



September 9, 2019

To: Grace Kane, City of Lake Stevens
 From: Jeff Hee, Transportation Solutions, Inc.
 Subject: Costco Lake Stevens
 No Connection from 24th Street SE to S Lake Stevens Road

It is understood that neighbors on S Lake Stevens Road south of the proposed Costco Wholesale membership warehouse and fueling station, have expressed concerns about S Lake Stevens Road being used as a major cut-through route. With the addition of Costco traffic, neighbors believe that traffic conditions at the future 24th Street SE and SR 9 intersection and on S Lake Stevens Road to the west of SR 9 will be significantly worse.

The Final October 2018 Traffic Impact Analysis for the Costco development documented future traffic conditions with a roundabout a 24th Street SE and SR 9 and a new road connection from 24th Street SE to S Lake Stevens Road, to latter to replace the current S Lake Stevens Road connection to SR 9. Traffic generated by the proposed Costco development was distributed to the local road network based on the Snohomish County’s travel demand model that was approved by the WSDOT. The traffic impact analysis did not identify any warrants for additional traffic mitigation on S Lake Stevens Road.

To address the neighbors’ concerns, this memorandum summarizes analyses of future traffic conditions with the proposed Costco and without a connection from 24th Street SE and S Lake Stevens Road. With no connection, the S Lake Stevens Road cut-through route in the vicinity of the site is removed.

Exhibit 1 illustrates the change in the roadway network in the vicinity of the proposed Costco with no connection between 24th Street SE and S Lake Stevens Road. condition.

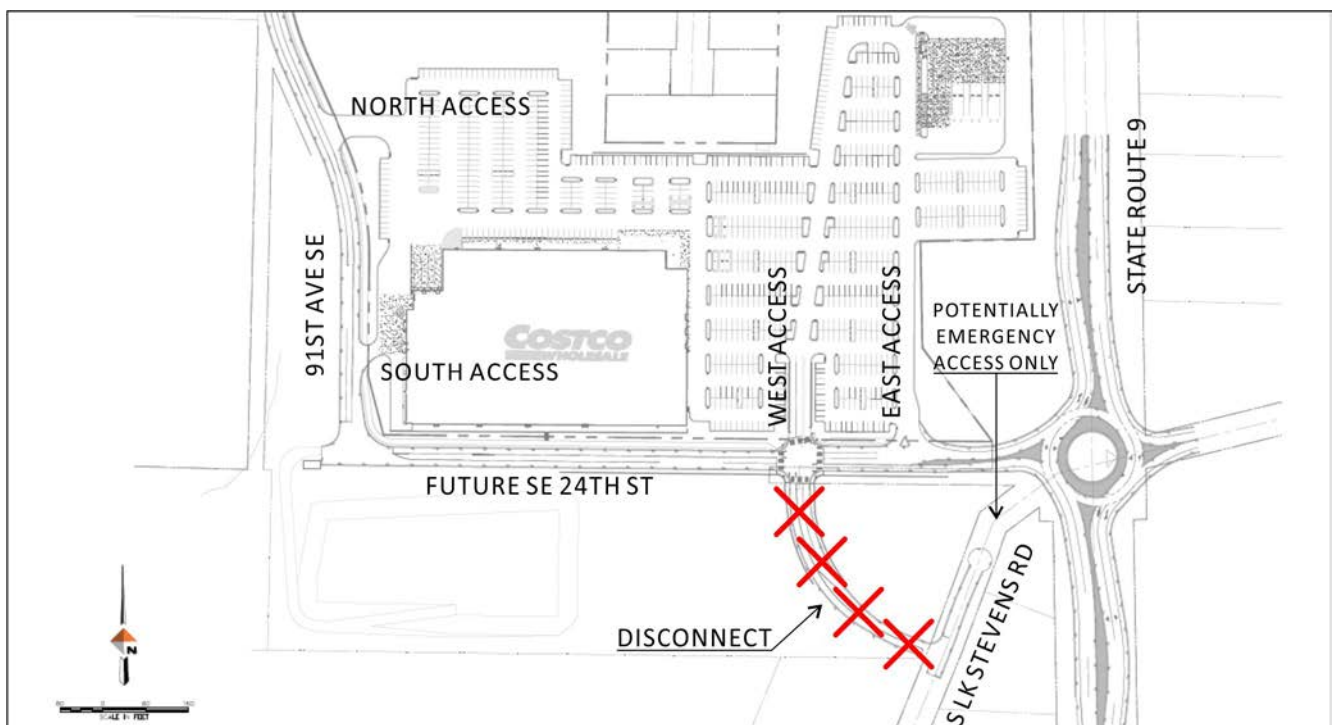


Exhibit 1: Proposed Revised Development Conditions

Without a direct connection between 24th Street SE and S Lake Stevens Road, traffic destined from southbound SR 9 to South Lake Stevens Road and from northbound Lake Stevens Road to SR 9 would shift to 32nd Street SE. For this analysis all traffic that was forecast to use 24th Street SE to/from S Lake Stevens Road was shifted to 32nd Street SE.

PM Peak Hour Volume Analysis

Exhibit 2 highlights the affected travel patterns without the connection and compares the 2025 PM peak hour traffic volumes with Costco and without a connection between 24th Street SE and S Lake Stevens Road.

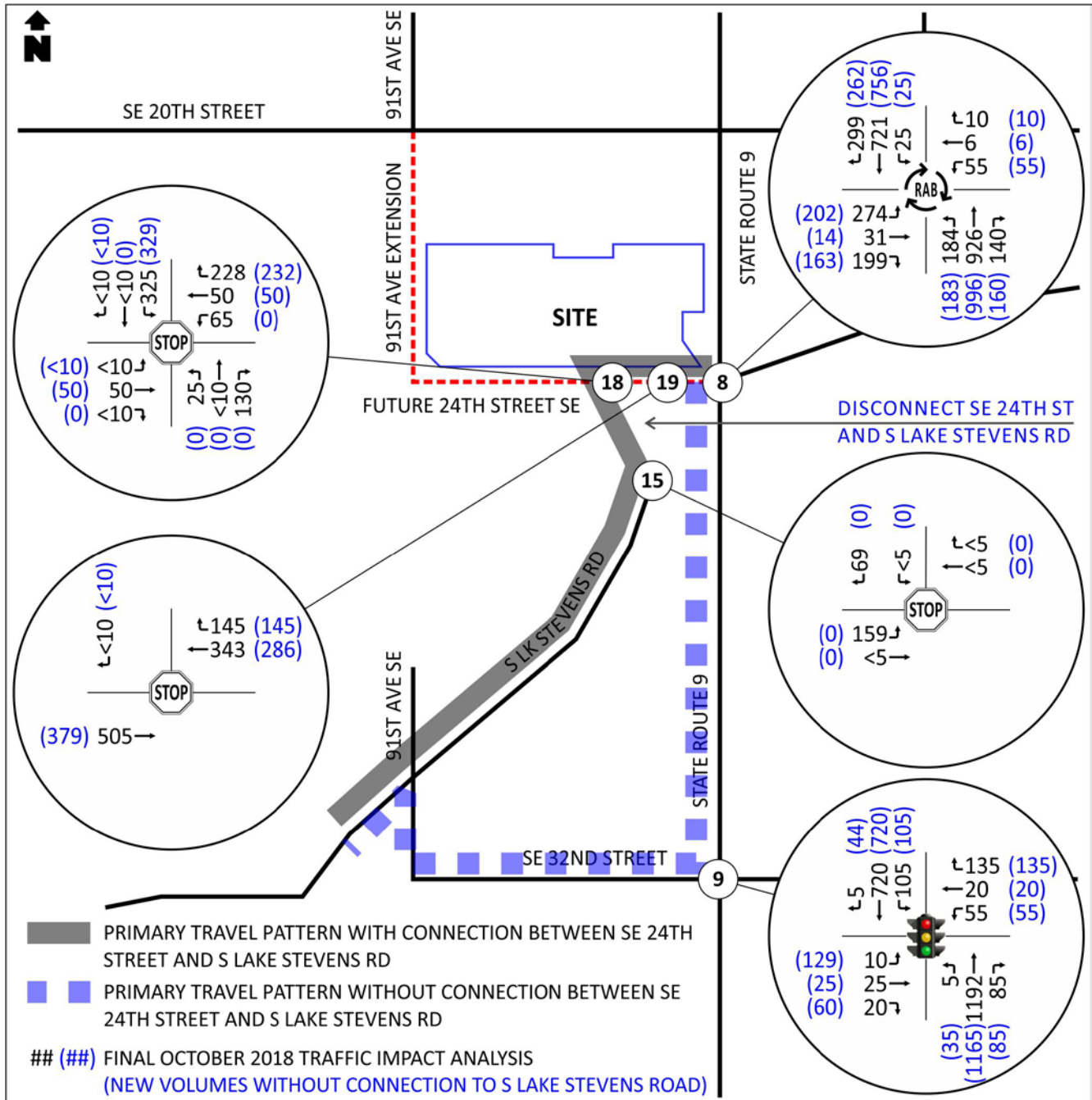


Exhibit 2: Major Travel Patterns and 2025 Volumes With and Without Road Connection



Traffic Operations

Table 1 compares the level-of-service analysis with and without the connection.

Table 1: 2025 With-Project With and Without Connection Level-of-Service and Delay

Intersection	With Connector SLKS Rd ¹			Without Connector SLKS Rd		
	Control	LOS	Delay	Control	LOS	Delay
West Access / SE 24th St	Signal ²	B	15.2	SB Stop	B	12.2
East Access / SE 24th St	SB Stop	B	10.0	SB Stop	A	9.8
SR 9 / S Lk Stevens Rd / SE 24th St	RAB	B	13.2	RAB	B	13.0
SR 9 / SE 32nd St	Signal	D	53.4	Signal	F	95.2

1. From Final October 2018 Traffic Impact Analysis
2. Does not require a signal in 2025 with Costco

By removing the connection between 24th Street SE and S Lake Stevens Road, fewer vehicles will be 24th Street SE compared the conditions with the connection.

The Costco access would operate will less delay without the connection due to the lower traffic volumes.

The without-connection analysis shows that the 24th Street SE and SE 9 roundabout would operate fractionally better, since more traffic is being served on the mainline (SR 9) than on the minor street (24th Street SE).

Traffic operations at the signalized intersection of 32nd Street SE and SR 9 are forecast to decrease from LOS D to LOS F. Without the connection, the additional volumes generated to and from the west leg of this intersection result in increasing delay at this intersection and would warrant mitigation to meet the WSDOT level of service requirements.

Improvements: 32nd Street SE and SR 9

Without the connection between 24th Street SE and S Lake Stevens Road, additional traffic volumes on 32nd Street SE combined with “split phase”, or non-concurrent, eastbound and westbound signal phasing results in the LOS F traffic conditions. The split phase is due to the offset alignment of the eastbound and westbound through movements.

Improvements considered at 32nd Street SE and SR 9 include:

1. Realign the east and west legs of the intersection and converting the split phased movements to permissive signal timing, allowing for concurrent eastbound and westbound traffic operations.
2. Widen the west leg of the intersection for a short (50-foot) eastbound left turn pocket, realign the east leg of the intersection by converting the westbound right-only and through-left lanes into a more traditional left only and through-right lanes, replace the split phased eastbound and westbound movements with concurrent eastbound and westbound signal timing, and update the signal timing.

Table 2 compares the results of the possible improvements.

Table 2: 32nd Street SE and SR 9 Improvement Analysis

Condition	Control	LOS	Delay
0. No Change (see Table 1)	Signal	F	95.2
1. Realign and Permissive Phasing	Signal	D	50.4
2. Widen and Concurrent Phasing	Signal	D	42.6

At 32nd Street SE and SR 9, by improvement the eastbound and westbound movements to be concurrent will reduce intersection delay and will also reduce queuing 32nd Street SE.

Copies of all intersection capacity reports are attached for reference.

Conclusions

In conclusion, to respond to concerns about cut-through traffic raised by neighbors south of the proposed Costco the above analysis reviewed traffic conditions with 24th Street SE disconnected from S Lake Stevens Road to the west of SR 9. By removing the connection, traffic that was forecast to and from S Lake Stevens Road was conservatively redistributed to 32nd Street SE.

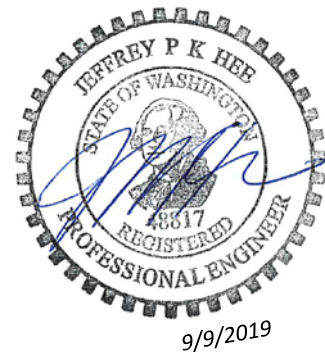
The analysis shows that the additional volume on 32nd Street SE will require a modification to the 32nd Street SE intersection with SR 9 to accommodate to additional traffic volume and support PM peak hour level-of-service conditions.

With respect to the Costco site, 24th Street SE will continue to support the development and operation of the site. No new improvements are required on 24th Street SE or at SR 9.

By removing the connection between 24th Street SE and S Lake Stevens Road, the impacts of Costco traffic to 32nd Street SE are negligible compared to the non-Costco traffic that would potentially redistribute itself to 32nd Street SE.

It is understood, that improvements to 32nd Street SE and SR 9 and to the areas south of Costco will be reviewed and permitted by Snohomish County, and at SR 9, by WSDOT.

I trust that this technical memorandum will support your discussions with both Snohomish County and the WSDOT. Should you or the other jurisdictions have comments or questions, please feel free to contact Transportation Solutions, Inc. at your convenience.



MOVEMENT SUMMARY

 Site: 9 [2025 With-Project SR 9/24th Street SE/S Lk Stevens Rd - No Connector]

2025 With-Project
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: SR 9											
3	L2	193	1.0	0.542	11.7	LOS B	4.2	106.9	0.60	0.56	28.4
8	T1	1048	1.0	0.542	4.6	LOS A	4.4	111.9	0.59	0.51	36.7
18	R2	168	1.0	0.542	4.6	LOS A	4.4	111.9	0.58	0.47	35.6
Approach		1409	1.0	0.542	5.6	LOS A	4.4	111.9	0.59	0.51	35.4
East: South Lake Stevens Road											
1	L2	58	1.0	0.146	14.5	LOS B	0.6	15.0	0.70	0.88	33.9
6	T1	6	1.0	0.146	7.7	LOS A	0.6	15.0	0.70	0.88	27.6
16	R2	11	1.0	0.146	8.3	LOS A	0.6	15.0	0.70	0.88	28.7
Approach		75	1.0	0.146	13.0	LOS B	0.6	15.0	0.70	0.88	33.0
North: SR 9											
7	L2	26	3.0	0.427	11.6	LOS B	2.8	71.9	0.52	0.48	35.5
4	T1	796	3.0	0.427	4.6	LOS A	2.9	74.9	0.51	0.48	37.3
14	R2	276	3.0	0.427	4.5	LOS A	2.9	74.9	0.49	0.48	32.9
Approach		1098	3.0	0.427	4.7	LOS A	2.9	74.9	0.51	0.48	36.6
West: 24th Street SE											
5	L2	213	1.0	0.575	15.1	LOS B	3.3	84.0	0.73	0.95	30.1
2	T1	15	1.0	0.575	8.4	LOS A	3.3	84.0	0.73	0.95	27.9
12	R2	172	1.0	0.575	9.0	LOS A	3.3	84.0	0.73	0.95	32.4
Approach		399	1.0	0.575	12.2	LOS B	3.3	84.0	0.73	0.95	31.3
All Vehicles		2981	1.7	0.575	6.3	LOS A	4.4	111.9	0.58	0.57	35.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: D:\Dropbox (MaryAnn)\Dropbox (TSI)\TSI Projects\2018\218002 Costco Lake Stevens\Level of Service\2025 SIDRA 24_SR9 RAB.sip7

Intersection

Int Delay, s/veh 6.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↘	↗	↗	↘	↘	↘
Traffic Vol, veh/h	10	50	50	232	329	10
Future Vol, veh/h	10	50	50	232	329	10
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	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	54	54	252	358	11

Major/Minor

	Major1	Major2	Minor2
Conflicting Flow All	306	0	0
Stage 1	-	-	54
Stage 2	-	-	76
Critical Hdwy	4.12	-	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.218	-	3.518
Pot Cap-1 Maneuver	1255	-	864
Stage 1	-	-	969
Stage 2	-	-	947
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1255	-	856
Mov Cap-2 Maneuver	-	-	856
Stage 1	-	-	960
Stage 2	-	-	947

Approach

	EB	WB	SB
HCM Control Delay, s	1.3	0	12.1
HCM LOS			B

Minor Lane/Major Mvmt

	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1255	-	-	-	856	1013
HCM Lane V/C Ratio	0.009	-	-	-	0.418	0.011
HCM Control Delay (s)	7.9	-	-	-	12.2	8.6
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0	-	-	-	2.1	0

Intersection

Int Delay, s/veh 0.1

Movement EBL EBT WBT WBR SBL SBR

Lane Configurations		↑↑	↑↑			↑
Traffic Vol, veh/h	0	379	286	145	0	10
Future Vol, veh/h	0	379	286	145	0	10
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	412	311	158	0	11

Major/Minor Major1 Major2 Minor2

Conflicting Flow All	-	0	-	0	-	235
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.32
Pot Cap-1 Maneuver	0	-	-	-	0	767
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	-	767
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach EB WB SB

HCM Control Delay, s	0	0	9.8
HCM LOS			A

Minor Lane/Major Mvmt EBT WBT WBR SBLn1

Capacity (veh/h)	-	-	-	767
HCM Lane V/C Ratio	-	-	-	0.014
HCM Control Delay (s)	-	-	-	9.8
HCM Lane LOS	-	-	-	A
HCM 95th %tile Q(veh)	-	-	-	0

Timings
10: SR 9 & 32nd St

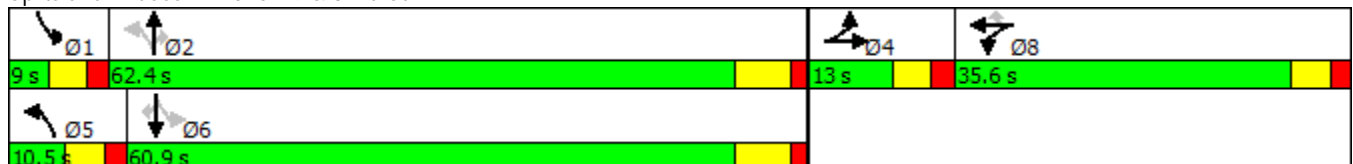


Lane Group	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↑	↔	↔	↑	↔
Traffic Volume (vph)	25	20	135	35	1195	85	105	720	44
Future Volume (vph)	25	20	135	35	1195	85	105	720	44
Turn Type	NA	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	4	8		5	2		1	6	
Permitted Phases			8	2		2	6		6
Detector Phase	4	8	8	5	2	2	1	6	6
Switch Phase									
Minimum Initial (s)	3.0	3.0	3.0	5.0	10.0	10.0	3.0	10.0	10.0
Minimum Split (s)	8.5	35.6	35.6	10.5	35.5	35.5	8.5	32.5	32.5
Total Split (s)	13.0	35.6	35.6	10.5	62.4	62.4	9.0	60.9	60.9
Total Split (%)	10.8%	29.7%	29.7%	8.8%	52.0%	52.0%	7.5%	50.8%	50.8%
Yellow Time (s)	3.5	3.6	3.6	3.5	5.0	5.0	3.5	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	1.5	1.5	2.0	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.6	5.6	5.5	6.5	6.5	5.5	6.5	6.5
Lead/Lag				Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?				Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Min	Min	None	Min	Min
Act Effect Green (s)	7.5	9.0	9.0	61.9	55.9	55.9	61.8	58.7	58.7
Actuated g/C Ratio	0.08	0.09	0.09	0.63	0.56	0.56	0.62	0.59	0.59
v/c Ratio	1.53	0.46	0.52	0.10	1.15	0.09	0.78	0.67	0.05
Control Delay	301.5	51.7	15.9	6.9	101.1	1.0	51.7	19.0	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	301.5	51.7	15.9	6.9	101.1	1.0	51.7	19.0	0.1
LOS	F	D	B	A	F	A	D	B	A
Approach Delay	301.5	28.6			92.1			22.0	
Approach LOS	F	C			F			C	

Intersection Summary






















Cycle Length: 120
 Actuated Cycle Length: 99
 Natural Cycle: 150
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 1.53
 Intersection Signal Delay: 81.2
 Intersection Capacity Utilization 102.1%
 Analysis Period (min) 15
 Intersection LOS: F
 ICU Level of Service G

Splits and Phases: 10: SR 9 & 32nd St



HCM 2010 Signalized Intersection Summary
10: SR 9 & 32nd St

Costco Lake Stevens
Timing Plan: PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	129	25	60	55	20	135	35	1195	85	105	720	44
Future Volume (veh/h)	129	25	60	55	20	135	35	1195	85	105	720	44
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1881	1881	1881	1863	1863	1863
Adj Flow Rate, veh/h	132	26	65	56	20	138	36	1219	87	107	735	45
Adj No. of Lanes	0	1	0	0	1	1	1	1	1	1	1	1
Peak Hour Factor	0.98	0.98	0.92	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	0	0	0	0	0	0	1	1	1	2	2	2
Cap, veh/h	77	15	38	147	52	176	314	1041	885	133	1037	881
Arrive On Green	0.07	0.07	0.07	0.11	0.11	0.11	0.03	0.55	0.55	0.03	0.56	0.56
Sat Flow, veh/h	1040	205	512	1350	482	1615	1792	1881	1599	1774	1863	1583
Grp Volume(v), veh/h	223	0	0	76	0	138	36	1219	87	107	735	45
Grp Sat Flow(s),veh/h/ln	1758	0	0	1832	0	1615	1792	1881	1599	1774	1863	1583
Q Serve(g_s), s	7.5	0.0	0.0	3.9	0.0	8.4	0.9	55.9	2.6	2.7	29.2	1.3
Cycle Q Clear(g_c), s	7.5	0.0	0.0	3.9	0.0	8.4	0.9	55.9	2.6	2.7	29.2	1.3
Prop In Lane	0.59		0.29	0.74		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	131	0	0	199	0	176	314	1041	885	133	1037	881
V/C Ratio(X)	1.71	0.00	0.00	0.38	0.00	0.79	0.11	1.17	0.10	0.81	0.71	0.05
Avail Cap(c_a), veh/h	131	0	0	544	0	480	347	1041	885	133	1037	881
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	0.00	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	46.7	0.0	0.0	41.8	0.0	43.9	13.2	22.5	10.6	24.6	16.4	10.2
Incr Delay (d2), s/veh	349.2	0.0	0.0	0.9	0.0	5.7	0.1	87.2	0.1	28.6	2.6	0.0
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(95%),veh/ln	29.3	0.0	0.0	3.6	0.0	7.3	0.8	97.0	2.1	4.8	22.1	1.1
LnGrp Delay(d),s/veh	395.9	0.0	0.0	42.7	0.0	49.5	13.3	109.8	10.7	53.2	19.0	10.3
LnGrp LOS	F			D		D	B	F	B	D	B	B
Approach Vol, veh/h		223			214			1342			887	
Approach Delay, s/veh		395.9			47.1			100.8			22.7	
Approach LOS		F			D			F			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.0	62.4		13.0	8.7	62.7		16.6				
Change Period (Y+Rc), s	5.5	6.5		5.5	5.5	6.5		5.6				
Max Green Setting (Gmax), s	3.5	55.9		7.5	5.0	54.4		30.0				
Max Q Clear Time (g_c+I1), s	4.7	57.9		9.5	2.9	31.2		10.4				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	20.6		0.6				
Intersection Summary												
HCM 2010 Ctrl Delay			95.2									
HCM 2010 LOS			F									

Timings
10: SR 9 & 32nd St

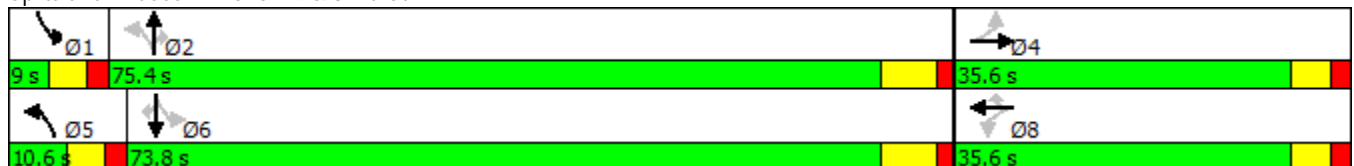


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕	↕	↕	↕	↕	↕	↕
Traffic Volume (vph)	129	25	55	20	135	35	1195	85	105	720	44
Future Volume (vph)	129	25	55	20	135	35	1195	85	105	720	44
Turn Type	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8	2		2	6		6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	3.0	3.0	3.0	3.0	3.0	5.0	10.0	10.0	3.0	10.0	10.0
Minimum Split (s)	8.5	8.5	35.6	35.6	35.6	10.5	35.5	35.5	8.5	32.5	32.5
Total Split (s)	35.6	35.6	35.6	35.6	35.6	10.6	75.4	75.4	9.0	73.8	73.8
Total Split (%)	29.7%	29.7%	29.7%	29.7%	29.7%	8.8%	62.8%	62.8%	7.5%	61.5%	61.5%
Yellow Time (s)	3.5	3.5	3.6	3.6	3.6	3.5	5.0	5.0	3.5	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	1.5	2.0	1.5	1.5
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		5.5		5.6	5.6	5.5	6.5	6.5	5.5	6.5	6.5
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Min	Min	None	Min	Min
Act Effect Green (s)		20.8		20.7	20.7	75.2	69.1	69.1	75.0	72.0	72.0
Actuated g/C Ratio		0.19		0.19	0.19	0.68	0.62	0.62	0.68	0.65	0.65
v/c Ratio		0.80		0.32	0.35	0.09	1.04	0.09	0.88	0.61	0.04
Control Delay		61.0		42.0	12.4	6.6	60.6	3.4	73.8	16.5	1.0
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		61.0		42.0	12.4	6.6	60.6	3.4	73.8	16.5	1.0
LOS		E		D	B	A	E	A	E	B	A
Approach Delay		61.0		22.9			55.5			22.7	
Approach LOS		E		C			E			C	

Intersection Summary






















Cycle Length: 120
 Actuated Cycle Length: 111
 Natural Cycle: 150
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 1.04
 Intersection Signal Delay: 42.4
 Intersection LOS: D
 Intersection Capacity Utilization 102.1%
 ICU Level of Service G
 Analysis Period (min) 15

Splits and Phases: 10: SR 9 & 32nd St



HCM 2010 Signalized Intersection Summary
10: SR 9 & 32nd St

Costco Lake Stevens
Timing Plan: PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	129	25	60	55	20	135	35	1195	85	105	720	44
Future Volume (veh/h)	129	25	60	55	20	135	35	1195	85	105	720	44
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1881	1881	1881	1863	1863	1863
Adj Flow Rate, veh/h	132	26	65	56	20	138	36	1219	87	107	735	45
Adj No. of Lanes	0	1	0	0	1	1	1	1	1	1	1	1
Peak Hour Factor	0.98	0.98	0.92	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	0	0	0	0	0	0	1	1	1	2	2	2
Cap, veh/h	191	39	74	255	83	351	352	1127	958	117	1117	950
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.03	0.60	0.60	0.03	0.60	0.60
Sat Flow, veh/h	649	178	340	921	383	1615	1792	1881	1599	1774	1863	1583
Grp Volume(v), veh/h	223	0	0	76	0	138	36	1219	87	107	735	45
Grp Sat Flow(s),veh/h/ln	1167	0	0	1305	0	1615	1792	1881	1599	1774	1863	1583
Q Serve(g_s), s	16.6	0.0	0.0	0.0	0.0	8.4	0.9	68.9	2.7	2.8	30.0	1.3
Cycle Q Clear(g_c), s	22.0	0.0	0.0	5.4	0.0	8.4	0.9	68.9	2.7	2.8	30.0	1.3
Prop In Lane	0.59		0.29	0.74		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	304	0	0	338	0	351	352	1127	958	117	1117	950
V/C Ratio(X)	0.73	0.00	0.00	0.22	0.00	0.39	0.10	1.08	0.09	0.92	0.66	0.05
Avail Cap(c_a), veh/h	366	0	0	401	0	421	378	1127	958	117	1117	950
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	0.00	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	45.5	0.0	0.0	37.2	0.0	38.5	12.2	23.1	9.8	29.7	15.2	9.5
Incr Delay (d2), s/veh	5.4	0.0	0.0	0.2	0.0	0.5	0.1	51.8	0.1	57.9	1.7	0.0
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(95%),veh/ln	11.8	0.0	0.0	3.7	0.0	6.9	0.8	92.8	2.1	9.0	22.4	1.1
LnGrp Delay(d),s/veh	50.9	0.0	0.0	37.4	0.0	39.0	12.3	74.8	9.8	87.6	17.0	9.5
LnGrp LOS	D			D		D	B	F	A	F	B	A
Approach Vol, veh/h		223			214			1342			887	
Approach Delay, s/veh		50.9			38.5			68.9			25.1	
Approach LOS		D			D			E			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.0	75.4		30.6	8.9	75.5		30.6				
Change Period (Y+Rc), s	5.5	6.5		* 5.6	5.5	6.5		5.6				
Max Green Setting (Gmax), s	3.5	68.9		* 30	5.1	67.3		30.0				
Max Q Clear Time (g_c+I1), s	4.8	70.9		24.0	2.9	32.0		10.4				
Green Ext Time (p_c), s	0.0	0.0		1.0	0.0	29.8		1.8				
Intersection Summary												
HCM 2010 Ctrl Delay			50.4									
HCM 2010 LOS			D									
Notes												

Timings
10: SR 9 & 32nd St

Costco Lake Stevens
Timing Plan: PM



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↖	↗	↗	↖	↗	↗
Traffic Volume (vph)	129	25	55	20	35	1195	85	105	720	44
Future Volume (vph)	129	25	55	20	35	1195	85	105	720	44
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2		1	6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	7	4	3	8	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	3.0	5.0	3.0	5.0	10.0	10.0	3.0	10.0	10.0
Minimum Split (s)	9.5	8.5	9.5	35.6	10.5	35.5	35.5	8.5	32.5	32.5
Total Split (s)	9.5	35.3	9.8	35.6	10.6	94.9	94.9	10.0	94.3	94.3
Total Split (%)	6.3%	23.5%	6.5%	23.7%	7.1%	63.3%	63.3%	6.7%	62.9%	62.9%
Yellow Time (s)	3.5	3.5	3.5	3.6	3.5	5.0	5.0	3.5	5.0	5.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	1.5	1.5	2.0	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	5.5	4.5	5.6	5.5	6.5	6.5	5.5	6.5	6.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Min	None	Min	Min
Act Effect Green (s)	15.0	10.0	14.6	8.2	94.5	88.4	88.4	94.6	90.0	90.0
Actuated g/C Ratio	0.12	0.08	0.11	0.06	0.74	0.69	0.69	0.74	0.70	0.70
v/c Ratio	1.02	0.47	0.33	0.71	0.08	0.94	0.08	0.90	0.56	0.04
Control Delay	137.5	29.3	53.5	32.9	4.3	33.4	1.5	84.4	12.5	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	137.5	29.3	53.5	32.9	4.3	33.4	1.5	84.4	12.5	0.1
LOS	F	C	D	C	A	C	A	F	B	A
Approach Delay		93.3		38.3		30.5			20.6	
Approach LOS		F		D		C			C	

Intersection Summary























Cycle Length: 150
 Actuated Cycle Length: 128.3
 Natural Cycle: 150
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 1.02
 Intersection Signal Delay: 33.1
 Intersection LOS: C
 Intersection Capacity Utilization 103.7%
 ICU Level of Service G
 Analysis Period (min) 15

Splits and Phases: 10: SR 9 & 32nd St

↖ Ø1	↗ Ø2	↖ Ø3	↗ Ø4
10.6 s	94.9 s	9.8 s	35.3 s
↖ Ø5	↗ Ø6	↖ Ø7	↗ Ø8
10.6 s	94.3 s	9.5 s	35.6 s

HCM 2010 Signalized Intersection Summary
10: SR 9 & 32nd St

Costco Lake Stevens
Timing Plan: PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	129	25	60	55	20	135	35	1195	85	105	720	44
Future Volume (veh/h)	129	25	60	55	20	135	35	1195	85	105	720	44
Number	7	4	14	3	8	18	5	2	12	1	6	16
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
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1881	1881	1881	1863	1863	1863
Adj Flow Rate, veh/h	132	26	65	56	20	138	36	1219	87	107	735	45
Adj No. of Lanes	1	1	0	1	1	0	1	1	1	1	1	1
Peak Hour Factor	0.98	0.98	0.92	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	0	0	0	0	0	0	1	1	1	2	2	2
Cap, veh/h	148	56	140	207	24	167	404	1225	1041	115	1223	1040
Arrive On Green	0.04	0.12	0.12	0.04	0.12	0.12	0.03	0.65	0.65	0.03	0.66	0.66
Sat Flow, veh/h	1810	482	1205	1810	208	1438	1792	1881	1599	1774	1863	1583
Grp Volume(v), veh/h	132	0	91	56	0	158	36	1219	87	107	735	45
Grp Sat Flow(s),veh/h/ln	1810	0	1687	1810	0	1646	1792	1881	1599	1774	1863	1583
Q Serve(g_s), s	5.0	0.0	6.8	3.7	0.0	12.7	0.9	87.3	2.7	3.8	30.4	1.4
Cycle Q Clear(g_c), s	5.0	0.0	6.8	3.7	0.0	12.7	0.9	87.3	2.7	3.8	30.4	1.4
Prop In Lane	1.00		0.71	1.00		0.87	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	148	0	196	207	0	192	404	1225	1041	115	1223	1040
V/C Ratio(X)	0.89	0.00	0.46	0.27	0.00	0.83	0.09	1.00	0.08	0.93	0.60	0.04
Avail Cap(c_a), veh/h	148	0	370	211	0	364	422	1225	1041	115	1223	1040
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	58.3	0.0	56.0	50.4	0.0	58.6	10.6	23.5	8.7	41.6	13.2	8.2
Incr Delay (d2), s/veh	44.3	0.0	1.3	0.7	0.0	6.6	0.1	24.6	0.1	61.1	1.1	0.0
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(95%),veh/ln	7.6	0.0	5.9	3.4	0.0	10.2	0.8	65.0	2.2	9.9	22.4	1.1
LnGrp Delay(d),s/veh	102.6	0.0	57.3	51.1	0.0	65.2	10.6	48.1	8.8	102.7	14.3	8.3
LnGrp LOS	F		E	D		E	B	D	A	F	B	A
Approach Vol, veh/h		223			214			1342			887	
Approach Delay, s/veh		84.1			61.5			44.5			24.7	
Approach LOS		F			E			D			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	10.0	94.9	9.5	21.4	9.2	95.7	9.5	21.4				
Change Period (Y+Rc), s	5.5	6.5	4.5	* 5.6	5.5	6.5	4.5	5.6				
Max Green Setting (Gmax), s	4.5	88.4	5.3	* 30	5.1	87.8	5.0	30.0				
Max Q Clear Time (g_c+I1), s	5.8	89.3	5.7	8.8	2.9	32.4	7.0	14.7				
Green Ext Time (p_c), s	0.0	0.0	0.0	1.2	0.0	43.2	0.0	1.1				
Intersection Summary												
HCM 2010 Ctrl Delay			42.6									
HCM 2010 LOS			D									
Notes												