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DANA M. BECKWITH
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MEMORANDUM

DATE: August 1, 2023

TO: Jon Holland, PE, Brown and Caldwell

FROM: Dana Beckwith, PE, PTOE
Richard Martin, EIT

SUBJECT: Bull Run Filtration Facility – Carpenter Lane One-Access Analysis P18-035

Introduction and Purpose

This memorandum is an update to the Construction Traffic Impact Analysis (Construction TIA) dated June 2, 2023 (staff's Exhibit A.230 in the Multnomah County land use record) and specifically addresses the case of a single site access via Access A (SE Carpenter Lane). The Construction TIA evaluated a one-site access case (see page 20) and established a limit on total construction trips on SE Carpenter Lane that would serve as effective mitigation to maintain an acceptable Level of Service (LOS) at all study intersections. The Construction TIA one-access evaluation assumed all Truck traffic would travel to and from north of the SE Cottrell Road / SE Carpenter Lane intersection (based on Scenario 2 volumes). This memo supplements the Construction TIA evaluation by considering a more conservative trip distribution scenario which routes all Truck trips to/from the south of this intersection:

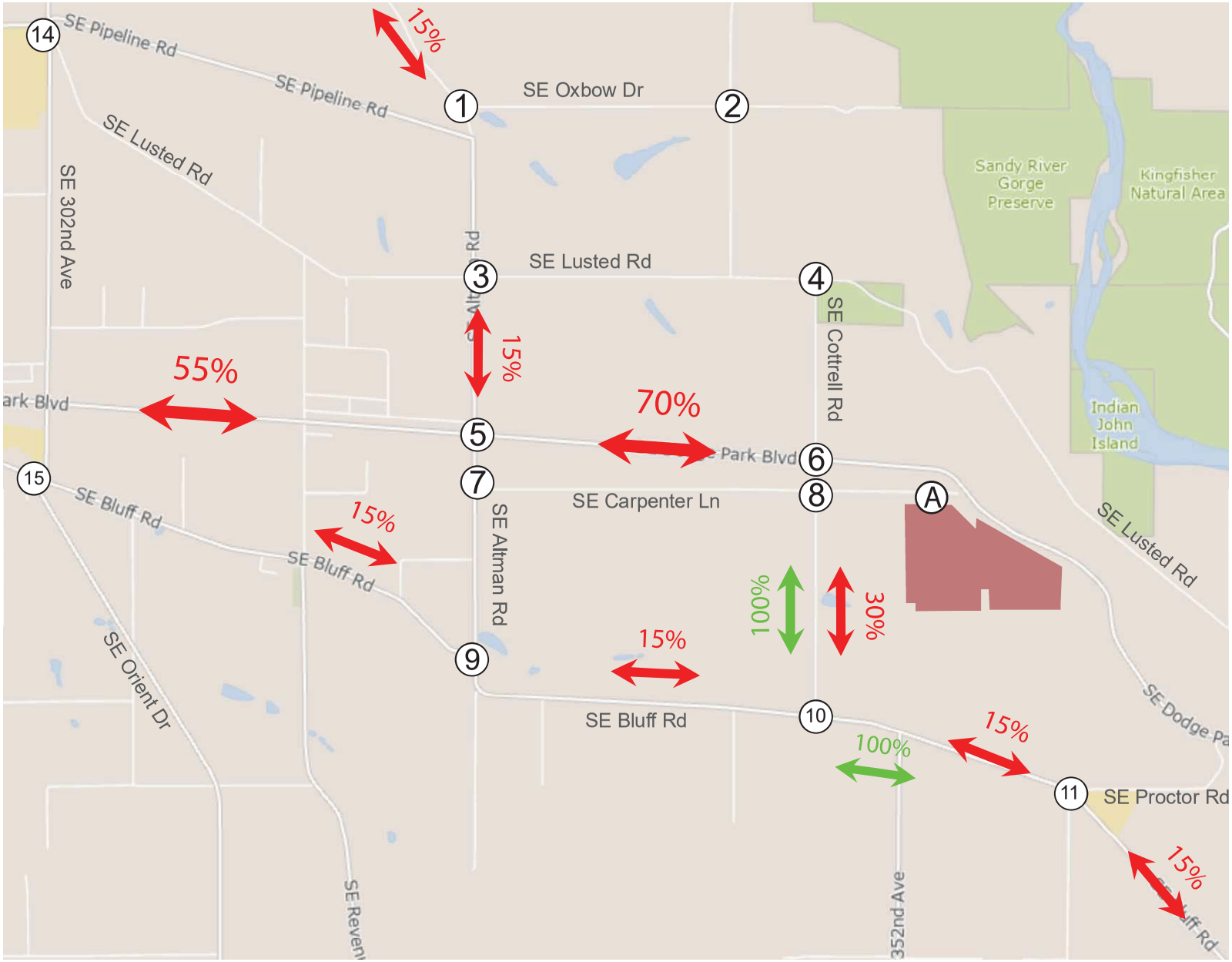
- Commuter trips are distributed per the Construction TIA two-access case, except Access B Commuter trips will now use SE Cottrell Road to Access A
- Truck trips are distributed using the 2025 Peak Construction Traffic Conditions Distribution Scenario 4 per the Construction TIA two-access case but with SE Cottrell Road between SE Bluff Road and SE Carpenter Lane replacing Access B. This provides an analysis of 100 percent of Truck trips routing through the SE Cottrell Road / SE Bluff Road intersection. Scenario 4 was chosen for this analysis and shows a higher level of delay at the intersection and level of service change in comparison to the Construction TIA Scenario 3. Thus, evaluation of Scenario 4 is the more conservative approach, and mitigation that addresses Scenario 4 would also address the lesser potential for delays in Scenario 3.

This distribution is shown in Figure 1.

Operations and mitigation are documented for those intersections where traffic volumes and travel patterns will change with the removal of Access B. The intersections included in this analysis are:

- SE Cottrell Road / SE Carpenter Lane
- SE Cottrell Road / SE Bluff Road

This updated analysis reports revised peak hour trip capacity limits for Access A. These capacity limits will be achieved by Transportation Demand Management (TDM) mitigation strategies to ensure that all intersections continue to meet performance standards.



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(X) = Study Intersection

% = Percentage of Commuter Vehicles Traveling Along Route

% = Percentage of Truck Vehicles Traveling Along Route

Figure 1: Trip Distribution
One-Access Scenario
Commuter and Truck Routes

Analysis

The analysis scenario that most heavily relied upon Access B in the Construction TIA and would have the greatest impact to study intersections with a one-access scenario was the 2025 Peak Construction Traffic Conditions Distribution Scenario 4. The intersections of SE Cottrell Road / SE Carpenter Lane and SE Cottrell Road / SE Bluff Road were analyzed under the 2025 Peak and Average Construction conditions based on trip generation presented in the Construction TIA.

Trip distribution was updated at these two study intersections. The new distribution maintains the 15% eastbound Commuter trip distribution along SE Bluff Road that previously routed to Access B, diverted at SE Cottrell Road / SE Bluff Road to reach Access A. Similarly, Truck trips and Commuter trips previously traveling westbound on SE Bluff Road to reach Site Access B were maintained along SE Bluff Road until they reached SE Cottrell Road / SE Bluff Road, where they turned north to reach Access A. This distribution scenario is shown in Figure 1 and the analysis results are shown in Table 1.

Table 1 shows that, without mitigation, the intersection of SE Carpenter Lane / SE Cottrell Road falls below the LOS C performance standard (defined in the Multnomah County Design Standards, Section 1.1.5) during both analyzed 2025 AM peak hour scenarios and the Peak PM scenario. This is caused by delays created by re-distributed Trucks and Commuters making westbound left-turns at the intersection.

Table 1: One-Access Intersection Performance Summary

#	Intersection	Peak Hour	2025 Peak		2025 Average		2025 Peak Mitigation		2025 Average Mitigation	
			Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
8	SE Carpenter Lane / SE Cottrell Road	AM	>100	**F**	34.1	**D**	24.8	C	25.0	C
		PM	25.2	**D**	12.2	B	15.5	C	11.5	B
10	SE Bluff Road / SE Cottrell Road	AM	15.8	C	12.4	B	15.8	C	12.4	B
		PM	14.3	B	11.7	B	14.3	B	11.7	B

A sensitivity analysis was conducted at the SE Carpenter Lane / SE Cottrell Road intersection to determine a limit to the number of Commuter vehicles that can access the site before dropping below the County's LOS C performance standard. This sensitivity analysis was conducted by reducing the number of southbound left-turning Commuter vehicles, the predominant movement for Commuter traffic as shown in Figure 1. No Truck trips were modified as the scenario assumes all Trucks are traveling to and from the south. Realistically the southbound left will include some Truck trips. Reducing both Commuter and Truck trips accessing the site will allow the intersection to operate at acceptable performance standards.

Results and Conclusion

The results of the sensitivity analysis determined that implementing TDM strategies that reduces the total number of vehicles (Trucks and Commuters) accessing the site to 296 will allow Multnomah County performance standards for peak Truck conditions and 305 vehicles for average Truck conditions to be met. These limits are applicable during both the peak hour AM and PM periods and

provide a reduction of the aggregate impact on the transportation network during construction below what is required for Multnomah County performance standards.

Detailed HCM reports are provided in Appendix A.

The two Mitigation columns in Table 1 show that LOS C is maintained for SE Carpenter Lane / SE Cottrell Road with these limits in place.

Amendment of TDM Plan

TDM strategies identified in the Construction TIA and subsequently proposed in the TDM Plan (included as Attachment 3 to the Applicant's Pre-Hearing Statement - Exhibit H.3) will be implemented to limit the number of Commuter trips accessing the site via Access A to 296 total peak hour vehicles, rather than the 387 previously included in the TDM Plan. This memorandum makes that numerical amendment to the TDM Plan.

Note that 296 total peak hour vehicles represents the number determined by the sensitivity analysis to be able to access the site before exceeding Multnomah County performance standards for the construction peak, rather than average, conditions. This provides reduction of the aggregate impact on the transportation network during construction below what is required for Multnomah County performance standards.

Appendix A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	1	3	43	0	6	1	19	149	250	12	3
Future Volume (Veh/h)	2	1	3	43	0	6	1	19	149	250	12	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	3	1	4	57	0	8	1	25	196	329	16	4
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		3.5										
Percent Blockage		0										
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	811	901	20	806	805	123	22			221		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	811	901	20	806	805	123	22			221		
tC, single (s)	7.8	7.5	6.2	8.1	6.5	6.4	4.6			4.1		
tC, 2 stage (s)												
tF (s)	4.1	4.9	3.3	4.4	4.0	3.5	2.7			2.2		
p0 queue free %	98	99	100	66	100	99	100			76		
cM capacity (veh/h)	187	147	1062	169	240	882	1329			1348		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	65	222	349
Volume Left	3	57	1	329
Volume Right	4	8	196	4
cSH	301	187	1329	1348
Volume to Capacity	0.03	0.35	0.00	0.24
Queue Length 95th (ft)	2	36	0	24
Control Delay (s)	17.3	34.1	0.0	8.2
Lane LOS	C	D	A	A
Approach Delay (s)	17.3	34.1	0.0	8.2
Approach LOS	C	D		

Intersection Summary				
Average Delay	8.1			
Intersection Capacity Utilization	41.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	54	96	111	110	58	0
Future Volume (Veh/h)	54	96	111	110	58	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	64	113	131	129	68	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	260				436	196
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	260				436	196
tC, single (s)	4.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	4.2
p0 queue free %	95				88	100
cM capacity (veh/h)	1316				553	648

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	177	260	68
Volume Left	64	0	68
Volume Right	0	129	0
cSH	1316	1700	553
Volume to Capacity	0.05	0.15	0.12
Queue Length 95th (ft)	4	0	10
Control Delay (s)	3.1	0.0	12.4
Lane LOS	A		B
Approach Delay (s)	3.1	0.0	12.4
Approach LOS			B

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	33.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	4	149	0	255	2	17	44	2	21	1
Future Volume (Veh/h)	0	0	4	149	0	255	2	17	44	2	21	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	0	0	5	175	0	300	2	20	52	2	25	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	380	106	26	84	80	46	26			72		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	380	106	26	84	80	46	26			72		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			5.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			3.1		
p0 queue free %	100	100	100	81	100	71	100			100		
cM capacity (veh/h)	410	786	1056	901	812	1023	1601			1085		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	475	74	28
Volume Left	0	175	2	2
Volume Right	5	300	52	1
cSH	1056	974	1601	1085
Volume to Capacity	0.00	0.49	0.00	0.00
Queue Length 95th (ft)	0	68	0	0
Control Delay (s)	8.4	12.2	0.2	0.6
Lane LOS	A	B	A	A
Approach Delay (s)	8.4	12.2	0.2	0.6
Approach LOS	A	B		

Intersection Summary				
Average Delay	10.0			
Intersection Capacity Utilization	41.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	142	94	63	122	53
Future Volume (Veh/h)	2	142	94	63	122	53
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	161	107	72	139	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	179				308	143
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	179				308	143
tC, single (s)	4.6				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.7				3.5	3.3
p0 queue free %	100				80	93
cM capacity (veh/h)	1154				679	910

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	163	179	199
Volume Left	2	0	139
Volume Right	0	72	60
cSH	1154	1700	735
Volume to Capacity	0.00	0.11	0.27
Queue Length 95th (ft)	0	0	27
Control Delay (s)	0.1	0.0	11.7
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	11.7
Approach LOS			B

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	25.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	1	3	88	0	6	1	19	260	408	12	3
Future Volume (Veh/h)	2	1	3	88	0	6	1	19	260	408	12	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	3	1	4	116	0	8	1	25	342	537	16	4
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		3.5										
Percent Blockage		0										
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1300	1463	20	1294	1294	196	22			367		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1300	1463	20	1294	1294	196	22			367		
tC, single (s)	7.8	7.5	6.2	8.1	6.5	6.4	4.6			4.1		
tC, 2 stage (s)												
tF (s)	4.1	4.9	3.3	4.4	4.0	3.5	2.7			2.2		
p0 queue free %	95	98	100	0	100	99	100			55		
cM capacity (veh/h)	65	44	1062	56	90	801	1329			1192		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	124	368	557
Volume Left	3	116	1	537
Volume Right	4	8	342	4
cSH	110	60	1329	1192
Volume to Capacity	0.07	2.08	0.00	0.45
Queue Length 95th (ft)	6	298	0	60
Control Delay (s)	40.3	648.0	0.0	10.3
Lane LOS	E	F	A	B
Approach Delay (s)	40.3	648.0	0.0	10.3
Approach LOS	E	F		

Intersection Summary			
Average Delay	81.7		
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	87	96	111	188	103	0
Future Volume (Veh/h)	87	96	111	188	103	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	102	113	131	221	121	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	352				558	242
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	352				558	242
tC, single (s)	4.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	4.2
p0 queue free %	92				73	100
cM capacity (veh/h)	1218				453	607

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	215	352	121
Volume Left	102	0	121
Volume Right	0	221	0
cSH	1218	1700	453
Volume to Capacity	0.08	0.21	0.27
Queue Length 95th (ft)	7	0	27
Control Delay (s)	4.3	0.0	15.8
Lane LOS	A		C
Approach Delay (s)	4.3	0.0	15.8
Approach LOS			C

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	4	260	0	409	2	17	89	2	21	1
Future Volume (Veh/h)	0	0	4	260	0	409	2	17	89	2	21	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	0	0	5	306	0	481	2	20	105	2	25	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	587	158	26	111	106	72	26			125		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	587	158	26	111	106	72	26			125		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			5.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			3.1		
p0 queue free %	100	100	100	65	100	51	100			100		
cM capacity (veh/h)	217	735	1056	865	785	990	1601			1029		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	787	127	28
Volume Left	0	306	2	2
Volume Right	5	481	105	1
cSH	1056	937	1601	1029
Volume to Capacity	0.00	0.84	0.00	0.00
Queue Length 95th (ft)	0	255	0	0
Control Delay (s)	8.4	25.2	0.1	0.6
Lane LOS	A	D	A	A
Approach Delay (s)	8.4	25.2	0.1	0.6
Approach LOS	A	D		

Intersection Summary				
Average Delay	21.0			
Intersection Capacity Utilization	59.8%	ICU Level of Service	B	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	142	94	108	200	86
Future Volume (Veh/h)	2	142	94	108	200	86
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	161	107	123	227	98
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	230				334	168
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	230				334	168
tC, single (s)	4.6				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.7				3.5	3.3
p0 queue free %	100				65	89
cM capacity (veh/h)	1101				656	881

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	163	230	325
Volume Left	2	0	227
Volume Right	0	123	98
cSH	1101	1700	711
Volume to Capacity	0.00	0.14	0.46
Queue Length 95th (ft)	0	0	60
Control Delay (s)	0.1	0.0	14.3
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	14.3
Approach LOS			B

Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	34.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	1	3	43	0	6	1	19	149	200	12	3
Future Volume (Veh/h)	2	1	3	43	0	6	1	19	149	200	12	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	3	1	4	57	0	8	1	25	196	263	16	4
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		3.5										
Percent Blockage		0										
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	679	769	20	674	673	123	22			221		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	679	769	20	674	673	123	22			221		
tC, single (s)	7.8	7.5	6.2	8.1	6.5	6.4	4.6			4.1		
tC, 2 stage (s)												
tF (s)	4.1	4.9	3.3	4.4	4.0	3.5	2.7			2.2		
p0 queue free %	99	99	100	74	100	99	100			80		
cM capacity (veh/h)	244	192	1062	222	304	882	1329			1348		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	65	222	283
Volume Left	3	57	1	263
Volume Right	4	8	196	4
cSH	376	245	1329	1348
Volume to Capacity	0.02	0.27	0.00	0.20
Queue Length 95th (ft)	2	26	0	18
Control Delay (s)	14.8	25.0	0.0	7.8
Lane LOS	B	C	A	A
Approach Delay (s)	14.8	25.0	0.0	7.8
Approach LOS	B	C		

Intersection Summary				
Average Delay	6.9			
Intersection Capacity Utilization	38.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	54	96	111	110	58	0
Future Volume (Veh/h)	54	96	111	110	58	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	64	113	131	129	68	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	260				436	196
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	260				436	196
tC, single (s)	4.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	4.2
p0 queue free %	95				88	100
cM capacity (veh/h)	1316				553	648

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	177	260	68
Volume Left	64	0	68
Volume Right	0	129	0
cSH	1316	1700	553
Volume to Capacity	0.05	0.15	0.12
Queue Length 95th (ft)	4	0	10
Control Delay (s)	3.1	0.0	12.4
Lane LOS	A		B
Approach Delay (s)	3.1	0.0	12.4
Approach LOS			B

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	33.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	4	149	0	205	2	17	44	2	21	1
Future Volume (Veh/h)	0	0	4	149	0	205	2	17	44	2	21	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	0	0	5	175	0	241	2	20	52	2	25	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	320	106	26	84	80	46	26			72		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	320	106	26	84	80	46	26			72		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			5.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			3.1		
p0 queue free %	100	100	100	81	100	76	100			100		
cM capacity (veh/h)	485	786	1056	901	812	1023	1601			1085		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	416	74	28
Volume Left	0	175	2	2
Volume Right	5	241	52	1
cSH	1056	968	1601	1085
Volume to Capacity	0.00	0.43	0.00	0.00
Queue Length 95th (ft)	0	55	0	0
Control Delay (s)	8.4	11.5	0.2	0.6
Lane LOS	A	B	A	A
Approach Delay (s)	8.4	11.5	0.2	0.6
Approach LOS	A	B		

Intersection Summary				
Average Delay	9.3			
Intersection Capacity Utilization	38.3%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	142	94	63	122	53
Future Volume (Veh/h)	2	142	94	63	122	53
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	161	107	72	139	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	179				308	143
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	179				308	143
tC, single (s)	4.6				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.7				3.5	3.3
p0 queue free %	100				80	93
cM capacity (veh/h)	1154				679	910

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	163	179	199
Volume Left	2	0	139
Volume Right	0	72	60
cSH	1154	1700	735
Volume to Capacity	0.00	0.11	0.27
Queue Length 95th (ft)	0	0	27
Control Delay (s)	0.1	0.0	11.7
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	11.7
Approach LOS			B

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	25.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	4	260	0	237	2	17	89	2	21	1
Future Volume (Veh/h)	0	0	4	260	0	237	2	17	89	2	21	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	0	0	5	306	0	279	2	20	105	2	25	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	385	158	26	111	106	72	26			125		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	385	158	26	111	106	72	26			125		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			5.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			3.1		
p0 queue free %	100	100	100	65	100	72	100			100		
cM capacity (veh/h)	413	735	1056	865	785	990	1601			1029		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	585	127	28
Volume Left	0	306	2	2
Volume Right	5	279	105	1
cSH	1056	921	1601	1029
Volume to Capacity	0.00	0.64	0.00	0.00
Queue Length 95th (ft)	0	118	0	0
Control Delay (s)	8.4	15.5	0.1	0.6
Lane LOS	A	C	A	A
Approach Delay (s)	8.4	15.5	0.1	0.6
Approach LOS	A	C		

Intersection Summary				
Average Delay	12.2			
Intersection Capacity Utilization	49.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	142	94	108	200	86
Future Volume (Veh/h)	2	142	94	108	200	86
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	161	107	123	227	98
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	230				334	168
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	230				334	168
tC, single (s)	4.6				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.7				3.5	3.3
p0 queue free %	100				65	89
cM capacity (veh/h)	1101				656	881

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	163	230	325
Volume Left	2	0	227
Volume Right	0	123	98
cSH	1101	1700	711
Volume to Capacity	0.00	0.14	0.46
Queue Length 95th (ft)	0	0	60
Control Delay (s)	0.1	0.0	14.3
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	14.3
Approach LOS			B

Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	34.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	1	3	88	0	6	1	19	260	124	12	3
Future Volume (Veh/h)	2	1	3	88	0	6	1	19	260	124	12	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	3	1	4	116	0	8	1	25	342	163	16	4
Pedestrians		2										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		3.5										
Percent Blockage		0										
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	552	715	20	546	546	196	22			367		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	552	715	20	546	546	196	22			367		
tC, single (s)	7.8	7.5	6.2	8.1	6.5	6.4	4.6			4.1		
tC, 2 stage (s)												
tF (s)	4.1	4.9	3.3	4.4	4.0	3.5	2.7			2.2		
p0 queue free %	99	100	100	60	100	99	100			86		
cM capacity (veh/h)	317	223	1062	291	386	801	1329			1192		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	124	368	183
Volume Left	3	116	1	163
Volume Right	4	8	342	4
cSH	452	303	1329	1192
Volume to Capacity	0.02	0.41	0.00	0.14
Queue Length 95th (ft)	1	48	0	12
Control Delay (s)	13.1	24.8	0.0	7.7
Lane LOS	B	C	A	A
Approach Delay (s)	13.1	24.8	0.0	7.7
Approach LOS	B	C		

Intersection Summary				
Average Delay	6.7			
Intersection Capacity Utilization	47.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	87	96	111	188	103	0
Future Volume (Veh/h)	87	96	111	188	103	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	102	113	131	221	121	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	352				558	242
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	352				558	242
tC, single (s)	4.1				6.4	7.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	4.2
p0 queue free %	92				73	100
cM capacity (veh/h)	1218				453	607

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	215	352	121
Volume Left	102	0	121
Volume Right	0	221	0
cSH	1218	1700	453
Volume to Capacity	0.08	0.21	0.27
Queue Length 95th (ft)	7	0	27
Control Delay (s)	4.3	0.0	15.8
Lane LOS	A		C
Approach Delay (s)	4.3	0.0	15.8
Approach LOS			C

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		