FINAL MEMORANDUM

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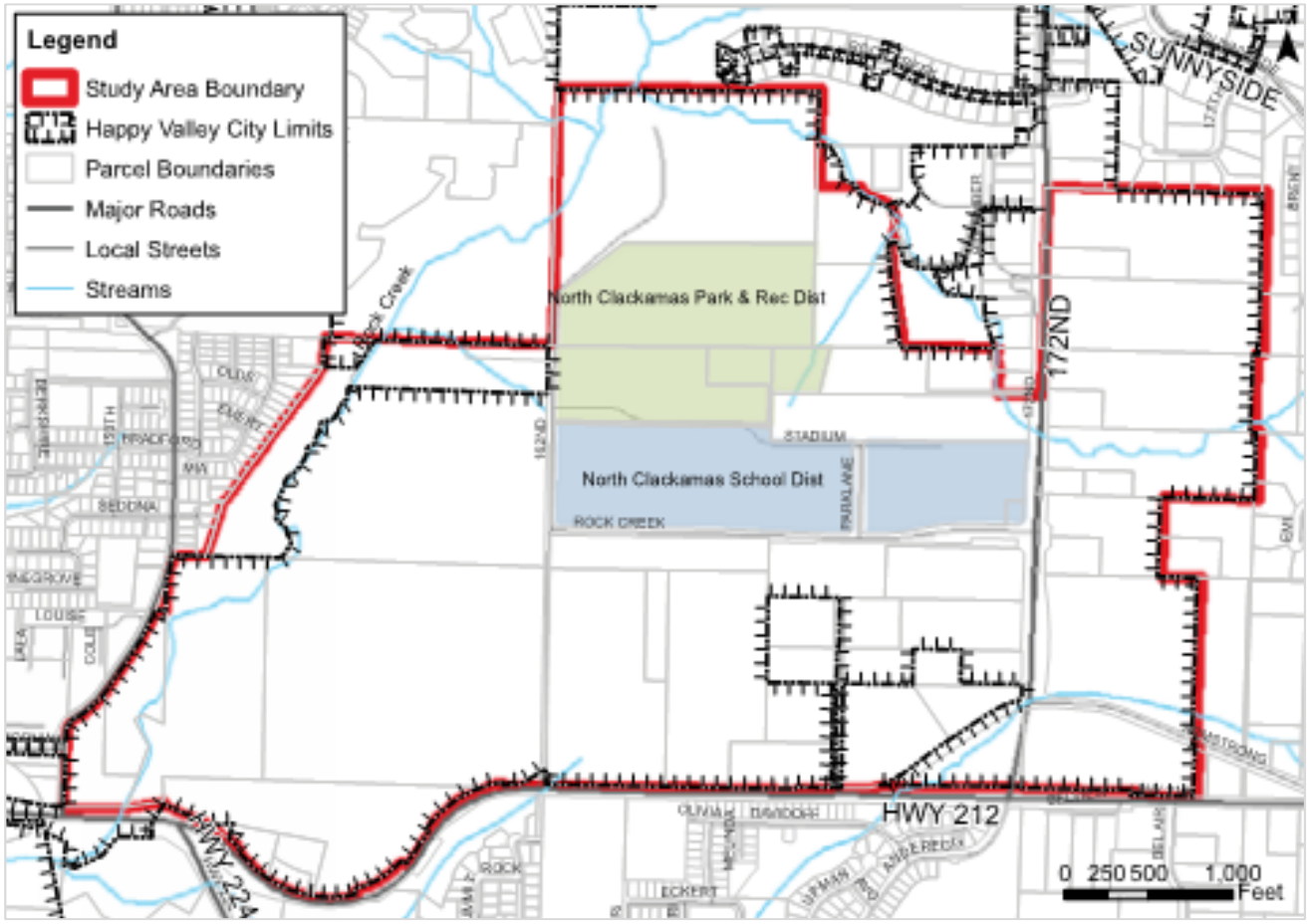
DATE: March 18, 2020

TO: Michael Walter, City of Happy Valley
Dan Houf, HHPR

FROM: Reah Flisakowski, Rochelle Starrett | DKS

SUBJECT: Rock Creek Employment Plan Traffic Study P# 19126-000

This memorandum summarizes the future transportation operating conditions and system needs for the Rock Creek Employment Center planning area in Happy Valley, Oregon. The project study area is generally bounded by OR 212 to the south, 177th Avenue to the east, Rock Creek to the west and Hood View Park to the north. The study area boundary is shown in red in the figure below. Currently, the area serves two public schools, a regional park, rural residential uses and agriculture uses. There is a significant amount of vacant land that is planned primarily for employment development.



FUTURE TRAFFIC VOLUMES

Future year 2040 operating conditions were conducted for the study intersections listed below. These locations were selected to capture potential infrastructure needs in the study area.

- OR 212/OR 224
- OR 212/162nd Avenue
- OR 212/172nd Avenue
- 162nd Avenue/Rock Creek Boulevard
- 172nd Avenue/Rock Creek Boulevard

Traffic volume forecasts were developed for the year 2040 using Metro travel demand models that were updated and refined for the Clackamas County Sunrise Gateway project. The modeled scenarios are described below.

2040 Baseline Scenario - included the following Metro RTP (2018 Regional Transportation Plan) and Happy Valley TSP projects:

- Widen/construct 162nd Avenue to three lanes, between OR 212 and Clatsop Street (RTP 10037, 10040, 10041 and TSP W9, R3, R4)
- Widen Rock Creek Boulevard to five lanes, between 162nd Avenue and 172nd Avenue (TSP W11)
- Widen 172nd Avenue to five lanes, between Sunnyside Road and 172nd-190th Connection (TSP W2)
- Widen 172nd Avenue to three lanes, between 172nd-190th Connection and Cheldelin Road (TSP W3)
- Construct 172nd-190th Connection as five lane facility, between 172nd Avenue and 190th Avenue (RTP 12071 and TSP R7)
- Widen Foster Road to three lanes, County line to 172nd-190th Connection Road (RTP 10035, not financially constrained)

2040 Sunrise Gateway Scenario – added the extension of the existing Sunrise corridor as a two-lane expressway between 122nd Avenue and 172nd Avenue.

Additional local level connectivity refinements were made to both 2040 models for the Rock Creek Employment Center planning area to support the development of future study intersection volumes. The 2040 Sunrise Gateway scenario model was modified to remove the proposed interchange at 172nd Avenue and return the existing at-grade OR 212/172nd Avenue intersection. Model volumes were post-processed to estimate future traffic volumes at the study intersections consistent with NCHRP 765 methodology. Future volume forecasts for both scenarios are provided in the appendix.

MOBILITY TARGETS

Intersection mobility targets are used to asses if roadway facilities are adequate to handle the expected traffic volumes. The following mobility targets apply within the Rock Creek Employment Center planning area:

- **ODOT State Highways (OR 212)**
  - Intersections located on OR 212 must operate at or below a volume to capacity (v/c) ratio of 0.99 during the first and second hours of peak travel times.[1] ODOT does not apply a standard to the intersection level of service (LOS).
- **City of Happy Valley Facilities**
  - Signalized intersections must operate at LOS D or better and a v/c ratio less than or equal to 0.90 during the peak hour. Individual movements must operate at LOS E or better and a v/c ratio less than or equal to 1.00 during the peak hour.
  - Roundabout intersections must operate at LOS D or better during the peak hour. Each approach must operate at LOS E or better and a v/c ratio less than or equal to 0.85.
  - All unsignalized two-way stop control intersections must operate at LOS E or better for all side street approaches during the peak hour.
  - All unsignalized all-way stop controlled intersections must operate at LOS D or better during the peak hour.

[1] Oregon Highway Plan, Table 7: Volume to Capacity Ratio Targets within Portland Metropolitan Region, Corridors.

FUTURE BASELINE SCENARIO OPERATIONS

The 2040 Baseline scenario volumes were used to evaluate study intersection operations for the PM peak hour and evaluate necessary capacity improvements prior to construction of the Sunrise Gateway project. The analysis was based on the Highway Capacity Manual[2] (HCM) 2000 methodology for signalized and HCM 6th Edition methodology for unsignalized intersections. The 2040 Baseline intersection operations are summarized below in Table 1. Detailed intersection operations are provided in the appendix. While Rock Creek Boulevard was modelled as a five-lane facility (consistent with the Happy Valley TSP), estimated future traffic volumes indicate a three-lane facility would be more appropriately sized for future demand.

Table 1: 2040 Baseline Intersection Performance (PM Peak Hour)

Signalized Intersection	Delay	Level of Service	V/C
OR 212/OR 224	71.0	E	1.23
172nd Avenue/OR 212	35.5	D	0.90
172nd Avenue/Rock Creek Boulevard	8.3	A	0.37
Unsignalized Intersection	**Delay**	**Level of Service**	**V/C**
162nd Avenue/OR 212	12.0/ >1000	B/F	0.05/ >2.00
162nd Avenue/Rock Creek Boulevard	7.4/9.5	A/A	0.01/0.04
Signalized Intersection: Delay = Average Intersection Delay (sec.) LOS = Level of Service V/C = Volume-to-Capacity Ratio Shaded values do not meet standards	Unsignalized Intersection: Delay = Critical Approach Delay (sec.) LOS = Major Street/Minor Street V/C = Critical Volume-to-Capacity Ratio Shaded values do not meet standards		

The intersections of OR 212/OR 224 and 162nd Avenue/OR 212 are expected to exceed their ODOT mobility targets. The 172nd Avenue/OR 212 intersection is expected to approach, but not exceed, its mobility target for the City of Happy Valley.

[2] 2000 Highway Capacity Manual, Transportation Research Board, Washington DC, 2000. 2010 Highway Capacity Manual, Transportation Research Board, Washington DC, 2010.

The following improvements were evaluated to meet mobility standards and improve future intersection operations for the 2040 Baseline scenario:

- Add a traffic signal or multi-lane roundabout at 162nd Avenue/OR 212 and realign 162nd Avenue and/or OR 212 to meet sight distance requirements.
- Add a second eastbound right turn lane at OR 212/OR 224 and widen intersection to include a second southbound receiving lane for approximately 1,000-feet. This would require additional right-of-way from adjacent property owners which may be challenging due to adjacent topography and environmental constraints.
- Add a second eastbound left turn lane at 172nd Avenue/OR 212. Note: Happy Valley TSP Project I8 would install a second southbound right turn lane and a second westbound through lane, but this capacity improvement was not needed to meet standards.

Traffic operations for the 2040 Baseline scenario with these recommended improvements are summarized in Table 2. Detailed traffic operations are provided in the appendix. The mobility standards for ODOT and the City of Happy Valley are met at all study intersections.

Table 2: 2040 Baseline Intersection Performance with Recommended Improvements (PM Peak Hour)

Signalized Intersection	Delay	Level of Service	V/C
OR 212/OR 224	28.6	C	0.89
162nd Avenue/OR 212	21.1	C	0.64
172nd Avenue/OR 212	26.7	C	0.78
172nd Avenue/Rock Creek Boulevard	7.6	A	0.35
Unsignalized Intersection	**Delay**	**Level of Service**	**V/C**
162nd Avenue/Rock Creek Boulevard	7.4/9.5	A/A	0.01/0.04
Signalized Intersection: Delay = Average Intersection Delay (sec.) LOS = Level of Service V/C = Volume-to-Capacity Ratio Shaded values do not meet standards	Unsignalized Intersection: Delay = Critical Approach Delay (sec.) LOS = Major Street/Minor Street V/C = Critical Volume-to-Capacity Ratio Shaded values do not meet standards		

The OR 212/OR 224 intersection was evaluated with multi-lane roundabout control. Intersection operations during the future PM peak hour for various signal and multi-lane roundabout configurations are summarized in Table 3. A standard two-lane roundabout would significantly exceed ODOT's mobility target by 2040. However, adding dual eastbound right-turn slip lanes and modifying the approach geometry to allow for dual northbound left-turn lanes would improve the intersection operations. Even with an expanded intersection footprint, ODOT's mobility standard would be exceeded by 2040.

Table 3: 2040 Baseline Intersection Performance at OR 212/OR 224 (PM Peak Hour)

Scenario	Delay	Level of Service	V/C
Signal with Existing Geometry	71.0	E	1.23
Signal with Recommended Improvements*	28.6	C	0.89
Two-Lane Roundabout	142.3	F	1.45
Two-Lane Roundabout with Recommended Improvements**	33.9	D	1.08

*Add second eastbound right-turn lane and second southbound receiving lane for approximately 1,000-ft
**Add dual eastbound right-turn slip lanes and dual northbound left-turn lanes

Additional analysis of the OR 212/OR 224 intersection with multi-lane roundabout control was conducted to test 2040 AM peak hour volumes as shown in Table 4. Detailed intersection operations are provided in the appendix. The intersection serves high westbound and northbound volumes due to typical morning commute routes (rural to urban areas for employment). Roundabout operations, both with and without capacity improvements, significantly exceeds ODOT's mobility target by 2040 during the AM peak hour. High northbound left-turn demand and high westbound through demand directly conflict in the roundabout which would result in congestion and high vehicle delays. Conversely, the PM peak hour would have a high eastbound through and right turn demand as residents return from the urban to rural areas, which can be accommodated through the addition of eastbound right turn slip lanes.

Table 4: 2040 Baseline Intersection Performance at OR-212/OR-224 (AM Peak Hour)

Scenario	Delay	Level of Service	V/C
Two-Lane Roundabout	139.0	F	1.64
Two-Lane Roundabout with Capacity Improvements*	168.7	F	1.82

*Add dual eastbound right-turn slip lanes and dual northbound left-turn lanes

FUTURE SUNRISE GATEWAY SCENARIO OPERATIONS

This scenario evaluated 2040 study intersection operations during the PM peak hour with construction of the Sunrise Gateway project to assess any changes from planned regional capacity improvements. The intersection operations are summarized in Table 5. Detailed intersection operations are provided in the appendix. Due to the reconfiguration of the OR 212/OR 224 intersection as part of the Sunrise Gateway project, the signal phasing at this location was modified to better represent future signal operations. Similar to the 2040 Baseline scenario, Rock Creek Boulevard was modelled as a five-lane facility, however estimated future traffic volumes indicate a three-lane facility would be more appropriately sized.

Table 5: 2040 Sunrise Gateway Intersection Performance (PM Peak Hour)

Signalized Intersection	Delay	Level of Service	V/C
OR 212/OR 224	62.1	E	1.10
172nd Avenue/OR 212	39.8	D	0.93
172nd Avenue/Rock Creek Boulevard	10.2	B	0.40
Unsignalized Intersection	**Delay**	**Level of Service**	**V/C**
162nd Avenue/OR 212	7.3/8.5	A/A	0.03/0.04
162nd Avenue/Rock Creek Boulevard	7.5/9.9	A/A	0.03/0.04
Signalized Intersection: Delay = Average Intersection Delay (sec.) LOS = Level of Service V/C = Volume-to-Capacity Ratio Shaded values do not meet standards	Unsignalized Intersection: Delay = Critical Approach Delay (sec.) LOS = Major Street/Minor Street V/C = Critical Volume-to-Capacity Ratio Shaded values do not meet standards		

Only the OR 212/OR 224 intersection would exceed the ODOT mobility target in 2040. The 172nd Avenue/OR 212 intersection would marginally exceed its mobility target for the City of Happy Valley in 2040. The Sunrise Gateway project would largely alleviate future traffic demand and congestion on OR 212. However, there would still be a high PM peak hour demand for eastbound right turns (over 1,500 vehicles per hour) and northbound left turns.

Since through traffic demand on OR 212 would be significantly reduced with construction of the Sunrise Gateway project, fewer through traffic lanes on OR 212 would be needed. There would be opportunity to repurpose some through lanes to a dual right turn lane with minimal right-of-way impacts.

The following mitigations were identified, in addition to the Sunrise Gateway project, to meet mobility standards for ODOT and the City of Happy Valley and improve overall operations:

- Add a second eastbound left turn lane at 172nd Avenue/OR 212.
- Reconfigure OR 212/OR 224 intersection lanes - convert an eastbound through lane to a second eastbound right turn lane, convert an existing northbound left turn lane to a second southbound receiving lane and widen to include a second southbound receiving lane for 1,000-feet.

Traffic operations for the 2040 Sunrise Gateway scenario with recommended improvements are summarized in Table 6, and detailed traffic operations are provided in the appendix. The mobility standards for ODOT and the City of Happy Valley are met at all study intersections.

Table 6: 2040 Sunrise Gateway Intersection Performance with Recommended Improvements (PM Peak Hour)

Signalized Intersection	Delay	Level of Service	V/C
OR 212/OR 224	6.5	A	0.57
172nd Avenue/OR 212	30.8	C	0.83
172nd Avenue/Rock Creek Boulevard	10.2	B	0.40
Unsignalized Intersection	**Delay**	**Level of Service**	**V/C**
162nd Avenue/OR 212	7.3/8.5	A/A	0.03/0.04
162nd Avenue/Rock Creek Boulevard	7.5/9.9	A/A	0.03/0.04
Signalized Intersection: Delay = Average Intersection Delay (sec.) LOS = Level of Service V/C = Volume-to-Capacity Ratio Shaded values do not meet standards	Unsignalized Intersection: Delay = Critical Approach Delay (sec.) LOS = Major Street/Minor Street V/C = Critical Volume-to-Capacity Ratio Shaded values do not meet standards		

As traffic volumes increase along the OR 212 and OR 224 corridors, traffic operations will continue to degrade without further improvements. While the Sunrise Gateway project is expected to significantly alleviate traffic demand and congestion on OR 212, the funding and timing for construction of the project is unknown.

PREFERRED IMPROVEMENT PLAN

With consideration of the 2040 operating conditions prior to construction of the Sunrise Gateway project, a preferred short-term roadway plan was developed for the Rock Creek area. The objective is to provide improvements to support local development in the short-term while limiting potential impacts to the planned Sunrise Gateway project alignment. The preferred Rock Creek Employment Plan includes the transportation improvements identified through this analysis and regional planned trails.

Street Network

- Realign OR 212 to the north to create a new intersection at 162nd Avenue
- Widen 162nd Avenue to 3-lanes between OR 212 and north terminus
- Extend 162nd Avenue as a 3-lane facility between north terminus and Taralon development, includes bridge of Rock Creek
- Widen Rock Creek Boulevard to 3-lanes between 162nd and 172nd Avenue
- Construct new 3-lane east-west facility, south of Rock Creek Boulevard between 162nd and 172nd Avenue
- Construct Parklane Drive as a 3-lane facility between Rock Creek Blvd and new 3-lane east-west facility to the south
- Construct Parklane Drive as a 3-lane facility between Stadium Way and 162nd Avenue
- Construct Rock Creek Boulevard as a 3-lane facility between 172nd and 177th Avenue
- Construct 177th Avenue as a 3-lane facility between Rock Creek Boulevard and north study area boundary
- Construct Big Timber Court as a 3-lane facility between 172nd Avenue and east study area boundary

Intersections

- Add a second eastbound left turn lane at Rock Creek Boulevard/172nd Avenue
- Add a second eastbound left turn lane at OR 212/172nd Avenue
- At OR 212/OR 224, add a second eastbound right turn lane and widen OR 224 to include a second southbound receiving lane for 1,000-feet
- Add a traffic signal (or roundabout) at Rock Creek Boulevard/162nd Avenue
- Add a traffic signal (or roundabout) at Rock Creek Boulevard/Parklane Drive
- Add a multi-lane roundabout at OR 212 (realignment)/162nd Avenue
- Add a roundabout at 162nd Avenue/Parklane Drive

Trails

- Build segment of East Mount Scott-Scouters Mountain Loop Trail - along Rock Creek between 162nd Avenue and OR 212
- Build Sunrise Corridor Trail – along new Sunrise Gateway Phase 2 corridor

APPENDIX

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1335	1355	370	880	605	180
Future Volume (vph)	1335	1355	370	880	605	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1568	1805	3406	3335	1599
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1568	1805	3406	3335	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	1391	1411	385	917	630	188
RTOR Reduction (vph)	0	14	0	0	0	66
Lane Group Flow (vph)	1391	1397	385	917	630	122
Heavy Vehicles (%)	2%	3%	0%	6%	5%	1%
Turn Type	NA	custom	Prot	NA	Prot	Perm
Protected Phases	2	2 8	1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	68.0	91.0	21.0	93.0	19.0	19.0
Effective Green, g (s)	68.0	91.0	21.0	93.0	19.0	19.0
Actuated g/C Ratio	0.57	0.76	0.18	0.78	0.16	0.16
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	2005	1189	315	2639	528	253
v/s Ratio Prot	0.39	c0.89	c0.21	0.27	0.19	
v/s Ratio Perm						0.08
v/c Ratio	0.69	1.18	1.22	0.35	1.19	0.48
Uniform Delay, d1	18.6	14.5	49.5	4.2	50.5	46.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	87.9	125.1	0.1	104.5	1.5
Delay (s)	19.6	102.4	174.6	4.2	155.0	47.5
Level of Service	B	F	F	A	F	D
Approach Delay (s)	61.3			54.6	130.3	
Approach LOS	E			D	F	

Intersection Summary			
HCM 2000 Control Delay	71.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	111.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	24.7

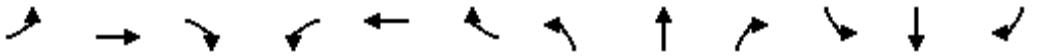
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕		↰	↱	
Traffic Vol, veh/h	25	1490	0	0	1200	25	0	0	20	25	0	60
Future Vol, veh/h	25	1490	0	0	1200	25	0	0	20	25	0	60
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	26	1568	0	0	1263	26	0	0	21	26	0	63

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1289	0	0	1568	0	0	2928	2909	1568	2907	2896	1276
Stage 1	-	-	-	-	-	-	1620	1620	-	1276	1276	-
Stage 2	-	-	-	-	-	-	1308	1289	-	1631	1620	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	538	-	-	421	-	-	9	16	137	~ 10	16	204
Stage 1	-	-	-	-	-	-	130	162	-	205	238	-
Stage 2	-	-	-	-	-	-	196	234	-	128	162	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	538	-	-	421	-	-	4	10	137	~ 6	10	204
Mov Cap-2 Maneuver	-	-	-	-	-	-	4	10	-	~ 6	10	-
Stage 1	-	-	-	-	-	-	81	101	-	128	238	-
Stage 2	-	-	-	-	-	-	135	234	-	68	101	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0	36	$ 814.2
HCM LOS			E	F

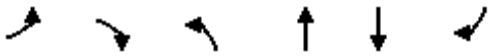
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	137	538	-	-	421	-	-	6	204
HCM Lane V/C Ratio	0.154	0.049	-	-	-	-	-	4.386	0.31
HCM Control Delay (s)	36	12	0	-	0	-	-	$ 2695.2	30.4
HCM Lane LOS	E	B	A	-	A	-	-	F	D
HCM 95th %tile Q(veh)	0.5	0.2	-	-	0	-	-	4.7	1.3

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	375	1065	100	10	780	85	40	40	10	150	95	390
Future Volume (vph)	375	1065	100	10	780	85	40	40	10	150	95	390
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3405		1583	1792	1524	1752	1841		1770	1845	1495
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.65	1.00		0.72	1.00	1.00
Satd. Flow (perm)	1752	3405		1583	1792	1524	1203	1841		1346	1845	1495
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	395	1121	105	11	821	89	42	42	11	158	100	411
RTOR Reduction (vph)	0	4	0	0	0	48	0	9	0	0	0	321
Lane Group Flow (vph)	395	1222	0	11	821	41	42	44	0	158	100	90
Heavy Vehicles (%)	3%	5%	1%	14%	6%	6%	3%	0%	0%	2%	3%	8%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	25.2	71.7		1.0	47.5	47.5	19.1	19.1		17.9	17.9	17.9
Effective Green, g (s)	25.7	74.2		1.5	50.0	50.0	20.1	20.1		20.1	20.1	20.1
Actuated g/C Ratio	0.24	0.69		0.01	0.46	0.46	0.19	0.19		0.19	0.19	0.19
Clearance Time (s)	4.5	6.5		4.5	6.5	6.5	5.0	5.0		6.2	6.2	6.2
Vehicle Extension (s)	2.3	5.4		2.3	5.4	5.4	2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	417	2343		22	831	706	224	343		250	344	278
v/s Ratio Prot	c0.23	0.36		0.01	c0.46			0.02			0.05	
v/s Ratio Perm						0.03	0.03			c0.12		0.06
v/c Ratio	0.95	0.52		0.50	0.99	0.06	0.19	0.13		0.63	0.29	0.32
Uniform Delay, d1	40.4	8.2		52.8	28.6	15.9	37.0	36.5		40.4	37.7	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	30.5	0.5		10.0	28.2	0.1	0.3	0.1		4.5	0.3	0.5
Delay (s)	70.9	8.6		62.8	56.8	16.0	37.3	36.7		44.9	38.1	38.4
Level of Service	E	A		E	E	B	D	D		D	D	D
Approach Delay (s)		23.8			52.9			36.9			39.9	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	35.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	107.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	105	105	75	440	490	135
Future Volume (vph)	105	105	75	440	490	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.4	5.4	5.4
Lane Util. Factor	1.00	1.00	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1719	1429	3242	3539	3471	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1719	1429	3242	3539	3471	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	111	111	79	463	516	142
RTOR Reduction (vph)	0	92	0	0	0	86
Lane Group Flow (vph)	111	19	79	463	516	56
Heavy Vehicles (%)	5%	13%	8%	2%	4%	2%
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	6.9	6.9	3.5	23.1	15.6	15.6
Effective Green, g (s)	6.9	6.9	3.5	23.1	15.6	15.6
Actuated g/C Ratio	0.18	0.18	0.09	0.59	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	5.4	5.4	5.4
Vehicle Extension (s)	2.3	2.3	2.3	1.0	1.0	1.0
Lane Grp Cap (vph)	301	250	287	2074	1374	626
v/s Ratio Prot	c0.06		0.02	c0.13	c0.15	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.37	0.08	0.28	0.22	0.38	0.09
Uniform Delay, d1	14.3	13.6	16.8	3.9	8.4	7.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.1	0.3	0.0	0.1	0.0
Delay (s)	14.8	13.7	17.1	3.9	8.5	7.5
Level of Service	B	B	B	A	A	A
Approach Delay (s)	14.2			5.8	8.3	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	39.4	Sum of lost time (s)	13.4
Intersection Capacity Utilization	33.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	3.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	40	60	20	10	50
Future Vol, veh/h	20	40	60	20	10	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	100	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	42	63	21	11	53

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	149	74	0	0	84	0
Stage 1	74	-	-	-	-	-
Stage 2	75	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	843	988	-	-	1513	-
Stage 1	949	-	-	-	-	-
Stage 2	948	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	837	988	-	-	1513	-
Mov Cap-2 Maneuver	813	-	-	-	-	-
Stage 1	949	-	-	-	-	-
Stage 2	941	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9	0	1.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	813	988	1513	-
HCM Lane V/C Ratio	-	-	0.026	0.043	0.007	-
HCM Control Delay (s)	-	-	9.5	8.8	7.4	-
HCM Lane LOS	-	-	A	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	0	-

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1335	1355	370	880	605	180
Future Volume (vph)	1335	1355	370	880	605	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	0.88	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	2760	1805	3406	3335	1599
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	2760	1805	3406	3335	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	1391	1411	385	917	630	188
RTOR Reduction (vph)	0	82	0	0	0	65
Lane Group Flow (vph)	1391	1329	385	917	630	123
Heavy Vehicles (%)	2%	3%	0%	6%	5%	1%
Turn Type	NA	custom	Prot	NA	Prot	Perm
Protected Phases	2	2 8	1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	52.3	81.3	28.0	84.3	25.0	25.0
Effective Green, g (s)	52.3	81.3	28.0	84.3	25.0	25.0
Actuated g/C Ratio	0.45	0.69	0.24	0.72	0.21	0.21
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1577	1912	430	2447	710	340
v/s Ratio Prot	c0.39	0.48	c0.21	0.27	c0.19	
v/s Ratio Perm						0.08
v/c Ratio	0.88	0.70	0.90	0.37	0.89	0.36
Uniform Delay, d1	29.7	10.7	43.2	6.4	44.8	39.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.2	1.1	20.5	0.1	12.9	0.7
Delay (s)	35.9	11.8	63.8	6.4	57.6	40.0
Level of Service	D	B	E	A	E	D
Approach Delay (s)	23.7			23.4	53.6	
Approach LOS	C			C	D	

Intersection Summary			
HCM 2000 Control Delay	28.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	117.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

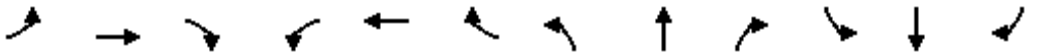
Intersection	
Int Delay, s/veh	0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1515	0	0	1260	0	20
Future Vol, veh/h	1515	0	0	1260	0	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1595	0	0	1326	0	21

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1595	0	-	1595
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.12	-	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.218	-	-	3.318
Pot Cap-1 Maneuver	-	-	411	-	0	132
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	411	-	-	132
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

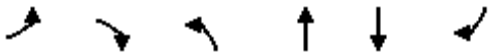
Approach	EB	WB	NB
HCM Control Delay, s	0	0	37.4
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	132	-	-	411	-
HCM Lane V/C Ratio	0.159	-	-	-	-
HCM Control Delay (s)	37.4	-	-	0	-
HCM Lane LOS	E	-	-	A	-
HCM 95th %tile Q(veh)	0.5	-	-	0	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	375	1065	100	10	780	85	40	40	10	150	95	390
Future Volume (vph)	375	1065	100	10	780	85	40	40	10	150	95	390
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	3405		1583	1792	1524	1752	1841		1770	1845	1495
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.66	1.00		0.72	1.00	1.00
Satd. Flow (perm)	3400	3405		1583	1792	1524	1213	1841		1346	1845	1495
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	395	1121	105	11	821	89	42	42	11	158	100	411
RTOR Reduction (vph)	0	4	0	0	0	43	0	9	0	0	0	248
Lane Group Flow (vph)	395	1222	0	11	821	46	42	44	0	158	100	163
Heavy Vehicles (%)	3%	5%	1%	14%	6%	6%	3%	0%	0%	2%	3%	8%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	18.3	69.6		1.0	52.3	52.3	19.5	19.5		18.3	18.3	18.3
Effective Green, g (s)	18.8	72.1		1.5	54.8	54.8	20.5	20.5		20.5	20.5	20.5
Actuated g/C Ratio	0.18	0.68		0.01	0.52	0.52	0.19	0.19		0.19	0.19	0.19
Clearance Time (s)	4.5	6.5		4.5	6.5	6.5	5.0	5.0		6.2	6.2	6.2
Vehicle Extension (s)	2.3	5.4		2.3	5.4	5.4	2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	602	2313		22	925	787	234	355		260	356	288
v/s Ratio Prot	c0.12	0.36		0.01	c0.46			0.02			0.05	
v/s Ratio Perm						0.03	0.03			c0.12		0.11
v/c Ratio	0.66	0.53		0.50	0.89	0.06	0.18	0.12		0.61	0.28	0.57
Uniform Delay, d1	40.6	8.5		51.9	22.9	12.8	35.8	35.4		39.1	36.5	38.8
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	2.2	0.5		10.0	11.2	0.1	0.3	0.1		3.4	0.3	2.1
Delay (s)	42.8	9.0		62.0	34.1	12.9	36.0	35.5		42.5	36.8	40.9
Level of Service	D	A		E	C	B	D	D		D	D	D
Approach Delay (s)		17.2			32.4			35.7			40.6	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	26.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	106.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	105	105	75	440	490	135
Future Volume (vph)	105	105	75	440	490	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1719	1429	3242	3539	3471	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1719	1429	3242	3539	3471	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	111	111	79	463	516	142
RTOR Reduction (vph)	0	92	0	0	0	81
Lane Group Flow (vph)	111	19	79	463	516	61
Heavy Vehicles (%)	5%	13%	8%	2%	4%	2%
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	6.9	6.9	3.5	23.1	15.6	15.6
Effective Green, g (s)	6.9	6.9	3.5	24.5	17.0	17.0
Actuated g/C Ratio	0.18	0.18	0.09	0.62	0.43	0.43
Clearance Time (s)	4.0	4.0	4.0	5.4	5.4	5.4
Vehicle Extension (s)	2.3	2.3	2.3	1.0	1.0	1.0
Lane Grp Cap (vph)	301	250	287	2200	1497	683
v/s Ratio Prot	c0.06		0.02	c0.13	c0.15	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.37	0.08	0.28	0.21	0.34	0.09
Uniform Delay, d1	14.3	13.6	16.8	3.2	7.5	6.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.1	0.3	0.0	0.1	0.0
Delay (s)	14.8	13.7	17.1	3.3	7.5	6.6
Level of Service	B	B	B	A	A	A
Approach Delay (s)	14.2			5.3	7.3	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	7.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	39.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	32.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	3.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	40	60	20	10	50
Future Vol, veh/h	20	40	60	20	10	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	100	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	42	63	21	11	53

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	149	74	0	0	84	0
Stage 1	74	-	-	-	-	-
Stage 2	75	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	843	988	-	-	1513	-
Stage 1	949	-	-	-	-	-
Stage 2	948	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	837	988	-	-	1513	-
Mov Cap-2 Maneuver	813	-	-	-	-	-
Stage 1	949	-	-	-	-	-
Stage 2	941	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9	0	1.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	813	988	1513	-
HCM Lane V/C Ratio	-	-	0.026	0.043	0.007	-
HCM Control Delay (s)	-	-	9.5	8.8	7.4	-
HCM Lane LOS	-	-	A	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	0	-

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	1200	25	25	1510	25	60
Future Volume (vph)	1200	25	25	1510	25	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	6.0	4.0	4.0
Lane Util. Factor	0.97		0.95	0.95	1.00	1.00
Frt	1.00		0.85	0.85	1.00	1.00
Flt Protected	0.95		1.00	1.00	0.95	1.00
Satd. Flow (prot)	3435		1513	1504	1770	1863
Flt Permitted	0.95		1.00	1.00	0.95	1.00
Satd. Flow (perm)	3435		1513	1504	1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1263	26	26	1589	26	63
RTOR Reduction (vph)	1	0	562	63	0	0
Lane Group Flow (vph)	1288	0	243	747	26	63
Turn Type	Prot		NA	pt+ov	Prot	NA
Protected Phases	8		2	2 8	1	6
Permitted Phases						
Actuated Green, G (s)	69.0		31.4	106.4	3.6	41.0
Effective Green, g (s)	71.0		33.4	106.4	3.6	41.0
Actuated g/C Ratio	0.59		0.28	0.89	0.03	0.34
Clearance Time (s)	6.0		6.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	2032		421	1333	53	636
v/s Ratio Prot	c0.37		0.16	c0.50	c0.01	0.03
v/s Ratio Perm						
v/c Ratio	0.63		0.58	0.56	0.49	0.10
Uniform Delay, d1	16.0		37.2	1.5	57.3	26.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5		5.7	1.7	7.0	0.1
Delay (s)	17.5		42.9	3.2	64.3	27.0
Level of Service	B		D	A	E	C
Approach Delay (s)	17.5		23.0			37.9
Approach LOS	B		C			D

Intersection Summary			
HCM 2000 Control Delay	21.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

MOVEMENT SUMMARY

Site: 101 [OR-212/162nd Ave]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: OR-212												
8	T1	26	2.0	0.595	9.4	LOS A	5.2	132.0	0.21	0.07	0.21	34.2
18	R2	1589	2.0	0.595	9.4	LOS A	5.2	132.0	0.21	0.07	0.21	37.6
Approach		1616	2.0	0.595	9.4	LOS A	5.2	132.0	0.21	0.07	0.21	37.5
East: OR-212												
1	L2	1263	2.0	0.475	7.4	LOS A	3.3	83.2	0.17	0.06	0.17	36.7
16	R2	26	2.0	0.475	7.4	LOS A	3.3	83.2	0.17	0.06	0.17	31.9
Approach		1289	2.0	0.475	7.4	LOS A	3.3	83.2	0.17	0.06	0.17	36.6
North: 162nd Ave												
7	L2	26	2.0	0.192	10.5	LOS B	0.6	16.2	0.71	0.71	0.71	32.4
4	T1	63	2.0	0.192	10.5	LOS B	0.6	16.2	0.71	0.71	0.71	32.5
Approach		89	2.0	0.192	10.5	LOS B	0.6	16.2	0.71	0.71	0.71	32.5
All Vehicles		2995	2.0	0.595	8.6	LOS A	5.2	132.0	0.21	0.08	0.21	36.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [OR-212/OR-224 2040 PM Two-Lane Roundabout]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: OR-224												
3	L2	630	5.0	1.095	92.2	LOS F	32.8	853.2	1.00	2.56	6.67	15.1
18	R2	188	1.0	0.354	12.2	LOS B	1.5	37.7	0.70	0.75	0.88	32.7
Approach		818	4.1	1.095	73.9	LOS F	32.8	853.2	0.93	2.14	5.34	17.1
East: OR-212												
1	L2	385	0.0	0.818	25.0	LOS D	12.7	324.1	0.94	1.36	2.26	27.5
6	T1	917	6.0	0.818	25.6	LOS D	12.7	324.1	0.92	1.36	2.27	27.5
Approach		1302	4.2	0.818	25.5	LOS D	12.7	324.1	0.92	1.36	2.26	27.5
West: OR-212/OR-224												
2	T1	1391	2.0	1.419	208.7	LOS F	160.3	4071.7	1.00	4.64	10.59	8.6
12	R2	1411	3.0	1.454	224.2	LOS F	169.5	4340.2	1.00	4.83	11.06	7.9
Approach		2802	2.5	1.454	216.5	LOS F	169.5	4340.2	1.00	4.74	10.83	8.3
All Vehicles		4922	3.2	1.454	142.3	LOS F	169.5	4340.2	0.97	3.41	7.65	11.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [OR-212/OR-224 2040 PM Two-Lane Roundabout with Reccommended Improvements]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: OR-224												
3	L2	630	5.0	1.075	102.2	LOS F	21.4	549.5	1.00	2.13	5.63	14.2
18	R2	188	1.0	1.075	97.7	LOS F	21.4	549.5	1.00	2.19	5.83	14.5
Approach		818	4.1	1.075	101.2	LOS F	21.4	549.5	1.00	2.14	5.68	14.2
East: OR-212												
1	L2	385	0.0	0.848	29.7	LOS D	13.5	344.9	0.94	1.43	2.49	26.0
6	T1	917	6.0	0.848	28.9	LOS D	13.7	359.1	0.92	1.43	2.50	26.5
Approach		1302	4.2	0.848	29.1	LOS D	13.7	359.1	0.93	1.43	2.50	26.3
West: OR-212/OR-224												
2	T1	1391	2.0	0.714	15.6	LOS C	10.4	264.6	0.80	1.00	1.46	32.1
12	R2	1411	3.0	0.792	17.3	LOS C	15.1	387.1	0.83	1.08	1.61	30.1
Approach		2802	2.5	0.792	16.5	LOS C	15.1	387.1	0.81	1.04	1.54	31.1
All Vehicles		4922	3.2	1.075	33.9	LOS D	21.4	549.5	0.87	1.33	2.48	24.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [OR-212/OR-224 2040 AM Two-Lane Roundabout]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: OR-224												
3	L2	1224	5.0	1.641	309.9	LOS F	167.0	4343.0	1.00	5.86	16.70	6.3
18	R2	161	7.0	0.243	8.4	LOS A	0.9	23.4	0.60	0.60	0.60	33.8
Approach		1385	5.2	1.641	274.9	LOS F	167.0	4343.0	0.95	5.25	14.83	6.9
East: OR-212												
1	L2	234	8.0	1.171	115.5	LOS F	51.9	1366.8	1.00	3.13	8.12	13.2
6	T1	1291	6.0	1.171	115.3	LOS F	52.2	1367.6	1.00	3.13	8.12	13.3
Approach		1525	6.3	1.171	115.3	LOS F	52.2	1367.6	1.00	3.13	8.12	13.3
West: OR-212/OR-224												
2	T1	630	11.0	0.583	11.0	LOS B	3.5	95.4	0.53	0.40	0.53	33.2
12	R2	558	18.0	0.574	11.3	LOS B	3.1	88.2	0.51	0.38	0.51	31.1
Approach		1188	14.3	0.583	11.1	LOS B	3.5	95.4	0.52	0.39	0.52	32.2
All Vehicles		4098	8.3	1.641	139.0	LOS F	167.0	4343.0	0.85	3.05	8.19	11.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [OR-212/OR-224 2040 AM Two-Lane Roundabout with Recommended Improvements]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: OR-224												
3	L2	1224	5.0	0.976	52.3	LOS F	24.5	638.9	1.00	1.96	4.13	20.3
18	R2	161	7.0	0.976	50.9	LOS F	24.5	638.9	1.00	1.98	4.17	20.2
Approach		1385	5.2	0.976	52.2	LOS F	24.5	638.9	1.00	1.96	4.14	20.3
East: OR-212												
1	L2	234	8.0	1.821	403.5	LOS F	109.6	2884.8	1.00	4.91	16.51	5.0
6	T1	1291	6.0	1.821	400.9	LOS F	125.8	3294.9	1.00	5.21	17.58	5.0
Approach		1525	6.3	1.821	401.3	LOS F	125.8	3294.9	1.00	5.16	17.42	5.0
West: OR-212/OR-224												
2	T1	630	11.0	0.283	5.9	LOS A	1.2	33.7	0.31	0.18	0.31	35.9
12	R2	558	18.0	0.288	6.0	LOS A	1.2	33.5	0.30	0.17	0.30	33.5
Approach		1188	14.3	0.288	5.9	LOS A	1.2	33.7	0.30	0.18	0.30	34.7
All Vehicles		4098	8.3	1.821	168.7	LOS F	125.8	3294.9	0.80	2.64	7.97	10.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	40	1640	10	45	680	10
Future Volume (vph)	40	1640	10	45	680	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1568	1805	3406	3335	1599
Flt Permitted	1.00	1.00	0.73	1.00	0.95	1.00
Satd. Flow (perm)	3539	1568	1384	3406	3335	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	42	1708	10	47	708	10
RTOR Reduction (vph)	0	134	0	0	0	1
Lane Group Flow (vph)	42	1574	10	47	708	9
Heavy Vehicles (%)	2%	3%	0%	6%	5%	1%
Turn Type	NA	custom	Perm	NA	Prot	Perm
Protected Phases	2	4		6	8	
Permitted Phases			6			8
Actuated Green, G (s)	7.0	96.0	7.0	7.0	96.0	96.0
Effective Green, g (s)	7.0	96.0	7.0	7.0	96.0	96.0
Actuated g/C Ratio	0.06	0.86	0.06	0.06	0.86	0.86
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	223	1356	87	214	2884	1382
v/s Ratio Prot	0.01	c1.00		c0.01	0.21	
v/s Ratio Perm			0.01			0.01
v/c Ratio	0.19	1.16	0.11	0.22	0.25	0.01
Uniform Delay, d1	49.3	7.5	49.1	49.4	1.3	1.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	80.9	0.6	0.5	0.0	0.0
Delay (s)	49.7	88.4	49.7	49.9	1.3	1.0
Level of Service	D	F	D	D	A	A
Approach Delay (s)	87.5			49.9	1.3	
Approach LOS	F			D	A	

Intersection Summary			
HCM 2000 Control Delay	62.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	111.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	111.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

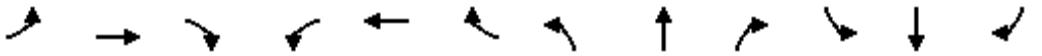
Intersection	
Int Delay, s/veh	6.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕		↰	↱	
Traffic Vol, veh/h	40	5	0	0	5	5	0	0	0	0	0	45
Future Vol, veh/h	40	5	0	0	5	5	0	0	0	0	0	45
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	42	5	0	0	5	5	0	0	0	0	0	47

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	10	0	0	5	0	0	120	99	5	97	97	8
Stage 1	-	-	-	-	-	-	89	89	-	8	8	-
Stage 2	-	-	-	-	-	-	31	10	-	89	89	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1610	-	-	1616	-	-	855	791	1078	885	793	1074
Stage 1	-	-	-	-	-	-	918	821	-	1013	889	-
Stage 2	-	-	-	-	-	-	986	887	-	918	821	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1610	-	-	1616	-	-	801	770	1078	867	772	1074
Mov Cap-2 Maneuver	-	-	-	-	-	-	801	770	-	867	772	-
Stage 1	-	-	-	-	-	-	894	800	-	987	889	-
Stage 2	-	-	-	-	-	-	943	887	-	894	800	-

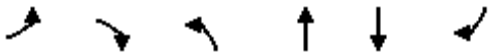
Approach	EB	WB	NB	SB
HCM Control Delay, s	6.5	0	0	8.5
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	-	1610	-	-	1616	-	-	-	1074
HCM Lane V/C Ratio	-	0.026	-	-	-	-	-	-	0.044
HCM Control Delay (s)	0	7.3	0	-	0	-	-	0	8.5
HCM Lane LOS	A	A	A	-	A	-	-	A	A
HCM 95th %tile Q(veh)	-	0.1	-	-	0	-	-	-	0.1



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	360	1125	105	10	780	90	60	60	15	190	120	460
Future Volume (vph)	360	1125	105	10	780	90	60	60	15	190	120	460
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3405		1583	1792	1524	1752	1842		1770	1845	1495
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.60	1.00		0.70	1.00	1.00
Satd. Flow (perm)	1752	3405		1583	1792	1524	1115	1842		1313	1845	1495
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	379	1184	111	11	821	95	63	63	16	200	126	484
RTOR Reduction (vph)	0	4	0	0	0	53	0	9	0	0	0	309
Lane Group Flow (vph)	379	1291	0	11	821	42	63	70	0	200	126	175
Heavy Vehicles (%)	3%	5%	1%	14%	6%	6%	3%	0%	0%	2%	3%	8%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	25.3	71.8		1.0	47.5	47.5	23.6	23.6		22.4	22.4	22.4
Effective Green, g (s)	25.8	74.3		1.5	50.0	50.0	24.6	24.6		24.6	24.6	24.6
Actuated g/C Ratio	0.23	0.66		0.01	0.44	0.44	0.22	0.22		0.22	0.22	0.22
Clearance Time (s)	4.5	6.5		4.5	6.5	6.5	5.0	5.0		6.2	6.2	6.2
Vehicle Extension (s)	2.3	5.4		2.3	5.4	5.4	2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	402	2250		21	797	677	244	403		287	403	327
v/s Ratio Prot	c0.22	0.38		0.01	c0.46			0.04			0.07	
v/s Ratio Perm						0.03	0.06			c0.15		0.12
v/c Ratio	0.94	0.57		0.52	1.03	0.06	0.26	0.17		0.70	0.31	0.54
Uniform Delay, d1	42.6	10.4		55.1	31.2	17.8	36.3	35.7		40.5	36.8	38.9
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	30.4	0.6		14.3	39.8	0.1	0.4	0.2		6.6	0.3	1.3
Delay (s)	73.0	11.0		69.4	71.0	17.9	36.8	35.8		47.1	37.1	40.2
Level of Service	E	B		E	E	B	D	D		D	D	D
Approach Delay (s)		25.1			65.6			36.2			41.4	
Approach LOS		C			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	39.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	112.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	125	155	90	445	585	165
Future Volume (vph)	125	155	90	445	585	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.4	5.4	5.4
Lane Util. Factor	1.00	1.00	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1719	1429	3242	3539	3471	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1719	1429	3242	3539	3471	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	132	163	95	468	616	174
RTOR Reduction (vph)	0	129	0	0	0	105
Lane Group Flow (vph)	132	34	95	468	616	69
Heavy Vehicles (%)	5%	13%	8%	2%	4%	2%
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	9.9	9.9	5.4	28.3	18.9	18.9
Effective Green, g (s)	9.9	9.9	5.4	28.3	18.9	18.9
Actuated g/C Ratio	0.21	0.21	0.11	0.59	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	5.4	5.4	5.4
Vehicle Extension (s)	2.3	2.3	2.3	1.0	1.0	1.0
Lane Grp Cap (vph)	357	297	367	2104	1378	628
v/s Ratio Prot	c0.08		0.03	c0.13	c0.18	
v/s Ratio Perm		0.02				0.04
v/c Ratio	0.37	0.11	0.26	0.22	0.45	0.11
Uniform Delay, d1	16.2	15.3	19.3	4.5	10.5	9.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.1	0.2	0.0	0.1	0.0
Delay (s)	16.6	15.4	19.5	4.5	10.6	9.1
Level of Service	B	B	B	A	B	A
Approach Delay (s)	15.9			7.1	10.3	
Approach LOS	B			A	B	

Intersection Summary			
HCM 2000 Control Delay	10.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	47.6	Sum of lost time (s)	13.4
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	4.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	30	40	60	40	40	15
Future Vol, veh/h	30	40	60	40	40	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	100	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	32	42	63	42	42	16

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	184	84	0	0	105	0
Stage 1	84	-	-	-	-	-
Stage 2	100	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	805	975	-	-	1486	-
Stage 1	939	-	-	-	-	-
Stage 2	924	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	782	975	-	-	1486	-
Mov Cap-2 Maneuver	766	-	-	-	-	-
Stage 1	913	-	-	-	-	-
Stage 2	924	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	5.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	766	975	1486	-
HCM Lane V/C Ratio	-	-	0.041	0.043	0.028	-
HCM Control Delay (s)	-	-	9.9	8.9	7.5	-
HCM Lane LOS	-	-	A	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	0.1	-

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	40	1640	10	45	680	10
Future Volume (vph)	40	1640	10	45	680	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.88	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	2760	1805	3406	1719	1599
Flt Permitted	1.00	1.00	0.73	1.00	0.95	1.00
Satd. Flow (perm)	1863	2760	1386	3406	1719	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	42	1708	10	47	708	10
RTOR Reduction (vph)	0	731	0	0	0	4
Lane Group Flow (vph)	42	977	10	47	708	6
Heavy Vehicles (%)	2%	3%	0%	6%	5%	1%
Turn Type	NA	custom	Perm	NA	Prot	Perm
Protected Phases	2	4		6	8	
Permitted Phases			6			8
Actuated Green, G (s)	6.6	19.5	6.6	6.6	19.5	19.5
Effective Green, g (s)	6.6	19.5	6.6	6.6	19.5	19.5
Actuated g/C Ratio	0.19	0.57	0.19	0.19	0.57	0.57
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	360	1578	268	659	983	914
v/s Ratio Prot	c0.02	0.35		0.01	c0.41	
v/s Ratio Perm			0.01			0.00
v/c Ratio	0.12	0.62	0.04	0.07	0.72	0.01
Uniform Delay, d1	11.3	4.8	11.2	11.2	5.3	3.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.7	0.1	0.0	2.6	0.0
Delay (s)	11.5	5.6	11.2	11.3	7.9	3.1
Level of Service	B	A	B	B	A	A
Approach Delay (s)	5.7			11.3	7.9	
Approach LOS	A			B	A	

Intersection Summary			
HCM 2000 Control Delay	6.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	34.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	6.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	5	0	0	5	5	0	0	0	0	0	45
Future Vol, veh/h	40	5	0	0	5	5	0	0	0	0	0	45
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	42	5	0	0	5	5	0	0	0	0	0	47

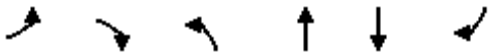
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	10	0	0	5	0	0	120	99	5	97	97	8
Stage 1	-	-	-	-	-	-	89	89	-	8	8	-
Stage 2	-	-	-	-	-	-	31	10	-	89	89	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1610	-	-	1616	-	-	855	791	1078	885	793	1074
Stage 1	-	-	-	-	-	-	918	821	-	1013	889	-
Stage 2	-	-	-	-	-	-	986	887	-	918	821	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1610	-	-	1616	-	-	801	770	1078	867	772	1074
Mov Cap-2 Maneuver	-	-	-	-	-	-	801	770	-	867	772	-
Stage 1	-	-	-	-	-	-	894	800	-	987	889	-
Stage 2	-	-	-	-	-	-	943	887	-	894	800	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	6.5	0	0	8.5
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	-	1610	-	-	1616	-	-	-	1074
HCM Lane V/C Ratio	-	0.026	-	-	-	-	-	-	0.044
HCM Control Delay (s)	0	7.3	0	-	0	-	-	0	8.5
HCM Lane LOS	A	A	A	-	A	-	-	A	A
HCM 95th %tile Q(veh)	-	0.1	-	-	0	-	-	-	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	360	1125	105	10	780	90	60	60	15	190	120	460
Future Volume (vph)	360	1125	105	10	780	90	60	60	15	190	120	460
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	3405		1583	1792	1524	1752	1842		1770	1845	1495
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.61	1.00		0.71	1.00	1.00
Satd. Flow (perm)	3400	3405		1583	1792	1524	1127	1842		1314	1845	1495
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	379	1184	111	11	821	95	63	63	16	200	126	484
RTOR Reduction (vph)	0	5	0	0	0	48	0	8	0	0	0	231
Lane Group Flow (vph)	379	1290	0	11	821	47	63	71	0	200	126	253
Heavy Vehicles (%)	3%	5%	1%	14%	6%	6%	3%	0%	0%	2%	3%	8%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	17.8	69.5		1.0	52.7	52.7	24.2	24.2		23.0	23.0	23.0
Effective Green, g (s)	18.3	72.0		1.5	55.2	55.2	25.2	25.2		25.2	25.2	25.2
Actuated g/C Ratio	0.17	0.65		0.01	0.50	0.50	0.23	0.23		0.23	0.23	0.23
Clearance Time (s)	4.5	6.5		4.5	6.5	6.5	5.0	5.0		6.2	6.2	6.2
Vehicle Extension (s)	2.3	5.4		2.3	5.4	5.4	2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	562	2214		21	893	759	256	419		299	420	340
v/s Ratio Prot	c0.11	0.38		0.01	c0.46			0.04			0.07	
v/s Ratio Perm						0.03	0.06			0.15		c0.17
v/c Ratio	0.67	0.58		0.52	0.92	0.06	0.25	0.17		0.67	0.30	0.74
Uniform Delay, d1	43.4	10.9		54.2	25.7	14.4	35.0	34.3		38.9	35.4	39.8
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	2.7	0.7		14.3	15.0	0.1	0.4	0.1		5.0	0.3	8.1
Delay (s)	46.1	11.6		68.5	40.7	14.4	35.3	34.5		44.0	35.7	47.9
Level of Service	D	B		E	D	B	D	C		D	D	D
Approach Delay (s)		19.4			38.4			34.9			45.0	
Approach LOS		B			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	30.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	110.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	125	155	90	445	585	165
Future Volume (vph)	125	155	90	445	585	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.4	5.4	5.4
Lane Util. Factor	1.00	1.00	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1719	1429	3242	3539	3471	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1719	1429	3242	3539	3471	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	132	163	95	468	616	174
RTOR Reduction (vph)	0	129	0	0	0	105
Lane Group Flow (vph)	132	34	95	468	616	69
Heavy Vehicles (%)	5%	13%	8%	2%	4%	2%
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	9.9	9.9	5.4	28.3	18.9	18.9
Effective Green, g (s)	9.9	9.9	5.4	28.3	18.9	18.9
Actuated g/C Ratio	0.21	0.21	0.11	0.59	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	5.4	5.4	5.4
Vehicle Extension (s)	2.3	2.3	2.3	1.0	1.0	1.0
Lane Grp Cap (vph)	357	297	367	2104	1378	628
v/s Ratio Prot	c0.08		0.03	c0.13	c0.18	
v/s Ratio Perm		0.02				0.04
v/c Ratio	0.37	0.11	0.26	0.22	0.45	0.11
Uniform Delay, d1	16.2	15.3	19.3	4.5	10.5	9.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.1	0.2	0.0	0.1	0.0
Delay (s)	16.6	15.4	19.5	4.5	10.6	9.1
Level of Service	B	B	B	A	B	A
Approach Delay (s)	15.9			7.1	10.3	
Approach LOS	B			A	B	

Intersection Summary			
HCM 2000 Control Delay	10.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	47.6	Sum of lost time (s)	13.4
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	4.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	30	40	60	40	40	15
Future Vol, veh/h	30	40	60	40	40	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	100	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	32	42	63	42	42	16

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	184	84	0	0	105	0
Stage 1	84	-	-	-	-	-
Stage 2	100	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	805	975	-	-	1486	-
Stage 1	939	-	-	-	-	-
Stage 2	924	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	782	975	-	-	1486	-
Mov Cap-2 Maneuver	766	-	-	-	-	-
Stage 1	913	-	-	-	-	-
Stage 2	924	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	5.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	766	975	1486	-
HCM Lane V/C Ratio	-	-	0.041	0.043	0.028	-
HCM Control Delay (s)	-	-	9.9	8.9	7.5	-
HCM Lane LOS	-	-	A	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	0.1	-