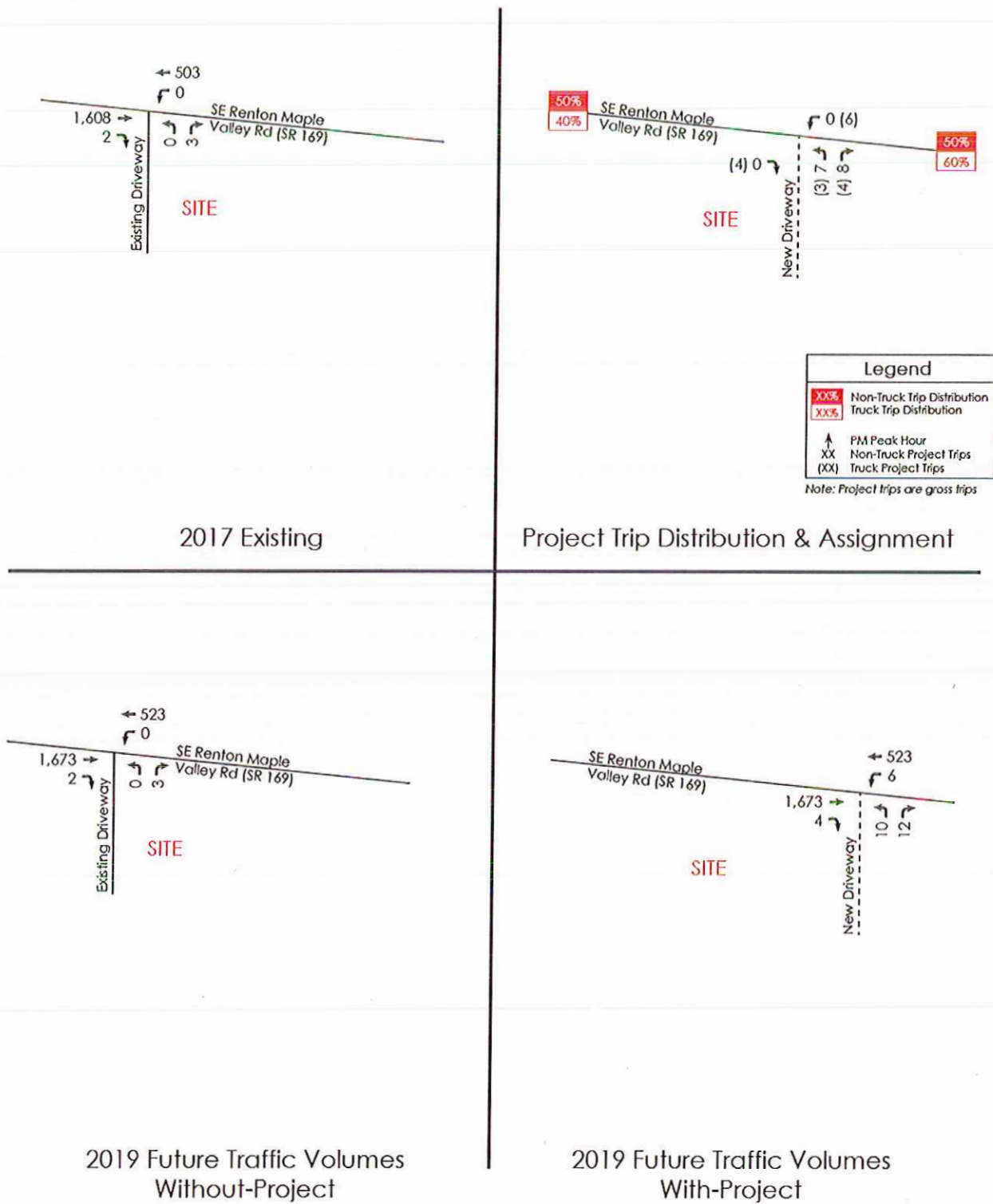


Figure 4: PM Peak Hour Traffic Volumes



The reported queues for the controlled movements at the unsignalized site driveway are 95th percentile queues, which are exceeded only 5 percent of the time during the analysis period.

The weekday PM peak hour LOS and queue results at the site access driveway for 2018 With-Project conditions are summarized in Table 2. The LOS and queue worksheets are included in Attachment E.

Table 2
Year 2019 With-Project Peak Hour Level of Service Summary at Site Driveway

Driveway	Movement	AM PEAK HOUR			PM PEAK HOUR		
		LOS ¹	Delay (sec)	Queue Length (veh) ²	LOS ¹	Delay (sec)	Queue Length (veh) ²
<u>Two-Way Stop Controlled:</u>							
SE Renton Maple Valley Rd (SR 169) / Driveway							
	Northbound left-right (exiting)	C	17.9	< 1 veh	E	45.7	< 1 veh
	Westbound left (entering)	A	8.5	< 1 veh	C	17.1	< 1 veh

1. LOS = Level of Service, reported by movement for unsignalized intersections.

2. Queues are 95th Percentile queues. < 1 vehicle indicates 95th percentile queue statistically less than 1 vehicle.

As shown in Table 2, the results of the LOS analysis show that all controlled movements at the unsignalized site access driveway on SR 169 are expected to operate at LOS C or better in 2019 during the AM and PM peak hour with the proposed Lakeside SR 169 project, except for the northbound (exiting site) movement during the PM peak hour which is anticipated to operate at LOS E. Also, all 95th percentile queues for controlled movements at the site access driveway are anticipated to be 1 vehicle or less during the AM and PM peak hours with the project.

Sight Distance Assessment

Intersection (entering) sight distances (ISD) and stopping sight distances (SSD) were field verified by TENW on March 1, 2017 at the proposed new site access to SE Renton Maple Valley Road (SR 169). The proposed new site access would be located approximately 360 feet east (centerline to centerline) of the existing driveway to the site. Along the project frontage, SE Renton Maple Valley Road (SR 169) is five lanes (two in each direction with a center-two way left-turn lane) and has a posted speed limit of 50 mph.

The intersection sight distance (ISD) standards were based on the Washington State Department of Transportation (WSDOT) *Design Manual* Chapter 1310.05 Intersection Sight Distance (updated November 2015). The setback distance from the intersection sight distance sight triangle is 18 feet from the edge of traveled way.

Stopping sight distance (SSD) standards were based on the July 2013 edition of the WSDOT Design Manual Chapter 1260.03 Stopping Sight Distance (updated July 2016). WSDOT standards use a driver's eye height of 3.5 feet, and an object height of 2.0 feet.

ISD and SSD were evaluated for a design speed of 55 mph based on a posted speed limit of 50 mph on SE Renton Maple Valley Road (SR 169) as sight distance values are typically represented by a design speed of 5 mph over posted speed.

Intersection (Entering) Sight Distance (ISD)

Based on a 55 mph design speed on SE Renton Maple Valley Road (SR 169), the desirable intersection sight distance for a left-turning passenger vehicle is 687 feet and the desirable intersection sight distance for a left-turning single-unit truck (SU-30) is 849 feet (*Design Manual* Exhibit 1310-19a). This assumes a vehicles making a left-turn from the site driveway and crossing 3 lanes (2 eastbound lanes and a center two-way left-turn lane). This is a conservative assumption since exiting left-turn vehicles can use the center two-way left-turn lane as a refuge and only cross 2 lanes.

Based on field measurements, the available intersection sight distance looking to the east from the proposed driveway location is approximately 850 feet and the available intersection sight distance looking to the west of the proposed driveway location is over 1,000 feet. Therefore, the WSDOT minimum intersection sight distance requirements are met for both a passenger vehicle and a single-unit truck.

Stopping Sight Distance (SSD)

For a 55 mph design speed on SE Renton Maple Valley Road (SR 169), the recommended design value for stopping sight distance based on WSDOT *Design Manual* standards is 495 feet (*Design Manual*/Exhibit 1260-1). Approaching the proposed new site access on SE Renton Maple Valley Road from the east and west, the available stopping sight distance was verified to be more than 500 feet, therefore meeting applicable WSDOT standards.

Parking Demand

Based on information provided by the project applicant, the proposed Lakeside Industries project estimates a maximum on-site parking demand of 54 vehicles. The maximum parking demand of 54 vehicles would be accommodated by the proposed on-site parking supply of 54 stalls. The parking demand forecasts are included in Attachment F.

Frontage and Right-of-Way

SR 169 (SE Renton Maple Valley Road) is classified as a rural principal arterial per King County. However, since it is a state highway, any right-of-way (ROW) dedication falls under the jurisdiction of the Washington State Department of Transportation (WSDOT). Since SR 169 has 150 to 160 feet of existing ROW along the proposed Lakeside Industries property frontage, no additional ROW dedication is expected to be required by WSDOT.

Mitigation

The traffic impacts of the proposed Lakeside Industries SR 169 project are not expected to create a significant adverse impact to the site or adjacent street network. As a result, there is no identified traffic mitigation anticipated for this project.

If you have any questions regarding the information presented in this Traffic Impact Analysis, please contact me at (425) 250-0581 or schramm@tenw.com.

cc: Felix Palisoc, WSDOT
Karen Deal, Lakeside Industries
Jeff Haynie, TENW

Attachments: A. Detailed Collision History
B. Proposed Use Trip Generation
C. Existing Use Trip Generation
D. Existing Traffic Count Worksheets
E. LOS Calculations
F. Parking Demand Calculations

ATTACHMENT A

Detailed Collision History

Driveway is at approximately MP 19.92

Driveway is at approximately MP 29.92.

Under 21 U.S.C. § 409 and 21 U.S.C. § 145, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or roadway/highway crossings are not subject to discovery, or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

[illegible]

ATTACHMENT B

Proposed Use Trip Generation

Estimated Trip Generation Forecasts - Average Weekday by Trip Type

Time Period	Employee Vehicle Trips		Truck Trips		Other Trips (vendors/delivery, mail, etc)		Total Trips		
	Entering	Exiting	Entering	Exiting	Entering	Exiting	Entering	Exiting	Total
before 6 am							0	0	0
6:00 - 7:00 am	15		14	18			29	18	47
7:00 - 8:00 am	10		11	16			21	16	37
8:00 - 9:00 am	2		21	22			23	22	45
9:00 - 10:00 am			22	22	5		27	22	49
10:00 - 11:00 am			20	20	5		25	20	45
11:00 am - 12:00 pm			16	16			16	16	32
12:00 - 1:00 pm	3	3	20	20			23	23	46
1:00 - 2:00 pm			22	22			22	22	44
2:00 - 3:00 pm			18	15		5	18	20	38
3:00 - 4:00 pm		5	10	7		5	10	17	27
4:00 - 5:00 pm		15	10	7			10	22	32
5:00 - 6:00 pm		7	6	5			6	12	18
after 6 pm							0	0	0
TOTAL TRIPS	30	30	190	190	10	10	230	230	460

ATTACHMENT C

Existing Use Trip Generation

Sunset Materials
Existing Trip Generation

According to information provided by owner:

Sunset Materials (existing site) is currently running 9 trucks and was running 28 trucks at peak operation. Estimated 150-250 trucks/day total.

	# of trucks per day	Total Trips Generated								
		Weekday Daily			AM Trips			PM Trips		
		in	out	total	in	out	total	in	out	total
January 2017	9	26	27	53	6	2	8	2	3	5
Typical Operations (at full capacity)	28	82	83	165	19	6	25	6	10	16

ATTACHMENT D

Existing Traffic Count Worksheets



(303) 216-2439
www.alltrafficdata.net

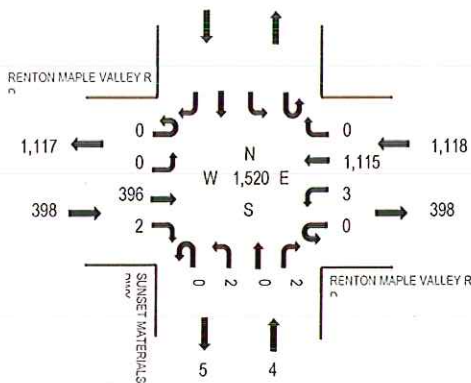
Location: 1 SUNSET MATERIALS DWY & RENTON MAPLE VALLEY RD AM

Date and Start Time: Tuesday, January 24, 2017

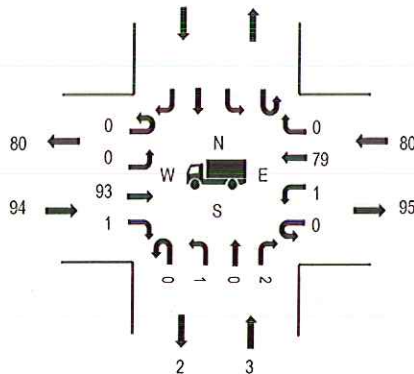
Peak Hour: 08:00 AM - 09:00 AM

Peak Hour

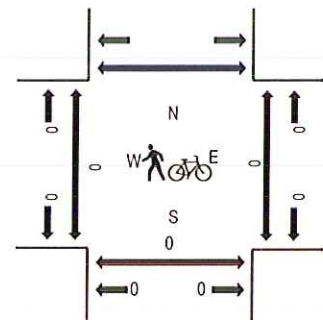
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	23.6%	0.80
WB	7.2%	0.89
NB	75.0%	0.50
SB		
All	11.6%	0.93

Traffic Counts - All Vehicles

Interval Start Time	RENTON MAPLE VALLEY RD Eastbound				RENTON MAPLE VALLEY RD Westbound				SUNSET MATERIALS DWY Northbound				Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
7:00 AM	0	0	67	0	0	0	320	0	0	0	0	0					387	1,479
7:15 AM	0	0	76	0	0	0	311	0	0	0	0	0					387	1,453
7:30 AM	0	0	87	1	0	1	269	0	0	1	0	0					359	1,476
7:45 AM	0	0	94	0	0	1	251	0	0	0	0	0					346	1,511
8:00 AM	0	0	92	0	0	1	267	0	0	0	0	1					361	1,520
8:15 AM	0	0	93	1	0	2	313	0	0	0	0	1					410	
8:30 AM	0	0	124	0	0	0	270	0	0	0	0	0					394	
8:45 AM	0	0	87	1	0	0	265	0	0	2	0	0					355	
Count Total	0	0	720	3	0	5	2,266	0	0	3	0	2					2,999	
Peak Hour	0	0	396	2	0	3	1,115	0	0	2	0	2					1,520	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
7:00 AM	7	0	19		26	7:00 AM	0	0	0		0
7:15 AM	4	0	18		22	7:15 AM	0	0	0		0
7:30 AM	7	1	9		17	7:30 AM	0	0	0		0
7:45 AM	16	0	12		28	7:45 AM	0	0	0		0
8:00 AM	22	1	16		39	8:00 AM	0	0	0		0
8:15 AM	22	1	20		43	8:15 AM	0	0	0		0
8:30 AM	27	0	25		52	8:30 AM	0	0	0		0
8:45 AM	23	1	19		43	8:45 AM	0	0	0		0
Count Total	128	4	138		270	Count Total	0	0	0		0
Peak Hour	94	3	80		177	Peak Hour	0	0	0		0



(303) 216-2439
www.alltrafficdata.net

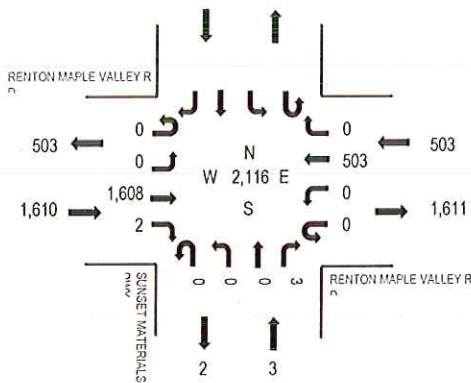
Location: 1 SUNSET MATERIALS DWY & RENTON MAPLE VALLEY RD PM

Date and Start Time: Tuesday, January 24, 2017

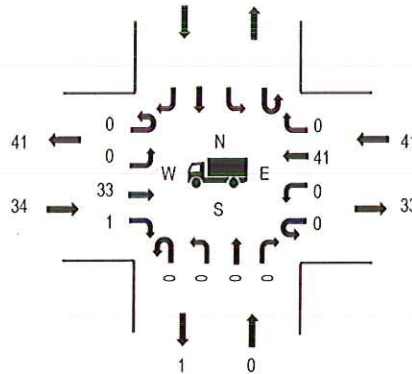
Peak Hour: 04:00 PM - 05:00 PM

Peak Hour

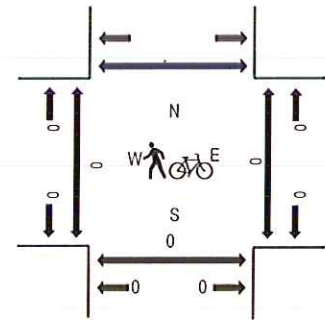
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	2.1%	0.97
WB	8.2%	0.92
NB	0.0%	0.38
SB		
All	3.5%	0.97

Traffic Counts - All Vehicles

Interval Start Time	RENTON MAPLE VALLEY RD Eastbound				RENTON MAPLE VALLEY RD Westbound				SUNSET MATERIALS DWY Northbound				Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	0	390	0	0	0	127	0	0	0	0	1					518	2,116
4:15 PM	0	0	404	1	0	0	137	0	0	0	0	2					544	2,046
4:30 PM	0	0	412	1	0	0	126	0	0	0	0	0					539	1,957
4:45 PM	0	0	402	0	0	0	113	0	0	0	0	0					515	1,891
5:00 PM	0	0	355	0	0	0	93	0	0	0	0	0					448	1,790
5:15 PM	0	0	349	0	0	0	106	0	0	0	0	0					455	
5:30 PM	0	0	382	0	0	0	91	0	0	0	0	0					473	
5:45 PM	0	0	329	0	0	0	85	0	0	0	0	0					414	
Count Total	0	0	3,023	2	0	0	878	0	0	0	0	3					3,906	
Peak Hour	0	0	1,608	2	0	0	503	0	0	0	0	3					2,116	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	7	0	16		23	4:00 PM	0	0	0		0
4:15 PM	10	0	18		28	4:15 PM	0	0	0		0
4:30 PM	9	0	5		14	4:30 PM	0	0	0		0
4:45 PM	8	0	2		10	4:45 PM	0	0	0		0
5:00 PM	3	0	1		4	5:00 PM	0	0	0		0
5:15 PM	10	0	2		12	5:15 PM	0	0	0		0
5:30 PM	7	0	1		8	5:30 PM	0	0	0		0
5:45 PM	3	0	1		4	5:45 PM	0	0	0		0
Count Total	57	0	46		103	Count Total	0	0	0		0
Peak Hour	34	0	41		75	Peak Hour	0	0	0		0

ATTACHMENT E

LOS Calculations

Level of Service Methodology

Level of service calculations for intersections were based on methodology and procedures outlined in the 6th Edition of the *Highway Capacity Manual*, Special Report 209, Transportation Research Board (2016) using *Synchro 10.0* traffic analysis software.

LOS generally refers to the degree of congestion on a roadway or intersection. It is a measure of vehicle operating speed, travel time, travel delays, and driving comfort. A letter scale from A to F generally describes intersection LOS. At signalized intersections, LOS A represents free-flow conditions (motorists experience little or no delays), and LOS F represents forced-flow conditions where motorists experience an average delay more than 80 seconds per vehicle.

The LOS reported for signalized intersections represents the average control delay (sec/veh) and can be reported for the overall intersection, for each approach, and for each lane group (additional v/c ratio criteria apply to lane group LOS only).

The LOS reported at stop-controlled intersections is based on the average control delay and can be reported for each controlled minor approach, controlled minor lane group, and controlled major-street movement (and for the overall intersection at all-way stop controlled intersections. Additional v/c ratio criteria apply to lane group or movement LOS only).

Table A1 outlines the current HCM 6th Edition LOS criteria for signalized and stop-controlled intersections based on these methodologies.

Table A1
LOS Criteria for Signalized and Stop Controlled Intersections¹

SIGNALIZED INTERSECTIONS			STOP-CONTROLLED INTERSECTIONS		
Control Delay (sec/veh)	LOS by Volume-to Capacity (V/C) Ratio ²		Control Delay (sec/veh)	LOS by Volume-to Capacity (V/C) Ratio ³	
	≤ 1.0	> 1.0		≤ 1.0	> 1.0
≤ 10	A	F	≤ 10	A	F
> 10 to ≤ 20	B	F	> 10 to ≤ 15	B	F
> 20 to ≤ 35	C	F	> 15 to ≤ 25	C	F
> 35 to ≤ 55	D	F	> 25 to ≤ 35	D	F
> 55 to ≤ 80	E	F	> 35 to ≤ 50	E	F
> 80	F	F	> 50	F	F

¹ Source: Highway Capacity Manual, 6th Edition, Transportation Research Board, 2016.

² For approach-based and intersection-wide assessments at signals, LOS is defined solely by control delay.

³ For two-way stop controlled intersections, the LOS criteria apply to each lane on a given approach and to each approach on the minor street. LOS is not calculated for major-street approaches or for the intersection as a whole at two-way stop controlled intersections. For approach-based and intersection-wide assessments at all-way stop controlled intersections, LOS is solely defined by control delay.

Lanes, Volumes, Timings

3: Site Access Dwy & SR 169 (SE Renton Maple Valley Rd)

06/15/2017

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	
Traffic Volume (vph)	412	9	14	1160	9	13
Future Volume (vph)	412	9	14	1160	9	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	100		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			25		25	
Link Speed (mph)	50			50	25	
Link Distance (ft)	659			764	440	
Travel Time (s)	9.0			10.4	12.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	24%	24%	8%	8%	100%	100%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection

Int Delay, s/veh 0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	
Traffic Vol, veh/h	412	9	14	1160	9	13
Future Vol, veh/h	412	9	14	1160	9	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	1	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	24	24	8	8	100	100
Mvmt Flow	448	10	15	1261	10	14

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	458	0	1114	229
Stage 1	-	-	-	-	453	-
Stage 2	-	-	-	-	661	-
Critical Hdwy	-	-	4.26	-	8.8	8.9
Critical Hdwy Stg 1	-	-	-	-	7.8	-
Critical Hdwy Stg 2	-	-	-	-	7.8	-
Follow-up Hdwy	-	-	2.28	-	4.5	4.3
Pot Cap-1 Maneuver	-	-	1058	-	97	543
Stage 1	-	-	-	-	393	-
Stage 2	-	-	-	-	281	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1058	-	96	543
Mov Cap-2 Maneuver	-	-	-	-	186	-
Stage 1	-	-	-	-	387	-
Stage 2	-	-	-	-	281	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	17.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	304	-	-	1058	-
HCM Lane V/C Ratio	0.079	-	-	0.014	-
HCM Control Delay (s)	17.9	-	-	8.5	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Lanes, Volumes, Timings

3: Site Access Dwy & SR 169 (SE Renton Maple Valley Rd)

06/15/2017

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↓	↑↑	↓	
Traffic Volume (vph)	1673	4	6	523	10	12
Future Volume (vph)	1673	4	6	523	10	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	100		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			25		25	
Link Speed (mph)	50			50	25	
Link Distance (ft)	659			764	440	
Travel Time (s)	9.0			10.4	12.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	9%	9%	32%	32%
Shared Lane Traffic (%)						
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection

Int Delay, s/veh 0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	
Traffic Vol, veh/h	1673	4	6	523	10	12
Future Vol, veh/h	1673	4	6	523	10	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	1	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	9	9	32	32
Mvmt Flow	1818	4	7	568	11	13

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1822	0	2118	911
Stage 1	-	-	-	-	1820	-
Stage 2	-	-	-	-	298	-
Critical Hdwy	-	-	4.28	-	7.44	7.54
Critical Hdwy Stg 1	-	-	-	-	6.44	-
Critical Hdwy Stg 2	-	-	-	-	6.44	-
Follow-up Hdwy	-	-	2.29	-	3.82	3.62
Pot Cap-1 Maneuver	-	-	304	-	30	225
Stage 1	-	-	-	-	82	-
Stage 2	-	-	-	-	645	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	304	-	29	225
Mov Cap-2 Maneuver	-	-	-	-	70	-
Stage 1	-	-	-	-	80	-
Stage 2	-	-	-	-	645	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	45.7
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	112	-	-	304	-
HCM Lane V/C Ratio	0.214	-	-	0.021	-
HCM Control Delay (s)	45.7	-	-	17.1	-
HCM Lane LOS	E	-	-	C	-
HCM 95th %tile Q(veh)	0.8	-	-	0.1	-

ATTACHMENT F

Parking Demand Calculations

Estimated Parking Demand Forecasts

Vehicle Type	# of Parking Stalls Needed
Super Solos	3
Transfer Truck & Trailers	4
Truck & Trailers	3
Lowboy and Trailer	1
Water Truck	1
Tack Truck	1
Equipment Trailers	4
Equipment Storage	6
White Fleet	11
Employee/Vendor	20
TOTAL	54