

MEMORANDUM

Date: October 10, 2019 Project #: 23147

To: Dayna Webb, P.E. and John Lewis, P.E.
City of Oregon City

From: Fred Wismer, P.E., Kristine Connolly, P.E., and Hermanus Steyn, P.E.

Project: Molalla Avenue Streetscape Project

Subject: September Transportation Advisory Committee (TAC) Meeting Follow-up

The purpose of this memorandum is to provide follow-up information to questions posed to the Molalla Avenue Streetscape Project (Project) design team regarding the traffic design and modeling at the intersection of Molalla Avenue and Beavercreek Road (Subject Intersection) on September 17th, 2019. Below is a summary of the issues raised from the recording of the Transportation Advisory Committee (TAC) meeting, as well as are our responses to the issues and additional analysis.

Traffic Design Issues

Mr. Ray Atkinson (Committee Member)

- 1) Is there potential to add an exclusive pedestrian phase to the traffic signal at the Intersection?

Mr. Mike Ard, P.E., representing Craig Danielson (Business Owner)

- 2) Expressed concern regarding the collected pedestrian volumes since the counts were conducted in November when the weather is darker and generally worse. This is a concern due to the fact that the Project is intended to improve pedestrian and bicycle facilities which should lead to increased pedestrian volumes. Therefore, he would like to see the effects of increased pedestrian volumes on the 2040 traffic operations at the Subject Intersection, especially the effect on southbound traffic with drivers having to wait for crossing pedestrians.
- 3) Requested an “apples to apples” comparison of the signal operations for the 2040 no-build and build conditions since the two were using different signal cycle lengths.
- 4) Expressed concern with the introduction of the southbound left-turn trap lane at the Subject Intersection and that it will trap drivers that are not paying attention and could therefore lead to an increase in side swipe crashes at the intersection, especially since there is a documented history of side swipes already.

Mr. William Gifford (Resident)

- 5) Expressed concerns that the southbound dual lefts will not reduce traffic volumes on Molalla Avenue since vehicles travelling the corridor are using the road to access the shopping centers, Post Office, and other destinations along the corridor.
- 6) Suggested that we drop one of the northbound through lanes at the Intersection and shift all the lanes on the north leg over to add a dedicated right-turn lane for southbound traffic on Molalla Avenue turning westbound on Beavercreek Road.

Responses to Traffic Issues

1) Potential exclusive pedestrian phase at the Subject Intersection

Since the future 2040 signal operations is operating at the maximum allowable volume-to-capacity (v/c) ratio of 0.99 it is infeasible to reduce the vehicle throughput for an exclusive pedestrian phase without causing the intersection to exceed a v/c of 0.99. Therefore, with this intersection configuration it is not possible to add an exclusive pedestrian phase.

2) Increased pedestrian volumes through the Intersection

Table 1 below provides a summary of the pedestrian volume analysis for the pedestrian crossing across the west leg of the Subject Intersection. The values below represent the resulting level of service and delay in seconds, respectively.

Table 1 - Pedestrian Volume Analysis

	Existing Pedestrians Crossing West Leg	No pedestrian volume growth		Pedestrian volumes doubled		Zero Pedestrians	
		Overall Intersection	SBTR Only	Overall Intersection	SBTR Only	Overall Intersection	SBTR Only
2040 Midday Peak Hour	20	D/51.6	E/58.7	D/51.8	E/63.3	D/51.6	E/56.2
2040 PM Peak Hour	24	E/56.3	E/67.6	E/56.4	E/67.9	E/56.1	E/66.6

SBTR = southbound thru-right lane

Based on the results of the analysis, increasing the pedestrian volume has a negligible effect on the intersection operations. The analysis assumes that a pedestrian actuates the pedestrian phase with

almost every cycle of the traffic signal due to the long cycle length and existing relative high pedestrian volumes. Refer to **Attachment A** for the full analysis results.

3) Signal Cycle Length Comparison

Table 2 contains the results for the comparison of traffic signal cycle lengths in 2040 using 140 seconds for the no-build and build scenarios. The 140-second cycle length was suggested by the software (Synchro) when using the Optimize Phasing function. Additionally, we would like to note that while the overall intersection delay increases with the build scenario the congestion along the Molalla Avenue corridor is reduced – improved operations at intersections between Beaver Creek Road and Highway 213. The values below represent the resulting level-of-service (LOS) and delay in seconds, respectively.

Table 2 - Traffic Signal Cycle Length Comparison

Cycle Length	No Build – 100/110 sec.	No Build – 140 sec.	Build – 140 sec.
2040 Midday Peak Hour	D/37.0	D/41.5	D/51.6
2040 PM Peak Hour	D/45.6	D/45.2	E/56.3

4) Increase in side-swipe crashes

We understand that under normal circumstances when a trap lane is introduced along a multi-lane facility, vehicles will be trapped if the drivers are not paying attention. However, to reduce this potential confusion, our design proposes to start the trap lane at the start of the existing two southbound lane, beyond Warner Milne Road, approximately 1,500 feet prior to the Subject Intersection. In addition, signs and pavement markings will be installed to guide drivers into the appropriate lane to reduce weaving as they approach the Intersection. Therefore, with these proposed countermeasures and the removal of the flashing yellow arrow traffic signal head for southbound and northbound traffic, we do not anticipate an increase in side-swipe crashes.

5) Dual lefts will not reduce traffic along Molalla Avenue

Upon reviewing the existing (2018) and forecast (2040) traffic volumes along the Molalla Avenue corridor, the design team noticed a high volume of southbound through vehicles at each intersection and a high southbound right-turn at the Highway 213/Molalla Avenue intersection, as shown in **Table 3**. Based on the traffic count data, 480 vehicles turned right from Molalla Avenue to Highway 213 and only 77 vehicles entered Clackamas County College with a comparatively small portion of vehicles entering the Molalla Avenue along the corridor from the residential side streets (148 vehicles). Therefore, based on these volumes, the design team concluded that a high volume of traffic travelling along the corridor must be cutting through from Beaver Creek Road to Highway 213, and proposed to install southbound dual left-turn lanes at the Subject Intersection to reduce cut through traffic along the corridor to create a safer pedestrian and bicyclist environment.

Table 3 - 2018 PM Peak Hour Traffic Volumes*

Beavercreek	Clairmont	Gaffney	Fir	Garden Meadow	Char Diaz	Highway 213
LOS=C Del=28.2 VIC=0.73	LOS=B Del=12.5 VIC=0.60	LOS=B Del=17.3 VIC=0.60	CM=WBL LOS=C Del=20.1 VIC=0.33	CM=LBL LOS=C Del=15.8 VIC=0.07	CM=WBL LOS=C Del=16.9 VIC=0.01	LOS=D Del=37.9 VIC=0.75

* - North is to the left for all bubbles in **Table 3**.

6) Remove second northbound lane and install a right-turn lane at the Intersection

Upon further analysis and review of the 2040 intersection operations it has been determined that the second northbound through lane at the Intersection is required to meet operation standards. Additionally, the addition of a dedicated southbound right-turn lane does not significantly reduce delay travel times for the overall intersection or southbound vehicles. **Table 4** summarizes the results of the following lane configurations for Molalla Avenue.

Scenario 1: one southbound through-right lane (SBTR), dual southbound and northbound left-turn lanes, and two northbound lanes (NBTR)

Scenario 2: one southbound right turn lane (SBR), one southbound through lane (SBT), dual southbound and northbound left-turn lanes, and two northbound lanes (NBTR)

Scenario 3: one southbound right-turn lane (SBR), one southbound through lane (SBT), dual southbound and northbound left-turn lanes, and one northbound through-right turn lane (NBTR)

The values below represent the resulting level-of-service and delay in seconds, respectively.

Table 4 - Alternative Lane Configurations

	Scenario 1			Scenario 2			
	Overall	NBTR	SBTR	Overall	NBTR	SBT	SBR
2040 Midday Peak Hour	D/51.6	D/46.4	E/58.7	D/47.9	D/44.8	D/44.5	B/16.0
2040 PM Peak Hour	E/56.3	C/34.6	E/67.6	D/53.5	D/35.1	E/56.1	B/19.3

	Scenario 3			
	Overall	NBTR	SBT	SBR
2040 Midday Peak Hour	E/59.2	F/91.7	D/44.5	B/16.0
2040 PM Peak Hour	E/59.9	E/76.4	D/54.4	B/19.0

Based upon the additional analysis the second northbound travel lane should not be removed as it would cause the lane to exceed its level-of-service performance threshold. Furthermore, the addition of a dedicated southbound right-turn lane does not add significant benefit to the intersection as it only reduces the overall intersection delay by approximately 2.8 seconds and in the southbound direction by approximately 11.5 seconds. These small delay reductions do not seem appropriate to justify spending public funds to add the southbound right-turn lane as a future City Capital Improvement Project unless some future unknown need requires the lane.

Attachment A – Traffic Analysis Results

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

No pedestrian growth

06/13/2019

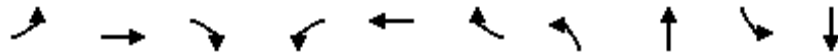
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	505	322	114	486	391	330	709	87	475	770	75
Future Volume (vph)	76	505	322	114	486	391	330	709	87	475	770	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1803	3539	1529	1784	3539	1534	3400	3457		3433	1851	
Flt Permitted	0.20	1.00	1.00	0.22	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	377	3539	1529	411	3539	1534	3400	3457		3433	1851	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	78	521	332	118	501	403	340	731	90	490	794	77
RTOR Reduction (vph)	0	0	72	0	0	58	0	7	0	0	2	0
Lane Group Flow (vph)	78	521	260	118	501	345	340	814	0	490	869	0
Confl. Peds. (#/hr)	13		10	10		13	20		10	10		20
Confl. Bikes (#/hr)						1						2
Heavy Vehicles (%)	0%	2%	3%	1%	2%	4%	3%	2%	6%	2%	1%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	3	8	1	7	4	5	1	6		5	2	
Permitted Phases	8		8	4		4						
Actuated Green, G (s)	33.0	26.3	44.4	30.2	24.9	65.8	18.1	45.0		40.9	67.8	
Effective Green, g (s)	33.0	26.3	44.4	30.2	24.9	65.8	18.1	45.0		40.9	67.8	
Actuated g/C Ratio	0.24	0.19	0.32	0.22	0.18	0.47	0.13	0.32		0.29	0.48	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	
Lane Grp Cap (vph)	157	664	550	140	629	720	439	1111		1002	896	
v/s Ratio Prot	0.02	0.15	0.06	c0.03	0.14	0.14	0.10	c0.24		0.14	c0.47	
v/s Ratio Perm	0.09		0.11	c0.15		0.09						
v/c Ratio	0.50	0.78	0.47	0.84	0.80	0.48	0.77	0.73		0.49	0.97	
Uniform Delay, d1	43.6	54.2	38.4	51.0	55.1	25.4	59.0	42.2		40.9	35.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.4	5.8	0.4	33.8	6.7	0.3	7.8	4.3		0.2	23.6	
Delay (s)	45.1	60.0	38.8	84.7	61.8	25.7	66.8	46.4		41.1	58.7	
Level of Service	D	E	D	F	E	C	E	D		D	E	
Approach Delay (s)		51.2			50.2			52.4			52.4	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			51.6				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			22.5		
Intersection Capacity Utilization			97.1%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

No pedestrian growth

06/13/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	78	521	332	118	501	403	340	821	490	871
v/c Ratio	0.48	0.78	0.60	0.82	0.80	0.52	0.77	0.73	0.49	0.97
Control Delay	48.4	62.6	27.5	82.4	64.8	14.8	71.3	45.8	44.4	59.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.4	62.6	27.5	82.4	64.8	14.8	71.3	45.8	44.4	59.3
Queue Length 50th (ft)	55	240	161	85	233	133	156	346	189	757
Queue Length 95th (ft)	94	294	236	#165	286	226	207	400	271	#1148
Internal Link Dist (ft)		681			472			129		786
Turn Bay Length (ft)	100		200	200		350	180		350	
Base Capacity (vph)	163	783	587	144	743	779	510	1321	1002	898
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.67	0.57	0.82	0.67	0.52	0.67	0.62	0.49	0.97

Intersection Summary

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

No pedestrian growth

06/13/2019

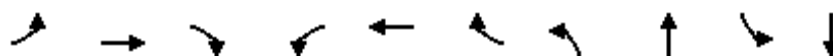
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	614	318	126	498	403	311	559	102	587	740	42
Future Volume (vph)	52	614	318	126	498	403	311	559	102	587	740	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1803	3574	1553	1752	3539	1566	3335	3468		3433	1845	
Flt Permitted	0.30	1.00	1.00	0.13	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	570	3574	1553	231	3539	1566	3335	3468		3433	1845	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	55	653	338	134	530	429	331	595	109	624	787	45
RTOR Reduction (vph)	0	0	71	0	0	95	0	10	0	0	2	0
Lane Group Flow (vph)	55	653	267	134	530	334	331	694	0	624	830	0
Confl. Peds. (#/hr)	6		5	5		6	24		9	9		24
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	1%	2%	3%	2%	2%	5%	1%	3%	2%	2%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	3	8	1	7	4	5	1	6		5	2	
Permitted Phases	8		8	4		4						
Actuated Green, G (s)	31.4	27.4	45.5	40.4	31.9	59.7	18.1	53.8		27.8	63.5	
Effective Green, g (s)	31.4	27.4	45.5	40.4	31.9	59.7	18.1	53.8		27.8	63.5	
Actuated g/C Ratio	0.22	0.20	0.32	0.29	0.23	0.43	0.13	0.38		0.20	0.45	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	
Lane Grp Cap (vph)	163	699	571	159	806	734	431	1332		681	836	
v/s Ratio Prot	0.01	c0.18	0.06	c0.05	0.15	0.09	0.10	0.20		c0.18	c0.45	
v/s Ratio Perm	0.07		0.11	0.19		0.12						
v/c Ratio	0.34	0.93	0.47	0.84	0.66	0.46	0.77	0.52		0.92	0.99	
Uniform Delay, d1	43.8	55.4	37.6	40.9	49.1	28.6	58.9	33.2		55.0	38.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	19.6	0.4	30.7	1.7	0.3	7.5	1.5		16.9	29.5	
Delay (s)	44.5	75.0	38.0	71.6	50.8	28.8	66.4	34.6		71.9	67.6	
Level of Service	D	E	D	E	D	C	E	C		E	E	
Approach Delay (s)		61.4			44.7			44.8			69.4	
Approach LOS		E			D			D			E	
Intersection Summary												
HCM 2000 Control Delay			56.3				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			0.99									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			22.5		
Intersection Capacity Utilization			94.5%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

No pedestrian growth

06/13/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	55	653	338	134	530	429	331	704	624	832
v/c Ratio	0.31	0.97	0.60	0.85	0.66	0.56	0.77	0.52	0.91	0.98
Control Delay	41.7	83.2	28.4	80.5	54.2	18.8	71.0	33.6	73.8	63.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.7	83.2	28.4	80.5	54.2	18.8	71.0	33.6	73.8	63.5
Queue Length 50th (ft)	37	314	165	94	236	164	152	253	286	734
Queue Length 95th (ft)	72	#438	254	#193	302	264	201	315	#382	#1067
Internal Link Dist (ft)		681			472			129		786
Turn Bay Length (ft)	100		200	200		350	180		350	
Base Capacity (vph)	178	676	602	158	806	774	512	1365	711	850
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.97	0.56	0.85	0.66	0.55	0.65	0.52	0.88	0.98

Intersection Summary

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

Doubled pedestrian vol.

10/03/2019

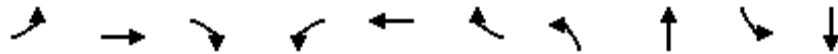
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	505	322	114	486	391	330	709	87	475	770	75
Future Volume (vph)	76	505	322	114	486	391	330	709	87	475	770	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.98	1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1801	3539	1507	1781	3539	1522	3400	3453		3433	1847	
Flt Permitted	0.21	1.00	1.00	0.23	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	400	3539	1507	434	3539	1522	3400	3453		3433	1847	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	78	521	332	118	501	403	340	731	90	490	794	77
RTOR Reduction (vph)	0	0	71	0	0	56	0	8	0	0	2	0
Lane Group Flow (vph)	78	521	261	118	501	347	340	813	0	490	869	0
Confl. Peds. (#/hr)	26		20	20		26	40		20	20		40
Confl. Bikes (#/hr)						1						2
Heavy Vehicles (%)	0%	2%	3%	1%	2%	4%	3%	2%	6%	2%	1%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	3	8	1	7	4	5	1	6		5	2	
Permitted Phases	8		8	4		4						
Actuated Green, G (s)	34.0	27.3	45.4	31.2	25.9	66.4	18.1	44.4		40.5	66.8	
Effective Green, g (s)	34.0	27.3	45.4	31.2	25.9	66.4	18.1	44.4		40.5	66.8	
Actuated g/C Ratio	0.24	0.20	0.32	0.22	0.18	0.47	0.13	0.32		0.29	0.48	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	
Lane Grp Cap (vph)	164	690	553	147	654	721	439	1095		993	881	
v/s Ratio Prot	0.02	0.15	0.06	c0.03	0.14	0.14	0.10	c0.24		0.14	c0.47	
v/s Ratio Perm	0.09		0.11	c0.15		0.09						
v/c Ratio	0.48	0.76	0.47	0.80	0.77	0.48	0.77	0.74		0.49	0.99	
Uniform Delay, d1	42.8	53.2	37.7	50.0	54.2	25.1	59.0	42.7		41.2	36.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	4.5	0.4	25.3	5.1	0.3	7.8	4.6		0.2	27.2	
Delay (s)	44.1	57.7	38.1	75.2	59.3	25.4	66.8	47.3		41.5	63.3	
Level of Service	D	E	D	E	E	C	E	D		D	E	
Approach Delay (s)		49.6			47.8			53.0			55.5	
Approach LOS		D			D			D			E	
Intersection Summary												
HCM 2000 Control Delay			51.8				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			22.5		
Intersection Capacity Utilization			99.6%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

Doubled pedestrian vol.

10/03/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	78	521	332	118	501	403	340	821	490	871
v/c Ratio	0.46	0.76	0.59	0.79	0.77	0.52	0.77	0.74	0.49	0.99
Control Delay	46.5	60.3	27.1	75.7	62.2	14.8	71.3	46.6	44.8	63.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.5	60.3	27.1	75.7	62.2	14.8	71.3	46.6	44.8	63.7
Queue Length 50th (ft)	52	230	151	81	223	127	156	357	193	~862
Queue Length 95th (ft)	94	294	236	#160	286	229	207	400	271	#1150
Internal Link Dist (ft)		681			472			129		786
Turn Bay Length (ft)	100		200	200		350	180		350	
Base Capacity (vph)	170	783	590	150	743	776	510	1319	991	883
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.67	0.56	0.79	0.67	0.52	0.67	0.62	0.49	0.99

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

Doubled pedestrian vol.

10/03/2019

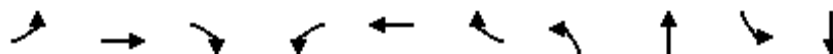
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	614	318	126	498	403	311	559	102	587	740	42
Future Volume (vph)	52	614	318	126	498	403	311	559	102	587	740	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1802	3574	1542	1752	3539	1558	3335	3463		3433	1842	
Flt Permitted	0.30	1.00	1.00	0.13	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	569	3574	1542	231	3539	1558	3335	3463		3433	1842	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	55	653	338	134	530	429	331	595	109	624	787	45
RTOR Reduction (vph)	0	0	71	0	0	91	0	10	0	0	2	0
Lane Group Flow (vph)	55	653	267	134	530	338	331	694	0	624	830	0
Confl. Peds. (#/hr)	12		10	10		12	48		18	18		48
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	1%	2%	3%	2%	2%	5%	1%	3%	2%	2%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	3	8	1	7	4	5	1	6		5	2	
Permitted Phases	8		8	4		4						
Actuated Green, G (s)	31.4	27.4	45.5	40.4	31.9	59.7	18.1	53.8		27.8	63.5	
Effective Green, g (s)	31.4	27.4	45.5	40.4	31.9	59.7	18.1	53.8		27.8	63.5	
Actuated g/C Ratio	0.22	0.20	0.32	0.29	0.23	0.43	0.13	0.38		0.20	0.45	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	
Lane Grp Cap (vph)	162	699	567	159	806	731	431	1330		681	835	
v/s Ratio Prot	0.01	c0.18	0.06	c0.05	0.15	0.09	0.10	0.20		c0.18	c0.45	
v/s Ratio Perm	0.07		0.11	0.19		0.13						
v/c Ratio	0.34	0.93	0.47	0.84	0.66	0.46	0.77	0.52		0.92	0.99	
Uniform Delay, d1	43.8	55.4	37.7	40.9	49.1	28.7	58.9	33.2		55.0	38.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	19.6	0.4	30.7	1.7	0.3	7.5	1.5		16.9	29.8	
Delay (s)	44.5	75.0	38.0	71.6	50.8	29.0	66.4	34.7		71.9	67.9	
Level of Service	D	E	D	E	D	C	E	C		E	E	
Approach Delay (s)		61.4			44.8			44.8			69.6	
Approach LOS		E			D			D			E	
Intersection Summary												
HCM 2000 Control Delay			56.4				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			0.99									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			22.5		
Intersection Capacity Utilization			95.8%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

Doubled pedestrian vol.

10/03/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	55	653	338	134	530	429	331	704	624	832
v/c Ratio	0.31	0.97	0.60	0.85	0.66	0.57	0.77	0.52	0.91	0.98
Control Delay	41.8	83.2	28.5	81.3	54.2	19.5	71.0	33.6	73.8	63.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.8	83.2	28.5	81.3	54.2	19.5	71.0	33.6	73.8	63.9
Queue Length 50th (ft)	37	314	165	94	236	169	152	253	286	735
Queue Length 95th (ft)	72	#438	254	#193	302	270	201	315	#382	#1068
Internal Link Dist (ft)		681			472			129		786
Turn Bay Length (ft)	100		200	200		350	180		350	
Base Capacity (vph)	177	676	598	157	806	767	512	1362	711	848
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.97	0.57	0.85	0.66	0.56	0.65	0.52	0.88	0.98

Intersection Summary

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

Zero pedestrian volume

10/03/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	505	322	114	486	391	330	709	87	475	770	75
Future Volume (vph)	76	505	322	114	486	391	330	709	87	475	770	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3539	1568	1787	3539	1546	3400	3466		3433	1856	
Flt Permitted	0.19	1.00	1.00	0.21	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	364	3539	1568	399	3539	1546	3400	3466		3433	1856	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	78	521	332	118	501	403	340	731	90	490	794	77
RTOR Reduction (vph)	0	0	72	0	0	61	0	7	0	0	2	0
Lane Group Flow (vph)	78	521	260	118	501	342	340	814	0	490	869	0
Confl. Bikes (#/hr)						1						2
Heavy Vehicles (%)	0%	2%	3%	1%	2%	4%	3%	2%	6%	2%	1%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	3	8	1	7	4	5	1	6		5	2	
Permitted Phases	8		8	4		4						
Actuated Green, G (s)	32.5	25.8	43.9	29.7	24.4	65.6	18.1	45.2		41.2	68.3	
Effective Green, g (s)	32.5	25.8	43.9	29.7	24.4	65.6	18.1	45.2		41.2	68.3	
Actuated g/C Ratio	0.23	0.18	0.31	0.21	0.17	0.47	0.13	0.32		0.29	0.49	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	
Lane Grp Cap (vph)	153	652	558	137	616	724	439	1119		1010	905	
v/s Ratio Prot	0.02	0.15	0.06	c0.03	0.14	0.14	0.10	c0.23		0.14	c0.47	
v/s Ratio Perm	0.09		0.11	c0.15		0.08						
v/c Ratio	0.51	0.80	0.47	0.86	0.81	0.47	0.77	0.73		0.49	0.96	
Uniform Delay, d1	44.0	54.6	38.6	51.5	55.6	25.4	59.0	41.9		40.7	34.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	6.6	0.4	38.4	7.9	0.3	7.8	4.1		0.2	21.7	
Delay (s)	45.6	61.2	39.0	89.9	63.5	25.7	66.8	46.1		40.9	56.2	
Level of Service	D	E	D	F	E	C	E	D		D	E	
Approach Delay (s)		52.0			51.6			52.2			50.7	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			51.6			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			140.0			Sum of lost time (s)				22.5		
Intersection Capacity Utilization			93.5%			ICU Level of Service				F		
Analysis Period (min)			15									

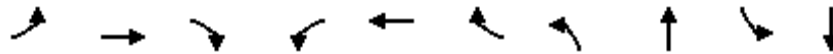
c Critical Lane Group

Queues

1: Molalla Ave & S Beavercreek Rd

Zero pedestrian volume

10/03/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	78	521	332	118	501	403	340	821	490	871
v/c Ratio	0.49	0.80	0.53	0.84	0.81	0.51	0.77	0.73	0.49	0.96
Control Delay	49.4	64.0	26.0	86.4	66.5	14.6	71.3	45.5	44.1	57.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.4	64.0	26.0	86.4	66.5	14.6	71.3	45.5	44.1	57.1
Queue Length 50th (ft)	55	240	161	85	233	130	156	347	189	756
Queue Length 95th (ft)	94	294	236	#167	286	223	207	401	271	#1146
Internal Link Dist (ft)		681			472			129		786
Turn Bay Length (ft)	100		200	200		350	180		350	
Base Capacity (vph)	160	783	657	141	743	784	510	1324	1009	907
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.67	0.51	0.84	0.67	0.51	0.67	0.62	0.49	0.96

Intersection Summary

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

Zero pedestrian volume

10/03/2019

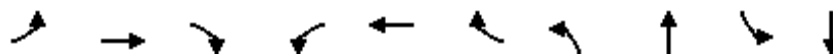
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 		 	 		 		
Traffic Volume (vph)	52	614	318	126	498	403	311	559	102	587	740	42
Future Volume (vph)	52	614	318	126	498	403	311	559	102	587	740	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3574	1563	1752	3539	1583	3335	3481		3433	1850	
Flt Permitted	0.30	1.00	1.00	0.13	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	570	3574	1563	231	3539	1583	3335	3481		3433	1850	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	55	653	338	134	530	429	331	595	109	624	787	45
RTOR Reduction (vph)	0	0	71	0	0	100	0	10	0	0	2	0
Lane Group Flow (vph)	55	653	267	134	530	329	331	694	0	624	830	0
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	1%	2%	3%	2%	2%	5%	1%	3%	2%	2%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	3	8	1	7	4	5	1	6		5	2	
Permitted Phases	8		8	4		4						
Actuated Green, G (s)	31.4	27.4	45.5	40.4	31.9	59.7	18.1	53.8		27.8	63.5	
Effective Green, g (s)	31.4	27.4	45.5	40.4	31.9	59.7	18.1	53.8		27.8	63.5	
Actuated g/C Ratio	0.22	0.20	0.32	0.29	0.23	0.43	0.13	0.38		0.20	0.45	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	
Lane Grp Cap (vph)	163	699	574	159	806	742	431	1337		681	839	
v/s Ratio Prot	0.01	c0.18	0.06	c0.05	0.15	0.09	0.10	0.20		c0.18	c0.45	
v/s Ratio Perm	0.07		0.11	0.19		0.12						
v/c Ratio	0.34	0.93	0.47	0.84	0.66	0.44	0.77	0.52		0.92	0.99	
Uniform Delay, d1	43.8	55.4	37.6	40.9	49.1	28.4	58.9	33.1		55.0	37.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	19.6	0.3	30.7	1.7	0.2	7.5	1.4		16.9	28.7	
Delay (s)	44.5	75.0	37.9	71.6	50.8	28.6	66.4	34.6		71.9	66.6	
Level of Service	D	E	D	E	D	C	E	C		E	E	
Approach Delay (s)		61.4			44.7			44.8			68.9	
Approach LOS		E			D			D			E	
Intersection Summary												
HCM 2000 Control Delay			56.1				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			22.5		
Intersection Capacity Utilization			93.1%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

Zero pedestrian volume

10/03/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	55	653	338	134	530	429	331	704	624	832
v/c Ratio	0.31	0.97	0.59	0.85	0.66	0.51	0.77	0.51	0.91	0.98
Control Delay	41.7	83.2	28.2	80.5	54.2	17.3	71.0	33.6	73.8	62.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.7	83.2	28.2	80.5	54.2	17.3	71.0	33.6	73.8	62.9
Queue Length 50th (ft)	37	314	165	94	236	158	152	252	286	732
Queue Length 95th (ft)	72	#438	254	#193	302	257	201	315	#382	#1065
Internal Link Dist (ft)		681			472			129		786
Turn Bay Length (ft)	100		200	200		350	180		350	
Base Capacity (vph)	178	676	605	158	806	847	512	1369	711	852
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.97	0.56	0.85	0.66	0.51	0.65	0.51	0.88	0.98

Intersection Summary

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

original cycle length

06/14/2019

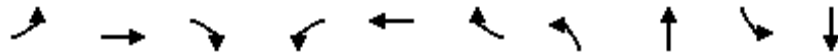
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	462	365	114	559	318	365	674	87	384	861	75
Future Volume (vph)	76	462	365	114	559	318	365	674	87	384	861	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1803	3539	1551	1785	3539	1530	1752	3455		1769	3525	
Flt Permitted	0.24	1.00	1.00	0.26	1.00	1.00	0.12	1.00		0.23	1.00	
Satd. Flow (perm)	458	3539	1551	493	3539	1530	214	3455		426	3525	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	78	476	376	118	576	328	376	695	90	396	888	77
RTOR Reduction (vph)	0	0	68	0	0	111	0	10	0	0	7	0
Lane Group Flow (vph)	78	476	308	118	576	217	376	775	0	396	958	0
Confl. Peds. (#/hr)	13		10	10		13	20		10	10		20
Confl. Bikes (#/hr)						1						2
Heavy Vehicles (%)	0%	2%	3%	1%	2%	4%	3%	2%	6%	2%	1%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA		pm+pt	NA	
Protected Phases	3	8	1	7	4	5	1	6		5	2	
Permitted Phases	8		8	4		4	6			2		
Actuated Green, G (s)	24.9	18.3	36.6	28.9	20.3	36.5	52.7	34.4		48.5	32.3	
Effective Green, g (s)	24.9	18.3	36.6	28.9	20.3	36.5	52.7	34.4		48.5	32.3	
Actuated g/C Ratio	0.25	0.18	0.37	0.29	0.20	0.36	0.53	0.34		0.48	0.32	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	
Lane Grp Cap (vph)	202	647	660	253	718	650	394	1188		424	1138	
v/s Ratio Prot	0.03	0.13	0.09	c0.04	c0.16	0.05	c0.17	0.22		0.15	0.27	
v/s Ratio Perm	0.07		0.11	0.09		0.09	c0.33			0.30		
v/c Ratio	0.39	0.74	0.47	0.47	0.80	0.33	0.95	0.65		0.93	0.84	
Uniform Delay, d1	29.8	38.6	24.2	27.6	37.9	23.0	28.2	27.7		18.7	31.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.92		1.00	1.00	
Incremental Delay, d2	0.7	4.1	0.3	0.8	6.3	0.2	27.2	2.0		27.5	7.6	
Delay (s)	30.6	42.7	24.5	28.3	44.2	23.1	51.6	27.5		46.2	39.1	
Level of Service	C	D	C	C	D	C	D	C		D	D	
Approach Delay (s)		34.3			35.6			35.3			41.2	
Approach LOS		C			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			37.0									
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			100.0							22.5		
Intersection Capacity Utilization			92.0%							F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

original cycle length

06/14/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	78	476	376	118	576	328	376	785	396	965
v/c Ratio	0.35	0.77	0.60	0.46	0.80	0.49	0.96	0.64	0.93	0.82
Control Delay	28.0	48.6	21.4	30.5	48.3	12.8	57.4	26.4	48.3	36.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.0	48.6	21.4	30.5	48.3	12.8	57.4	26.4	48.3	36.6
Queue Length 50th (ft)	34	150	128	52	183	63	~236	240	149	283
Queue Length 95th (ft)	68	209	225	96	#290	144	m#351	m300	#341	356
Internal Link Dist (ft)		681			472			129		786
Turn Bay Length (ft)	100		200	200		350	180		350	
Base Capacity (vph)	258	649	623	267	719	669	393	1266	427	1275
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.73	0.60	0.44	0.80	0.49	0.96	0.62	0.93	0.76

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

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

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

original cycle length

06/14/2019

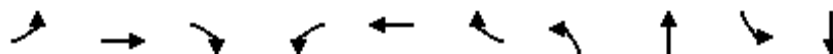
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	562	370	126	468	340	341	622	102	480	847	42
Future Volume (vph)	52	562	370	126	468	340	341	622	102	480	847	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1803	3574	1568	1752	3539	1568	1718	3479		1769	3511	
Flt Permitted	0.36	1.00	1.00	0.20	1.00	1.00	0.14	1.00		0.13	1.00	
Satd. Flow (perm)	676	3574	1568	369	3539	1568	246	3479		239	3511	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	55	598	394	134	498	362	363	662	109	511	901	45
RTOR Reduction (vph)	0	0	43	0	0	93	0	12	0	0	3	0
Lane Group Flow (vph)	55	598	351	134	498	269	363	759	0	511	943	0
Confl. Peds. (#/hr)	6		5	5		6	24		9	9		24
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	1%	2%	3%	2%	2%	5%	1%	3%	2%	2%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA		pm+pt	NA	
Protected Phases	3	8	1	7	4	5	1	6		5	2	
Permitted Phases	8		8	4		4	6			2		
Actuated Green, G (s)	30.4	24.7	46.2	34.8	26.9	52.4	50.9	29.4		58.9	33.4	
Effective Green, g (s)	30.4	24.7	46.2	34.8	26.9	52.4	50.9	29.4		58.9	33.4	
Actuated g/C Ratio	0.28	0.22	0.42	0.32	0.24	0.48	0.46	0.27		0.54	0.30	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	
Lane Grp Cap (vph)	245	802	744	216	865	832	401	929		482	1066	
v/s Ratio Prot	0.01	c0.17	0.09	c0.04	0.14	0.07	0.18	0.22		c0.25	c0.27	
v/s Ratio Perm	0.05		0.13	0.15		0.10	0.24			c0.32		
v/c Ratio	0.22	0.75	0.47	0.62	0.58	0.32	0.91	0.82		1.06	0.88	
Uniform Delay, d1	29.9	39.7	23.1	29.0	36.5	17.8	29.7	37.8		31.7	36.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	3.6	0.3	4.4	0.8	0.1	23.1	7.9		57.9	10.7	
Delay (s)	30.2	43.3	23.4	33.4	37.3	18.0	52.8	45.6		89.6	47.2	
Level of Service	C	D	C	C	D	B	D	D		F	D	
Approach Delay (s)		35.1			29.7			47.9			62.0	
Approach LOS		D			C			D			E	
Intersection Summary												
HCM 2000 Control Delay			45.6			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			110.0			Sum of lost time (s)				22.5		
Intersection Capacity Utilization			98.6%			ICU Level of Service				F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

original cycle length

06/14/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	55	598	394	134	498	362	363	771	511	946
v/c Ratio	0.21	0.77	0.57	0.62	0.58	0.43	0.90	0.79	1.05	0.86
Control Delay	25.0	47.5	20.8	38.8	39.6	10.2	57.5	42.8	87.2	44.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	47.5	20.8	38.8	39.6	10.2	57.5	42.8	87.2	44.4
Queue Length 50th (ft)	26	210	156	67	168	73	200	254	~352	320
Queue Length 95th (ft)	51	254	247	105	210	145	#456	326	#637	402
Internal Link Dist (ft)		681			472			129		786
Turn Bay Length (ft)	100		200	200		350	180		350	
Base Capacity (vph)	278	974	689	215	965	839	403	1024	485	1152
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.61	0.57	0.62	0.52	0.43	0.90	0.75	1.05	0.82

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

140 second cycle length

10/03/2019

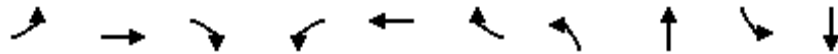
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	462	365	114	559	318	365	674	87	384	861	75
Future Volume (vph)	76	462	365	114	559	318	365	674	87	384	861	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1803	3539	1549	1785	3539	1528	1752	3453		1768	3523	
Flt Permitted	0.18	1.00	1.00	0.24	1.00	1.00	0.13	1.00		0.25	1.00	
Satd. Flow (perm)	340	3539	1549	445	3539	1528	245	3453		460	3523	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	78	476	376	118	576	328	376	695	90	396	888	77
RTOR Reduction (vph)	0	0	35	0	0	55	0	6	0	0	4	0
Lane Group Flow (vph)	78	476	341	118	576	273	376	779	0	396	961	0
Confl. Peds. (#/hr)	13		10	10		13	20		10	10		20
Confl. Bikes (#/hr)						1						2
Heavy Vehicles (%)	0%	2%	3%	1%	2%	4%	3%	2%	6%	2%	1%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA		pm+pt	NA	
Protected Phases	3	8	1	7	4	5	1	6		5	2	
Permitted Phases	8		8	4		4	6			2		
Actuated Green, G (s)	33.2	26.0	55.6	36.2	27.5	54.2	85.7	56.1		79.9	53.2	
Effective Green, g (s)	33.2	26.0	55.6	36.2	27.5	54.2	85.7	56.1		79.9	53.2	
Actuated g/C Ratio	0.24	0.19	0.40	0.26	0.20	0.39	0.61	0.40		0.57	0.38	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	
Lane Grp Cap (vph)	155	657	681	198	695	657	468	1383		511	1338	
v/s Ratio Prot	0.03	0.13	0.11	c0.04	c0.16	0.08	c0.17	0.23		0.15	0.27	
v/s Ratio Perm	0.09		0.11	0.12		0.10	c0.32			0.29		
v/c Ratio	0.50	0.72	0.50	0.60	0.83	0.42	0.80	0.56		0.77	0.72	
Uniform Delay, d1	43.5	53.6	31.8	42.0	54.0	31.3	31.4	32.5		18.9	37.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.5	3.7	0.3	3.7	7.9	0.2	9.3	1.7		6.8	3.3	
Delay (s)	45.0	57.4	32.1	45.7	61.9	31.6	40.7	34.1		25.7	40.3	
Level of Service	D	E	C	D	E	C	D	C		C	D	
Approach Delay (s)		46.1			50.3			36.3			36.1	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			41.5			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			140.0			Sum of lost time (s)				22.5		
Intersection Capacity Utilization			92.0%			ICU Level of Service				F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

140 second cycle length

10/03/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	78	476	376	118	576	328	376	785	396	965
v/c Ratio	0.49	0.72	0.58	0.58	0.83	0.51	0.81	0.57	0.77	0.72
Control Delay	46.7	59.9	26.8	50.0	64.6	21.4	42.7	36.5	27.8	42.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.7	59.9	26.8	50.0	64.6	21.4	42.7	36.5	27.8	42.0
Queue Length 50th (ft)	52	217	204	80	267	147	229	296	170	405
Queue Length 95th (ft)	92	267	271	131	324	192	368	410	277	512
Internal Link Dist (ft)		681			472			129		786
Turn Bay Length (ft)	100		200	200		350	180		350	
Base Capacity (vph)	161	783	687	203	803	744	504	1387	623	1342
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.61	0.55	0.58	0.72	0.44	0.75	0.57	0.64	0.72
Intersection Summary										

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

140 second cycle length

10/03/2019

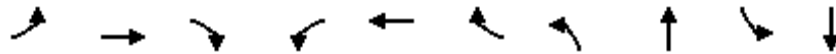
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	562	370	126	468	340	341	622	102	480	847	42
Future Volume (vph)	52	562	370	126	468	340	341	622	102	480	847	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1803	3574	1567	1752	3539	1567	1718	3478		1769	3510	
Flt Permitted	0.36	1.00	1.00	0.14	1.00	1.00	0.18	1.00		0.15	1.00	
Satd. Flow (perm)	676	3574	1567	261	3539	1567	321	3478		283	3510	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	55	598	394	134	498	362	363	662	109	511	901	45
RTOR Reduction (vph)	0	0	64	0	0	57	0	9	0	0	2	0
Lane Group Flow (vph)	55	598	330	134	498	305	363	762	0	511	944	0
Confl. Peds. (#/hr)	6		5	5		6	24		9	9		24
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	1%	2%	3%	2%	2%	5%	1%	3%	2%	2%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA		pm+pt	NA	
Protected Phases	3	8	1	7	4	5	1	6		5	2	
Permitted Phases	8		8	4		4	6			2		
Actuated Green, G (s)	33.4	28.6	54.9	43.1	33.8	69.8	69.2	42.9		84.9	52.6	
Effective Green, g (s)	33.4	28.6	54.9	43.1	33.8	69.8	69.2	42.9		84.9	52.6	
Actuated g/C Ratio	0.24	0.20	0.39	0.31	0.24	0.50	0.49	0.31		0.61	0.38	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	
Lane Grp Cap (vph)	199	730	681	186	854	848	421	1065		553	1318	
v/s Ratio Prot	0.01	c0.17	0.09	c0.05	0.14	0.09	0.16	0.22		c0.24	0.27	
v/s Ratio Perm	0.06		0.12	0.17		0.10	0.26			c0.32		
v/c Ratio	0.28	0.82	0.48	0.72	0.58	0.36	0.86	0.72		0.92	0.72	
Uniform Delay, d1	42.0	53.2	31.9	38.4	46.9	21.4	29.1	43.1		34.6	37.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	7.0	0.3	11.7	0.8	0.2	16.1	4.1		21.2	3.4	
Delay (s)	42.5	60.2	32.3	50.1	47.7	21.6	45.2	47.2		55.8	40.7	
Level of Service	D	E	C	D	D	C	D	D		E	D	
Approach Delay (s)		48.8			38.5			46.6			46.0	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			45.2									
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			140.0									
Intersection Capacity Utilization			98.6%									
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

140 second cycle length

10/03/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	55	598	394	134	498	362	363	771	511	946
v/c Ratio	0.26	0.85	0.59	0.72	0.58	0.43	0.86	0.70	0.92	0.70
Control Delay	36.4	65.8	24.6	57.7	50.1	13.8	51.5	47.1	54.3	40.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.4	65.8	24.6	57.7	50.1	13.8	51.5	47.1	54.3	40.7
Queue Length 50th (ft)	35	275	181	90	214	117	228	340	346	398
Queue Length 95th (ft)	68	340	278	#151	270	186	#406	417	#564	479
Internal Link Dist (ft)		681			472			129		786
Turn Bay Length (ft)	100		200	200		350	180		350	
Base Capacity (vph)	217	791	680	187	886	863	436	1100	581	1347
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.76	0.58	0.72	0.56	0.42	0.83	0.70	0.88	0.70

Intersection Summary

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

Scenario 2

10/09/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	505	322	114	486	391	330	709	87	475	770	75
Future Volume (vph)	76	505	322	114	486	391	330	709	87	475	770	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	4.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1803	3539	1529	1784	3539	1534	3400	3457		3433	1881	1556
Flt Permitted	0.21	1.00	1.00	0.21	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	396	3539	1529	403	3539	1534	3400	3457		3433	1881	1556
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	78	521	332	118	501	403	340	731	90	490	794	77
RTOR Reduction (vph)	0	0	72	0	0	60	0	7	0	0	0	33
Lane Group Flow (vph)	78	521	260	118	501	343	340	814	0	490	794	44
Confl. Peds. (#/hr)	13		10	10		13	20		10	10		20
Confl. Bikes (#/hr)						1						2
Heavy Vehicles (%)	0%	2%	3%	1%	2%	4%	3%	2%	6%	2%	1%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6		5	2	3
Permitted Phases	8		8	4		4						2
Actuated Green, G (s)	33.0	26.3	44.4	31.2	25.4	64.5	18.1	46.3		39.1	67.3	74.0
Effective Green, g (s)	33.0	26.3	44.4	31.2	25.4	64.5	18.1	46.3		39.1	67.3	74.0
Actuated g/C Ratio	0.24	0.19	0.32	0.22	0.18	0.46	0.13	0.33		0.28	0.48	0.53
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	4.5
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	2.3
Lane Grp Cap (vph)	160	664	550	147	642	706	439	1143		958	904	822
v/s Ratio Prot	0.02	c0.15	0.06	c0.03	0.14	0.14	0.10	c0.24		0.14	c0.42	0.00
v/s Ratio Perm	0.09		0.11	0.15		0.09						0.03
v/c Ratio	0.49	0.78	0.47	0.80	0.78	0.49	0.77	0.71		0.51	0.88	0.05
Uniform Delay, d1	43.6	54.2	38.4	49.3	54.6	26.2	59.0	41.0		42.4	32.7	16.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	5.8	0.4	25.3	5.9	0.3	7.8	3.8		0.3	11.8	0.0
Delay (s)	44.9	60.0	38.8	74.5	60.5	26.5	66.8	44.8		42.7	44.5	16.0
Level of Service	D	E	D	E	E	C	E	D		D	D	B
Approach Delay (s)		51.2			48.8			51.2			42.2	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			47.9				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			22.5		
Intersection Capacity Utilization			92.3%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

Scenario 2

10/09/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	78	521	332	118	501	403	340	821	490	794	77
v/c Ratio	0.48	0.78	0.60	0.78	0.78	0.53	0.77	0.71	0.51	0.88	0.09
Control Delay	47.7	62.7	27.5	75.8	63.4	15.1	71.3	44.5	45.6	46.2	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.7	62.7	27.5	75.8	63.4	15.1	71.3	44.5	45.6	46.2	4.5
Queue Length 50th (ft)	55	240	161	85	233	132	156	346	189	636	3
Queue Length 95th (ft)	94	294	236	#166	286	226	207	400	271	#986	29
Internal Link Dist (ft)		681			472			129		786	
Turn Bay Length (ft)	100		200	200		350	180		350		
Base Capacity (vph)	167	783	586	151	743	766	510	1321	958	903	873
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.67	0.57	0.78	0.67	0.53	0.67	0.62	0.51	0.88	0.09

Intersection Summary

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

Scenario 2

10/09/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	614	318	126	498	403	311	559	102	587	740	42
Future Volume (vph)	52	614	318	126	498	403	311	559	102	587	740	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	4.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1803	3574	1553	1752	3539	1566	3335	3468		3433	1863	1547
Flt Permitted	0.31	1.00	1.00	0.12	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	586	3574	1553	231	3539	1566	3335	3468		3433	1863	1547
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	55	653	338	134	530	429	331	595	109	624	787	45
RTOR Reduction (vph)	0	0	71	0	0	95	0	11	0	0	0	23
Lane Group Flow (vph)	55	653	267	134	530	334	331	693	0	624	787	22
Confl. Peds. (#/hr)	6		5	5		6	24		9	9		24
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	1%	2%	3%	2%	2%	5%	1%	3%	2%	2%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6		5	2	3
Permitted Phases	8		8	4		4						2
Actuated Green, G (s)	31.5	27.5	45.6	40.9	32.4	60.2	18.1	53.3		27.8	63.0	67.0
Effective Green, g (s)	31.5	27.5	45.6	40.9	32.4	60.2	18.1	53.3		27.8	63.0	67.0
Actuated g/C Ratio	0.22	0.20	0.33	0.29	0.23	0.43	0.13	0.38		0.20	0.45	0.48
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	4.5
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	2.3
Lane Grp Cap (vph)	166	702	572	164	819	740	431	1320		681	838	740
v/s Ratio Prot	0.01	c0.18	0.06	c0.05	0.15	0.09	0.10	0.20		c0.18	c0.42	0.00
v/s Ratio Perm	0.06		0.11	0.19		0.12						0.01
v/c Ratio	0.33	0.93	0.47	0.82	0.65	0.45	0.77	0.53		0.92	0.94	0.03
Uniform Delay, d1	43.7	55.3	37.5	40.5	48.6	28.2	58.9	33.6		55.0	36.7	19.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	18.9	0.4	25.2	1.6	0.3	7.5	1.5		16.9	19.4	0.0
Delay (s)	44.4	74.2	37.9	65.7	50.2	28.5	66.4	35.1		71.9	56.1	19.3
Level of Service	D	E	D	E	D	C	E	D		E	E	B
Approach Delay (s)		60.9			43.6			45.1			61.7	
Approach LOS		E			D			D			E	
Intersection Summary												
HCM 2000 Control Delay			53.5				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			22.5		
Intersection Capacity Utilization			91.9%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beaver Creek Rd

Scenario 2

10/09/2019



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	55	653	338	134	530	429	331	704	624	787	45
v/c Ratio	0.30	0.96	0.60	0.82	0.65	0.56	0.77	0.52	0.91	0.93	0.06
Control Delay	41.5	82.6	28.3	75.7	53.8	18.6	71.0	33.9	73.8	53.8	1.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.5	82.6	28.3	75.7	53.8	18.6	71.0	33.9	73.8	53.8	1.5
Queue Length 50th (ft)	37	314	165	94	236	163	152	253	286	663	0
Queue Length 95th (ft)	72	#438	254	#193	302	263	201	315	#382	#970	9
Internal Link Dist (ft)		681			472			129		786	
Turn Bay Length (ft)	100		200	200		350	180		350		
Base Capacity (vph)	182	678	603	163	818	779	512	1354	711	850	813
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.96	0.56	0.82	0.65	0.55	0.65	0.52	0.88	0.93	0.06

Intersection Summary

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

Scenario 3

10/03/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	505	322	114	486	391	330	709	87	475	770	75
Future Volume (vph)	76	505	322	114	486	391	330	709	87	475	770	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	4.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00		1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1801	3539	1529	1784	3539	1513	3400	1820		3433	1881	1556
Flt Permitted	0.21	1.00	1.00	0.21	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	396	3539	1529	403	3539	1513	3400	1820		3433	1881	1556
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	78	521	332	118	501	403	340	731	90	490	794	77
RTOR Reduction (vph)	0	0	72	0	0	69	0	3	0	0	0	33
Lane Group Flow (vph)	78	521	260	118	501	334	340	818	0	490	794	44
Confl. Peds. (#/hr)	13		10	10		13	20		10	10		20
Confl. Bikes (#/hr)						1						2
Heavy Vehicles (%)	0%	2%	3%	1%	2%	4%	3%	2%	6%	2%	1%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6		5	2	3
Permitted Phases	8		8	4		4						2
Actuated Green, G (s)	33.0	26.3	44.4	31.2	25.4	51.7	18.1	59.1		26.3	67.3	74.0
Effective Green, g (s)	33.0	26.3	44.4	31.2	25.4	51.7	18.1	59.1		26.3	67.3	74.0
Actuated g/C Ratio	0.24	0.19	0.32	0.22	0.18	0.37	0.13	0.42		0.19	0.48	0.53
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	4.5
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	2.3
Lane Grp Cap (vph)	160	664	550	147	642	558	439	768		644	904	822
v/s Ratio Prot	0.02	c0.15	0.06	c0.03	0.14	0.11	0.10	c0.45		0.14	c0.42	0.00
v/s Ratio Perm	0.09		0.11	0.15		0.11						0.03
v/c Ratio	0.49	0.78	0.47	0.80	0.78	0.60	0.77	1.07		0.76	0.88	0.05
Uniform Delay, d1	43.6	54.2	38.4	49.3	54.6	35.7	59.0	40.5		53.9	32.7	16.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	5.8	0.4	25.3	5.9	1.3	7.8	51.3		4.9	11.8	0.0
Delay (s)	44.9	60.0	38.8	74.5	60.5	37.1	66.8	91.7		58.8	44.5	16.0
Level of Service	D	E	D	E	E	D	E	F		E	D	B
Approach Delay (s)		51.2			52.9			84.4			48.0	
Approach LOS		D			D			F			D	
Intersection Summary												
HCM 2000 Control Delay			59.2				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			22.5		
Intersection Capacity Utilization			98.6%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beavercreek Rd

Scenario 3

10/03/2019

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	78	521	332	118	501	403	340	821	490	794	77
v/c Ratio	0.48	0.78	0.60	0.78	0.78	0.64	0.77	1.06	0.76	0.88	0.09
Control Delay	47.8	62.7	27.5	75.8	63.4	22.1	71.3	89.9	62.2	46.2	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.8	62.7	27.5	75.8	63.4	22.1	71.3	89.9	62.2	46.2	4.5
Queue Length 50th (ft)	55	240	161	85	233	170	156	~835	217	636	3
Queue Length 95th (ft)	94	294	236	#166	286	241	207	#1150	280	#986	29
Internal Link Dist (ft)		681			472			129		786	
Turn Bay Length (ft)	100		200	200		350	180		350		
Base Capacity (vph)	166	783	586	151	743	645	510	771	686	903	873
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.67	0.57	0.78	0.67	0.62	0.67	1.06	0.71	0.88	0.09

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Molalla Ave & S Beavercreek Rd

Scenario 3

10/03/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	614	318	126	498	403	311	559	102	587	740	42
Future Volume (vph)	52	614	318	126	498	403	311	559	102	587	740	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	4.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1802	3574	1553	1752	3539	1554	3335	1825		3433	1863	1547
Flt Permitted	0.30	1.00	1.00	0.13	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	570	3574	1553	231	3539	1554	3335	1825		3433	1863	1547
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	55	653	338	134	530	429	331	595	109	624	787	45
RTOR Reduction (vph)	0	0	71	0	0	95	0	5	0	0	0	23
Lane Group Flow (vph)	55	653	267	134	530	334	331	699	0	624	787	22
Confl. Peds. (#/hr)	6		5	5		6	24		9	9		24
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	1%	2%	3%	2%	2%	5%	1%	3%	2%	2%	0%
Turn Type	pm+pt	NA	pm+ov	pm+pt	NA	pm+ov	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6		5	2	3
Permitted Phases	8		8	4		4						2
Actuated Green, G (s)	31.4	27.4	45.5	40.4	31.9	59.7	18.1	53.8		27.8	63.5	67.5
Effective Green, g (s)	31.4	27.4	45.5	40.4	31.9	59.7	18.1	53.8		27.8	63.5	67.5
Actuated g/C Ratio	0.22	0.20	0.32	0.29	0.23	0.43	0.13	0.38		0.20	0.45	0.48
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0		6.0	6.0	4.5
Vehicle Extension (s)	2.3	2.5	2.3	2.3	2.5	2.3	2.3	4.6		2.3	4.2	2.3
Lane Grp Cap (vph)	163	699	571	159	806	729	431	701		681	845	745
v/s Ratio Prot	0.01	c0.18	0.06	c0.05	0.15	0.09	0.10	c0.38		c0.18	c0.42	0.00
v/s Ratio Perm	0.07		0.11	0.19		0.12						0.01
v/c Ratio	0.34	0.93	0.47	0.84	0.66	0.46	0.77	1.00		0.92	0.93	0.03
Uniform Delay, d1	43.8	55.4	37.6	40.9	49.1	28.6	58.9	43.0		55.0	36.2	19.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	19.6	0.4	30.7	1.7	0.3	7.5	33.3		16.9	18.2	0.0
Delay (s)	44.5	75.0	38.0	71.6	50.8	28.9	66.4	76.4		71.9	54.4	19.0
Level of Service	D	E	D	E	D	C	E	E		E	D	B
Approach Delay (s)		61.4			44.8			73.2			60.8	
Approach LOS		E			D			E			E	
Intersection Summary												
HCM 2000 Control Delay			59.9				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			0.96									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			22.5		
Intersection Capacity Utilization			96.6%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

1: Molalla Ave & S Beaver Creek Rd

Scenario 3

10/03/2019

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	55	653	338	134	530	429	331	704	624	787	45
v/c Ratio	0.31	0.97	0.60	0.85	0.66	0.57	0.77	0.98	0.91	0.92	0.06
Control Delay	41.8	83.2	28.4	80.5	54.2	19.0	71.0	71.1	73.8	52.7	1.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.8	83.2	28.4	80.5	54.2	19.0	71.0	71.1	73.8	52.7	1.5
Queue Length 50th (ft)	37	314	165	94	236	164	152	~635	286	663	0
Queue Length 95th (ft)	72	#438	254	#193	302	264	201	#909	#382	#970	9
Internal Link Dist (ft)		681			472			129		786	
Turn Bay Length (ft)	100		200	200		350	180		350		
Base Capacity (vph)	177	676	602	158	806	769	512	718	711	856	817
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.97	0.56	0.85	0.66	0.56	0.65	0.98	0.88	0.92	0.06

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.