APPENDIX 2:TRAFFIC ANALYSES

APPENDIX 2A: SUPPORTING TRAFFIC ANALYSES AND TECHNICAL DOCUMENTATION

SOUTHERN CONNECTOR/CHAMPLAIN PARKWAY PROJECT
CHITTENDEN COUNTY, VERMONT

LIMITED SCOPE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURLINGTON, VERMONT MEGC-M5000 (1)

APPENDIX – TRAFFIC

DESIGN YEAR TRAFFIC VOLUMES

Vehicle traffic volumes were originally developed for the Project's NEPA evaluation and Project design in 2004, for the Draft Supplemental Environmental Impact Statement (DSEIS) published in 2006 and FSEIS in 2009, based on the regional travel demand model that was developed for the Chittenden County Regional Planning Commission (CCRPC, which at the time was named the Chittenden County Metropolitan Planning Organization, CCMPO). The regional model captures the interaction of transportation demand and supply and is used by the CCRPC as a basis for performing comprehensive regional planning and developing the Metropolitan Transportation Plan (MTP) to address short-and long-range transportation needs. The model that was current at the time of the Supplemental Environmental Impact Statement (SEIS) was calibrated to a base year 1998, and provided model runs for the year 2002, 2012 and 2022 planning horizons. These model outputs were then used to develop the weekday AM and PM peak hours for the Project's Estimated Time of Completion (ETC) and ETC+20 design horizon years which were the basis for the SEIS transportation analysis.

While regional travel demand models are used to identify future trends, it is common to perform post-model refinements at the intersection level to enhance the model accuracy for application to a specific project. These refinements involve an adjustment process to correlate the model's base year conditions to the project's base year and design horizon years. Essentially, this process uses the model to forecast the changes that will occur between the model's base and future years and then applies those changes to actual contemporaneous traffic counts for the project's base year. See the Transportation Modeling Methodology Documentation (2009 FSEIS Volume II, Appendix 3B) for more information about the modeling and forecasting methodology.

The design horizons considered in the 2009 FSEIS were 2008 (ETC) and 2028 (ETC+20). The traffic volumes for these design horizons were reviewed and approved by the City, VTrans, and FHWA for use as the basis of the traffic analyses for the Project. In early 2005, the design team learned that the regional model had been updated by CCRPC and that they were in the process of having this new model validated by FHWA. CCRPC staff identified that there were no substantive changes in volume trends associated with this updated model, and that the forecasted volumes as developed for the SEIS were applicable.

The path to construction did not follow the Project schedule anticipated in the 2009 FSEIS. However, the design volumes for the Project were independently checked by Resource Systems Group, Inc. (RSG) in 2011 as part of the State's Act 250 review of the Project. Act 250 is Vermont's land use and development law which provides a public process for reviewing the environmental, social and fiscal consequences of major developments and construction projects. In their review, RSG concluded that the ETC and ETC+20

traffic volumes from the FSEIS were still appropriate to be used for the analysis and design of the Project even though the construction schedule had been delayed.[1] This conclusion was also later affirmed in 2013 in Pre-filed Testimony prepared by Clough, Harbour & Associates, LLP as part of a Vermont Environmental Court Appeal of the Act 250 Permit.[2]

There have been numerous other occasions between 2011 and 2016 where traffic counts have been collected at key Project intersections and reviewed by the City and the Champlain Parkway design team for consistency with the ETC and ETC+20 design volumes. This data was collected as part of various land development impact studies, community planning studies, and Burlington Department of Public Works (DPW) projects. They are listed below (the dates noted in parentheses are the year(s) of the count data in the respective report):

- Pine Street/Howard Street Intersection Signal Warrant Analysis: 2011 (2011 data)
- Pine Street/Lakeside Avenue Interim Signal Replacement project: 2015 (2013 data)
- Maple-King Neighborhood Traffic Counts: (2013 data)
- Plan BTV South Planning Study - Phase 1 Existing Conditions Report: 2015 (2014 data)
- Burlington City Place Redevelopment (Burlington CCD) Traffic Impact Study: 2016 (2014 & 2016 data)
- City Market Development (Flynn Avenue) Traffic Impact Study: 2016 (2014 & 2016 data)
- Rail Enterprise Project Phase I: Scoping/Planning and Environmental Linkages (PEL) Study: 2016[3]
- Petra Cliffs Climbing Center (Briggs Street) Traffic Impact Study: 2018 (2018 data)
- 44-50 Lakeside Avenue Redevelopment Traffic Impact Study: 2018 (2018 data)

In each of these cases, the traffic counts confirmed that the existing volumes were consistent with the anticipated growth (such as in the areas of Pine Street and Lakeside Avenue where redevelopment has occurred), but that the projected future design volumes were still conservatively higher.

Most recently, traffic volumes in the Project study area were reviewed as part of a Project Reevaluation prepared in May 2019.[4] The Reevaluation included a comprehensive compilation of historic volume data for the period 2003-2016. The reevaluation of traffic conditions concluded that, although the Project's construction schedule has been pushed out, the traffic data and forecasts utilized for the Project from the 2009 FSEIS are still relevant. This is because actual traffic data collected in the Project area in recent years shows that the modeling for the 2009 FSEIS used conservative growth assumptions, resulting in a higher forecast of traffic volumes than has actually occurred to date. Thus, traffic volumes have not yet reached the levels forecast for the 2008 ETC, making it appropriate to continue to use the 2008 forecast traffic

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[1] *Champlain Parkway Traffic and Safety Analysis: Section 3.2.1 – Traffic Forecast Review*, Resource Systems Group, Inc., February 18, 2011 (Vermont Agency of Natural Resources ANR Act 250 Exhibit 14).

[2] *Champlain Parkway Traffic and Safety Analysis for Vermont Environmental Court Appeal: Section 3.3 – Traffic Forecast Review*, Clough, Harbour & Associates, LLP, April 5, 2013.

[3] *The REP study used the Champlain Parkway volume forecasts (2009 FSEIS) and CCRPC regional model forecasts as the basis of the analysis.*

[4] *Southern Connector/Champlain Parkway Project MEGC-M5000(1) – Reevaluation of 2009 Final Supplemental Environmental Impact Statement*, Clough Harbour & Associates in association with Stantec Consulting Services, Inc., March 2019

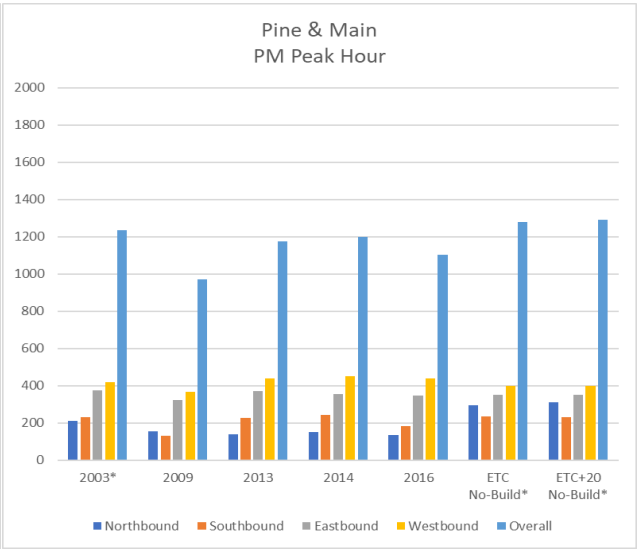
volumes for the ETC of the Project. However, these design volumes are not so conservatively high as to affect the overall objectives of the Project or the elements of the design.

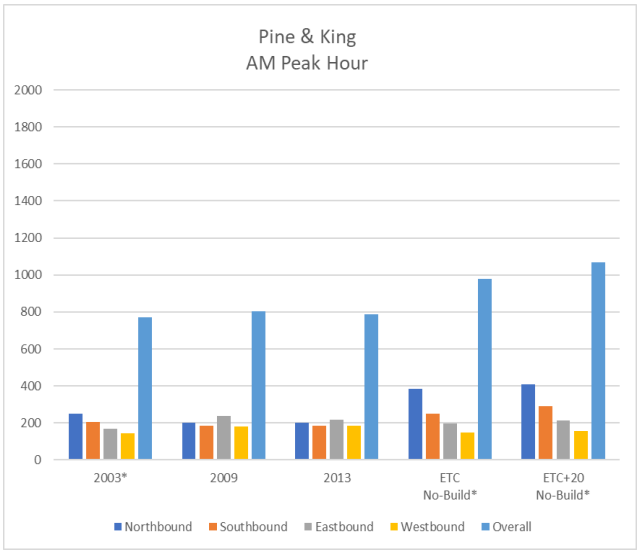
The May 2019 Reevaluation also reviewed and documented traffic forecasts in the Maple and King Street Neighborhood from the Railyard Enterprise Project (REP) Scoping/PEL study. The REP project is located in the Waterfront South area of Burlington. The study explored alternatives to enhance multimodal transportation safety and mobility and advance economic development opportunities through the creation of new urban streets. The REP study used the projected ETC and ETC+20 Build volumes from the 2009 FSEIS for the Champlain Parkway as the base condition for its traffic analyses. However, the REP study also included a sensitivity analysis using CCRPC's current regional travel demand model for the 2015 and 2035 planning horizon years. The CCRPC model used for the REP study was a model developed in 2013 calibrated to 2010 base year traffic volumes. The travel demand model forecasts for years 2015 and 2035 included current socio-economic and land use projections and information provided by the City. These models also reflect the effects of other reasonably foreseeable transportation improvements that are programmed on the Transportation Improvement Program (TIP). The TIP includes the Project as well as a variety of spot safety/operations improvement projects, pedestrian and bicycle facility enhancements, and the intersection and interchange improvements comprising the alternatives to the Chittenden County Circumferential Highway project.

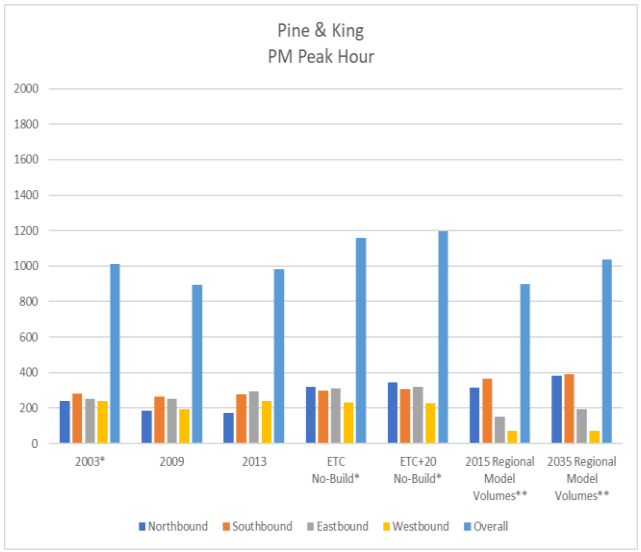
As described in the May 2019 Reevaluation Report the CCRPC model forecasts along Pine Street for the 2015 and 2035 planning horizon years are lower than the design volumes used for the Project. However, these more recently modeled results further confirm that the Parkway's design volumes are still appropriate to be used for the analysis and design of the Project. Figure 1 shows the traffic volumes for key Project intersections along Pine Street from Lakeside Avenue to Main Street for the ETC and ETC+20 design horizons from the 2009 FSEIS in the context of the 2003-2016 volume trends. These exhibits also show the CCRPC model-based volumes from the REP Scoping/PEL report for the 2015 and 2035 years, where available (note that the REP study did not evaluate the AM peak hour condition).

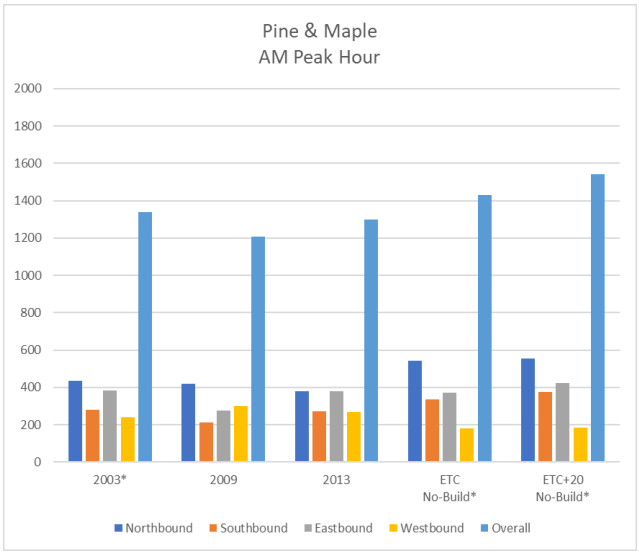
The fact that traffic volumes have increased at a slower rate makes it appropriate to continue to use the previous ETC and ETC+20 volumes from the 2009 FSEIS as the ETC and ETC+20 traffic forecasts for the Project. Further, the fact that traffic increased at a slower rate than forecasted does not invalidate the results of the traffic analysis, it simply makes the traffic analysis a more conservative forecast of future conditions. One conclusion from the slower traffic growth is that if traffic continues to grow at a slower pace, the design life of the Project will effectively be extended.

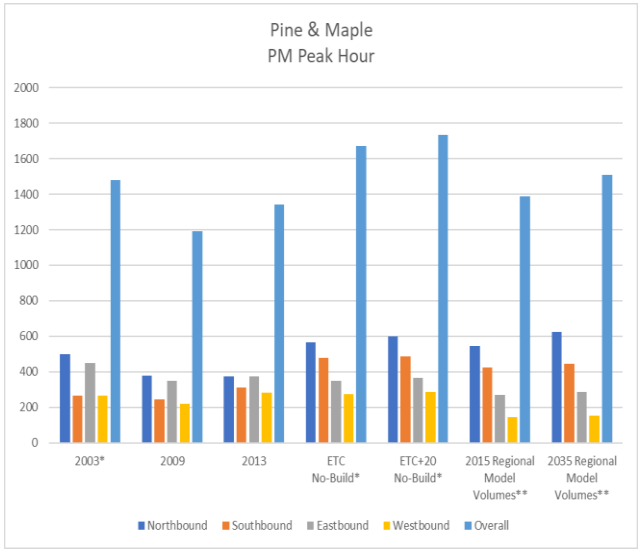
Figure 1: Traffic Volumes at Key Pine Street Project Intersections







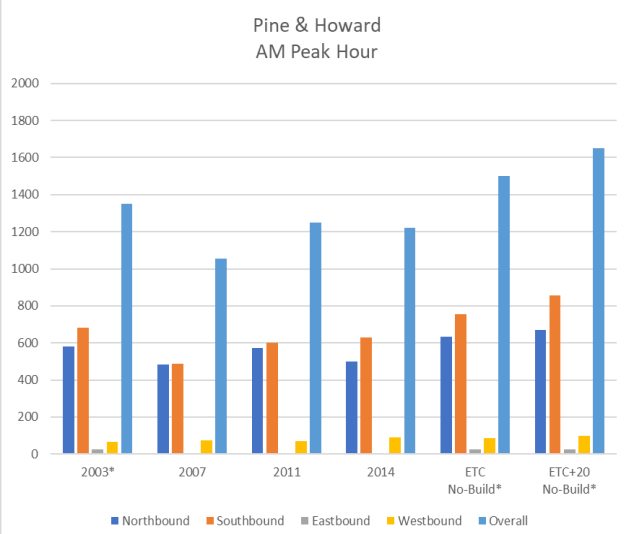


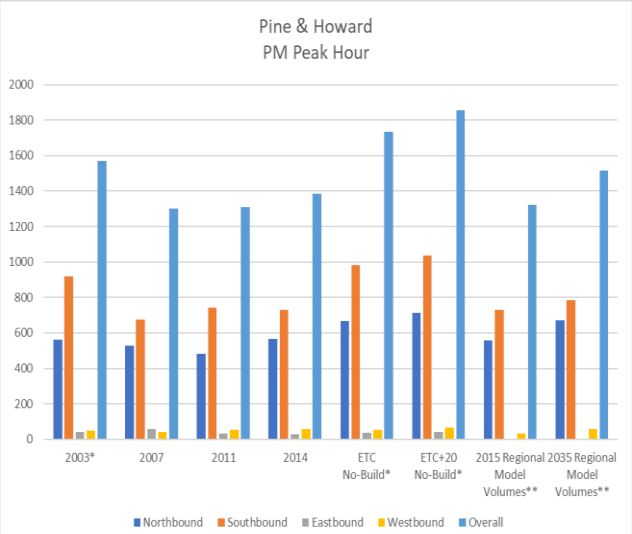


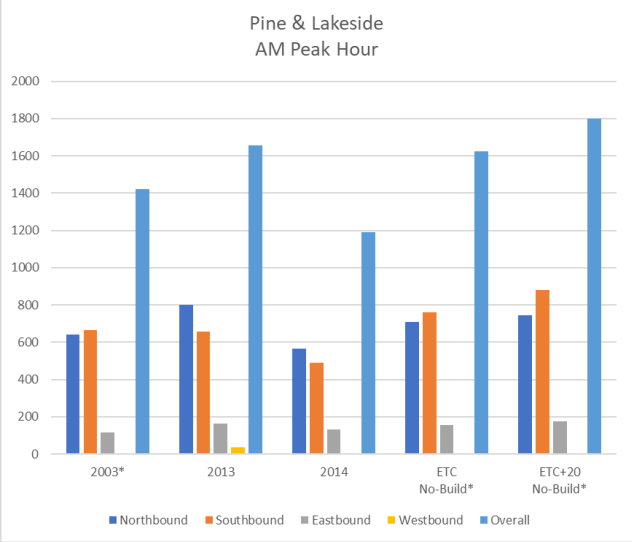
* *volumes from the Champlain Parkway 2009 FSEIS*

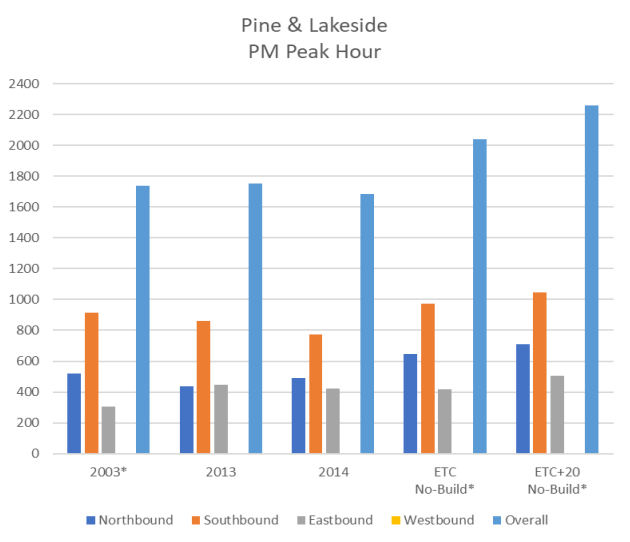
** *volumes from the REP Scoping/PEL Report*

Figure 1: Traffic Volumes at Key Pine Street Project Intersections (continued)









* *volumes from the Champlain Parkway 2009 FSEIS*

** *volumes from the REP Scoping/PEL Report*

TRAFFIC OPERATIONS METHODOLOGY

There have been two updates to the HCM following the completion of the 2009 FSEIS: HCM 2010, and HCM 6 (released in 2016). Each of these editions of the HCM have included new or enhanced tools and methodologies for analyzing a variety of urban and rural roadway networks incorporating the findings of ongoing research. Many of the changes in these HCM updates pertain to aspects of transportation system performance on freeway facilities, managed-lane facilities (HOV lanes), alternative interchange/ intersection forms,[5] and off-road pedestrian and bicycle facilities. The methodologies for analysis of vehicle traffic operations at conventional intersection types with signal or stop-sign control have not changed appreciably from the HCM 2000 edition. Also, the HCM 2010 and HCM 6 versions of the manual do not provide methodologies for calculating intersection delays at certain intersection types that are included in the Project. These include signalized intersections with exclusive pedestrian phases that operate in a coordinated signal system and complex signalized intersections that function with clustered phasing to accommodate more than 4 approaches (also in a coordinated signal system). Because of these project elements, the HCM 2000 methodologies as used in the 2009 FSEIS continue to be applicable for the analysis of the Project.

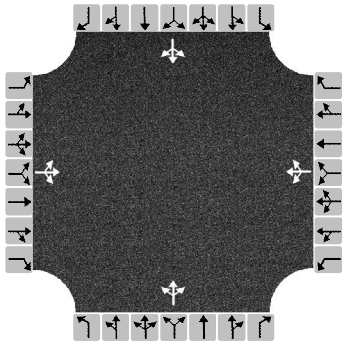
[5] *Groups of two or more closely spaced intersections that are operationally interdependent and function as a single unit and where one or more traffic movements are rerouted to nearby secondary junctions. Examples include diverging-diamond interchanges, restricted crossing U-turn intersections, and median U-turn intersections.*

APPENDIX 2B: 2020 LS DSEIS UPDATED TRAFFIC CAPACITY ANALYSIS

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst	CHA	Intersection	Pine St & Maple St
Agency/Co.		Jurisdiction	City of Burlington, VT
Date Performed	1/7/2020	East/West Street	Maple St
Analysis Year		North/South Street	Pine St
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.90
Time Analyzed	ETC AM Peak Hour NO-BUILD CONDITION		
Project Description	Champlain Parkway CHA File 008659.000		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	5	55	310	70	100	10	120	370	55	5	325	5
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	411			200			606			372		
Percent Heavy Vehicles	2			2			2			2		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.365			0.178			0.538			0.331		
Final Departure Headway, hd (s)	7.44			8.83			7.73			7.93		
Final Degree of Utilization, x	0.850			0.491			1.301			0.820		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	5.44			6.83			5.73			5.93		

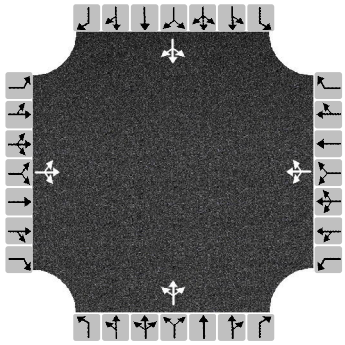
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	411			200			606			372		
Capacity	484			407			466			454		
95% Queue Length, Q_{95} (veh)	8.7			2.6			26.2			7.8		
Control Delay (s/veh)	39.7			20.1			173.9			38.0		
Level of Service, LOS	E			C			F			E		
Approach Delay (s/veh)	39.7			20.1			173.9			38.0		
Approach LOS	E			C			F			E		
Intersection Delay, s/veh | LOS	88.0						F					

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst	CHA	Intersection	Pine St & Maple St
Agency/Co.		Jurisdiction	City of Burlington, VT
Date Performed	1/7/2020	East/West Street	Maple St
Analysis Year		North/South Street	Pine St
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.90
Time Analyzed	ETC PM Peak Hour NO-BUILD CONDITION		
Project Description	Champlain Parkway CHA File 008659.000		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	5	140	205	60	105	110	300	205	60	60	415	5
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	389			306			628			533		
Percent Heavy Vehicles	2			2			2			2		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.346			0.272			0.558			0.474		
Final Departure Headway, hd (s)	8.69			9.24			8.95			8.93		
Final Degree of Utilization, x	0.938			0.784			1.561			1.322		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	6.69			7.24			6.95			6.93		

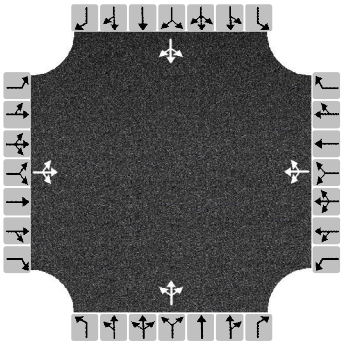
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	389			306			628			533		
Capacity	414			390			402			403		
95% Queue Length, Q_{95} (veh)	10.6			6.7			34.9			24.4		
Control Delay (s/veh)	59.9			38.6			287.2			187.3		
Level of Service, LOS	F			E			F			F		
Approach Delay (s/veh)	59.9			38.6			287.2			187.3		
Approach LOS	F			E			F			F		
Intersection Delay, s/veh | LOS	169.9						F					

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst	CHA	Intersection	Pine St & Maple St
Agency/Co.		Jurisdiction	City of Burlington, VT
Date Performed	1/7/2020	East/West Street	Maple St
Analysis Year		North/South Street	Pine St
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.90
Time Analyzed	ETC+20 AM Peak Hour NO-BUILD CONDITION		
Project Description	Champlain Parkway CHA File 008659.000		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	5	55	365	75	100	10	105	395	55	5	365	5
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	472			206			617			417		
Percent Heavy Vehicles	2			2			2			2		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.420			0.183			0.548			0.370		
Final Departure Headway, hd (s)	7.87			9.58			8.36			8.42		
Final Degree of Utilization, x	1.033			0.547			1.433			0.975		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	5.87			7.58			6.36			6.42		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	472			206			617			417		
Capacity	457			376			430			427		
95% Queue Length, Q_{95} (veh)	14.3			3.2			30.8			11.8		
Control Delay (s/veh)	79.2			23.6			230.7			66.8		
Level of Service, LOS	F			C			F			F		
Approach Delay (s/veh)	79.2			23.6			230.7			66.8		
Approach LOS	F			C			F			F		
Intersection Delay, s/veh | LOS	124.1						F					

HCS7 All-Way Stop Control Report

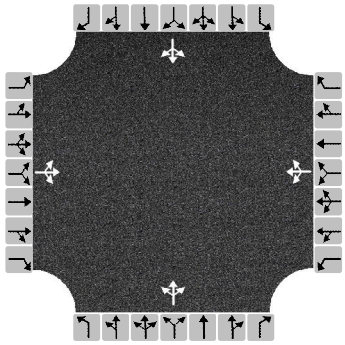
General Information

Analyst	CHA
Agency/Co.	
Date Performed	1/7/2020
Analysis Year	2020
Analysis Time Period (hrs)	0.25
Time Analyzed	ETC+20 PM Peak Hour NO-BUILD CONDITION
Project Description	Champlain Parkway CHA File 008659.000

Site Information

Intersection	Pine St & Maple St
Jurisdiction	City of Burlington, VT
East/West Street	Maple St
North/South Street	Pine St
Peak Hour Factor	0.90

Lanes



Vehicle Volume and Adjustments

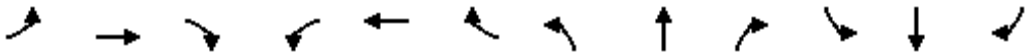
Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	5	145	215	65	100	120	320	220	60	60	420	5
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	406			317			667			539		
Percent Heavy Vehicles	2			2			2			2		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.360			0.281			0.593			0.479		
Final Departure Headway, hd (s)	8.78			9.35			9.18			9.15		
Final Degree of Utilization, x	0.989			0.823			1.700			1.370		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	6.78			7.35			7.18			7.15		

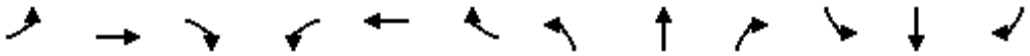
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	406			317			667			539		
Capacity	410			385			392			393		
95% Queue Length, Q_{95} (veh)	12.1			7.4			40.5			26.0		
Control Delay (s/veh)	71.9			43.6			348.1			207.5		
Level of Service, LOS	F			E			F			F		
Approach Delay (s/veh)	71.9			43.6			348.1			207.5		
Approach LOS	F			E			F			F		
Intersection Delay, s/veh | LOS	200.7						F					



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	50	300	80	100	10	85	470	55	10	600	5
Future Volume (vph)	5	50	300	80	100	10	85	470	55	10	600	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	11	11	11	11	11	11	11	11
Grade (%)		3%			-3%			4%			-3%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.89			0.99			0.99			1.00	
Flt Protected		1.00			0.98			0.99			1.00	
Satd. Flow (prot)		1516			1777			1731			1824	
Flt Permitted		1.00			0.50			0.83			0.99	
Satd. Flow (perm)		1511			899			1450			1806	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	6	56	333	89	111	11	94	522	61	11	667	6
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	395	0	0	211	0	0	677	0	0	684	0
Parking (#/hr)			5			5						
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		25.1			25.1			51.1			51.1	
Effective Green, g (s)		25.1			25.1			51.1			51.1	
Actuated g/C Ratio		0.28			0.28			0.57			0.57	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		2.0			2.0			3.0			3.0	
Lane Grp Cap (vph)		421			250			823			1025	
v/s Ratio Prot												
v/s Ratio Perm		c0.26			0.23			c0.47			0.38	
v/c Ratio		0.94			0.84			0.82			0.67	
Uniform Delay, d1		31.7			30.6			15.8			13.5	
Progression Factor		1.00			1.00			1.00			1.16	
Incremental Delay, d2		28.2			21.3			9.1			3.0	
Delay (s)		59.9			51.9			24.9			18.6	
Level of Service		E			D			C			B	
Approach Delay (s)		59.9			51.9			24.9			18.6	
Approach LOS		E			D			C			B	

Intersection Summary			
HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	110.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			



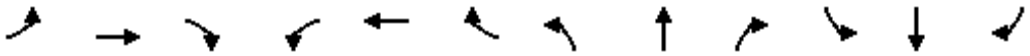
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	105	185	35	105	25	60	365	55	20	395	5
Future Volume (vph)	10	105	185	35	105	25	60	365	55	20	395	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Grade (%)		3%			-5%			3%			-4%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.92			0.98			0.98			1.00	
Flt Protected		1.00			0.99			0.99			1.00	
Satd. Flow (prot)		1567			1727			1735			1829	
Flt Permitted		0.99			0.79			0.90			0.97	
Satd. Flow (perm)		1553			1382			1567			1775	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	117	206	39	117	28	67	406	61	22	439	6
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	334	0	0	184	0	0	534	0	0	467	0
Parking (#/hr)			5			5			5			
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		22.8			22.8			53.4			53.4	
Effective Green, g (s)		22.8			22.8			53.4			53.4	
Actuated g/C Ratio		0.25			0.25			0.59			0.59	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		2.0			2.0			3.0			3.0	
Lane Grp Cap (vph)		393			350			929			1053	
v/s Ratio Prot												
v/s Ratio Perm		c0.22			0.13			c0.34			0.26	
v/c Ratio		0.85			0.53			0.57			0.44	
Uniform Delay, d1		32.0			28.9			11.3			10.1	
Progression Factor		1.00			1.00			0.73			0.82	
Incremental Delay, d2		15.1			0.7			1.5			1.1	
Delay (s)		47.1			29.6			9.8			9.4	
Level of Service		D			C			A			A	
Approach Delay (s)		47.1			29.6			9.8			9.4	
Approach LOS		D			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	75.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	185	225	10	235	60	215	165	20	45	190	40
Future Volume (vph)	40	185	225	10	235	60	215	165	20	45	190	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	10	11	11	11	11	10	12	12	12
Grade (%)		5%			-5%			4%			-4%	
Total Lost time (s)		5.0		5.0	5.0			6.0	6.0		6.0	
Lane Util. Factor		1.00		1.00	1.00			1.00	1.00		1.00	
Frt		0.93		1.00	0.97			1.00	0.85		0.98	
Flt Protected		1.00		0.95	1.00			0.97	1.00		0.99	
Satd. Flow (prot)		1686		1693	1789			1716	1448		1848	
Flt Permitted		0.93		0.32	1.00			0.64	1.00		0.87	
Satd. Flow (perm)		1583		567	1789			1129	1448		1617	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	44	206	250	11	261	67	239	183	22	50	211	44
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	500	0	11	328	0	0	422	22	0	305	0
Parking (#/hr)			5			8						3
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		31.7		31.7	31.7			39.9	39.9		39.9	
Effective Green, g (s)		31.7		31.7	31.7			39.9	39.9		39.9	
Actuated g/C Ratio		0.35		0.35	0.35			0.44	0.44		0.44	
Clearance Time (s)		5.0		5.0	5.0			6.0	6.0		6.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		557		199	630			500	641		716	
v/s Ratio Prot					0.18							
v/s Ratio Perm		c0.32		0.02				c0.37	0.02		0.19	
v/c Ratio		0.90		0.06	0.52			0.84	0.03		0.43	
Uniform Delay, d1		27.6		19.3	23.1			22.3	14.2		17.2	
Progression Factor		1.00		1.00	1.00			0.72	0.94		1.00	
Incremental Delay, d2		17.0		0.1	0.8			13.7	0.1		1.9	
Delay (s)		44.7		19.4	23.9			29.8	13.4		19.0	
Level of Service		D		B	C			C	B		B	
Approach Delay (s)		44.7			23.8			29.0			19.0	
Approach LOS		D			C			C			B	

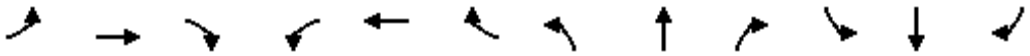
Intersection Summary			
HCM 2000 Control Delay	30.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	95.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	145	245	80	85	90	110	495	60	55	475	10
Future Volume (vph)	10	145	245	80	85	90	110	495	60	55	475	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	11	11	11	11	11	11	11	11	11
Grade (%)		3%			-3%			4%			-3%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.92			0.95			0.99			1.00	
Flt Protected		1.00			0.98			0.99			0.99	
Satd. Flow (prot)		1569			1714			1729			1814	
Flt Permitted		0.99			0.55			0.80			0.88	
Satd. Flow (perm)		1556			959			1399			1613	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	161	272	89	94	100	122	550	67	61	528	11
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	444	0	0	283	0	0	739	0	0	600	0
Parking (#/hr)			5			5						
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		27.0			27.0			49.2			49.2	
Effective Green, g (s)		27.0			27.0			49.2			49.2	
Actuated g/C Ratio		0.30			0.30			0.55			0.55	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		4.0			4.0			4.0			4.0	
Lane Grp Cap (vph)		466			287			764			881	
v/s Ratio Prot												
v/s Ratio Perm		0.29			c0.30			c0.53			0.37	
v/c Ratio		0.95			0.99			0.97			0.68	
Uniform Delay, d1		30.9			31.3			19.6			14.7	
Progression Factor		1.00			1.00			1.00			0.89	
Incremental Delay, d2		30.0			49.0			25.5			3.5	
Delay (s)		60.9			80.3			45.1			16.6	
Level of Service		E			F			D			B	
Approach Delay (s)		60.9			80.3			45.1			16.6	
Approach LOS		E			F			D			B	

Intersection Summary			
HCM 2000 Control Delay	45.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	103.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	130	200	50	160	30	185	390	25	30	290	10
Future Volume (vph)	5	130	200	50	160	30	185	390	25	30	290	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Grade (%)		4%			-5%			3%			-4%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.92			0.98			0.99			1.00	
Flt Protected		1.00			0.99			0.98			1.00	
Satd. Flow (prot)		1565			1734			1737			1821	
Flt Permitted		0.99			0.73			0.75			0.92	
Satd. Flow (perm)		1558			1272			1324			1680	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	6	144	222	56	178	33	206	433	28	33	322	11
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	372	0	0	267	0	0	667	0	0	366	0
Parking (#/hr)			5			5			5			
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		24.5			24.5			51.7			51.7	
Effective Green, g (s)		24.5			24.5			51.7			51.7	
Actuated g/C Ratio		0.27			0.27			0.57			0.57	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		4.0			4.0			4.0			4.0	
Lane Grp Cap (vph)		424			346			760			965	
v/s Ratio Prot												
v/s Ratio Perm		c0.24			0.21			c0.50			0.22	
v/c Ratio		0.88			0.77			0.88			0.38	
Uniform Delay, d1		31.3			30.2			16.4			10.4	
Progression Factor		1.00			1.00			0.48			1.24	
Incremental Delay, d2		18.6			10.8			5.7			1.0	
Delay (s)		49.9			41.0			13.6			13.9	
Level of Service		D			D			B			B	
Approach Delay (s)		49.9			41.0			13.6			13.9	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	95.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

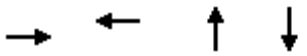
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	255	95	65	290	40	260	105	60	65	170	15
Future Volume (vph)	10	255	95	65	290	40	260	105	60	65	170	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	10	11	11	11	11	10	12	12	12
Grade (%)		5%			-5%			4%			-4%	
Total Lost time (s)		5.0		5.0	5.0			6.0	6.0		6.0	
Lane Util. Factor		1.00		1.00	1.00			1.00	1.00		1.00	
Frt		0.96		1.00	0.98			1.00	0.85		0.99	
Flt Protected		1.00		0.95	1.00			0.97	1.00		0.99	
Satd. Flow (prot)		1749		1693	1812			1704	1448		1860	
Flt Permitted		0.98		0.28	1.00			0.63	1.00		0.81	
Satd. Flow (perm)		1714		502	1812			1111	1448		1535	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	283	106	72	322	44	289	117	67	72	189	17
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	400	0	72	366	0	0	406	67	0	278	0
Parking (#/hr)			5			8						3
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		24.3		24.3	24.3			47.3	47.3		47.3	
Effective Green, g (s)		24.3		24.3	24.3			47.3	47.3		47.3	
Actuated g/C Ratio		0.27		0.27	0.27			0.53	0.53		0.53	
Clearance Time (s)		5.0		5.0	5.0			6.0	6.0		6.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		462		135	489			583	761		806	
v/s Ratio Prot					0.20							
v/s Ratio Perm		c0.23		0.14				c0.37	0.05		0.18	
v/c Ratio		0.87		0.53	0.75			0.70	0.09		0.34	
Uniform Delay, d1		31.3		28.0	30.1			16.0	10.6		12.4	
Progression Factor		1.00		1.00	1.00			0.92	1.19		1.00	
Incremental Delay, d2		15.5		4.0	6.2			3.7	0.1		1.2	
Delay (s)		46.8		32.0	36.2			18.4	12.7		13.5	
Level of Service		D		C	D			B	B		B	
Approach Delay (s)		46.8			35.5			17.6			13.5	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	29.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	395	211	677	684
v/c Ratio	0.94	0.84	0.79	0.64
Control Delay	64.4	60.6	24.7	19.5
Queue Delay	0.0	0.0	0.0	0.8
Total Delay	64.4	60.6	24.7	20.3
Queue Length 50th (ft)	216	111	247	310
Queue Length 95th (ft)	#387	#235	#644	#555
Internal Link Dist (ft)	745	331	2283	316
Turn Bay Length (ft)				
Base Capacity (vph)	436	259	862	1074
Starvation Cap Reductn	0	0	0	159
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.91	0.81	0.79	0.75

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

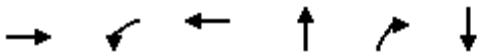


Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	334	184	534	467
v/c Ratio	0.85	0.53	0.55	0.42
Control Delay	52.3	34.1	10.9	10.3
Queue Delay	0.0	0.0	0.5	0.5
Total Delay	52.3	34.1	11.4	10.8
Queue Length 50th (ft)	177	88	111	61
Queue Length 95th (ft)	#317	155	m127	m235
Internal Link Dist (ft)	744	334	316	332
Turn Bay Length (ft)				
Base Capacity (vph)	431	383	971	1099
Starvation Cap Reductn	0	0	142	288
Spillback Cap Reductn	0	0	0	238
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.77	0.48	0.64	0.58

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

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



Lane Group	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	500	11	328	422	22	305
v/c Ratio	0.90	0.06	0.52	0.80	0.03	0.40
Control Delay	47.8	18.4	25.8	31.4	18.8	22.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.8	18.4	25.8	31.4	18.8	22.7
Queue Length 50th (ft)	255	4	140	119	4	101
Queue Length 95th (ft)	#421	15	213	m#534	m13	#319
Internal Link Dist (ft)	746		303	332		338
Turn Bay Length (ft)		100			75	
Base Capacity (vph)	615	220	695	530	680	760
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.81	0.05	0.47	0.80	0.03	0.40

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

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

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	444	283	739	600
v/c Ratio	0.95	0.99	0.92	0.65
Control Delay	64.3	83.9	38.2	17.4
Queue Delay	0.0	0.0	15.8	1.0
Total Delay	64.3	83.9	54.0	18.4
Queue Length 50th (ft)	246	159	316	192
Queue Length 95th (ft)	#435	#321	#747	m#497
Internal Link Dist (ft)	745	331	2283	316
Turn Bay Length (ft)				
Base Capacity (vph)	466	287	801	925
Starvation Cap Reductn	0	0	0	130
Spillback Cap Reductn	0	0	74	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.95	0.99	1.02	0.75

Intersection Summary

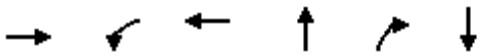
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	372	267	667	366
v/c Ratio	0.88	0.77	0.84	0.36
Control Delay	53.9	46.2	15.8	15.0
Queue Delay	0.3	0.1	2.5	0.3
Total Delay	54.2	46.4	18.4	15.4
Queue Length 50th (ft)	197	136	93	114
Queue Length 95th (ft)	#348	#250	m#502	m152
Internal Link Dist (ft)	744	334	316	332
Turn Bay Length (ft)				
Base Capacity (vph)	450	367	795	1008
Starvation Cap Reductn	0	0	55	243
Spillback Cap Reductn	4	3	0	91
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.83	0.73	0.90	0.48

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

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



Lane Group	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	400	72	366	406	67	278
v/c Ratio	0.86	0.53	0.75	0.66	0.08	0.33
Control Delay	50.4	42.6	39.9	22.1	17.3	16.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.4	42.6	39.9	22.1	17.3	16.1
Queue Length 50th (ft)	209	34	184	90	13	74
Queue Length 95th (ft)	#346	80	281	m#376	m30	219
Internal Link Dist (ft)	746		303	332		338
Turn Bay Length (ft)		100			75	
Base Capacity (vph)	514	150	543	613	798	847
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.48	0.67	0.66	0.08	0.33

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

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

APPENDIX 2C: 2009 FSEIS TRAFFIC CAPACITY ANALYSIS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	5	55	365	75	100	10	105	395	55	5	365	5
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	61	406	83	111	11	117	439	61	6	406	6

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	472	206	617	417
Volume Left (vph)	6	83	117	6
Volume Right (vph)	406	11	61	6
Hadj (s)	-0.48	0.08	0.01	0.03
Departure Headway (s)	7.9	9.6	8.4	8.4
Degree Utilization, x	1.03	0.55	1.43	0.97
Capacity (veh/h)	460	363	442	417
Control Delay (s)	79.0	23.5	230.4	66.8
Approach Delay (s)	79.0	23.5	230.4	66.8
Approach LOS	F	C	F	F

Intersection Summary			
Delay	123.9		
HCM Level of Service	F		
Intersection Capacity Utilization	98.8%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	5	145	215	65	100	120	320	220	60	60	420	5
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	161	239	72	111	133	356	244	67	67	467	6

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	406	317	667	539
Volume Left (vph)	6	72	356	67
Volume Right (vph)	239	133	67	6
Hadj (s)	-0.32	-0.17	0.08	0.05
Departure Headway (s)	8.8	9.4	9.2	9.2
Degree Utilization, x	0.99	0.82	1.70	1.37
Capacity (veh/h)	406	379	395	402
Control Delay (s)	72.3	43.8	350.3	209.2
Approach Delay (s)	72.3	43.8	350.3	209.2
Approach LOS	F	E	F	F

Intersection Summary			
Delay	202.0		
HCM Level of Service	F		
Intersection Capacity Utilization	109.3%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	10	110	95	25	105	25	10	355	45	25	260	5
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	122	106	28	117	28	11	394	50	28	289	6

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	239	172	456	322
Volume Left (vph)	11	28	11	28
Volume Right (vph)	106	28	50	6
Hadj (s)	-0.22	-0.03	-0.03	0.04
Departure Headway (s)	6.5	6.9	6.0	6.3
Degree Utilization, x	0.43	0.33	0.76	0.56
Capacity (veh/h)	481	438	579	527
Control Delay (s)	14.4	13.3	25.1	17.1
Approach Delay (s)	14.4	13.3	25.1	17.1
Approach LOS	B	B	D	C

Intersection Summary			
Delay	19.1		
HCM Level of Service	C		
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	5	130	185	40	160	25	35	285	25	30	265	10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	144	206	44	178	28	39	317	28	33	294	11

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	356	250	383	339
Volume Left (vph)	6	44	39	33
Volume Right (vph)	206	28	28	11
Hadj (s)	-0.31	0.00	0.01	0.03
Departure Headway (s)	7.1	7.8	7.3	7.4
Degree Utilization, x	0.71	0.54	0.77	0.70
Capacity (veh/h)	466	401	467	448
Control Delay (s)	25.5	19.6	31.1	26.0
Approach Delay (s)	25.5	19.6	31.1	26.0
Approach LOS	D	C	D	D

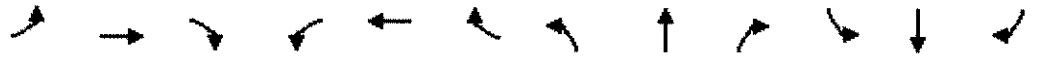
Intersection Summary			
Delay	26.1		
HCM Level of Service	D		
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↱		↰	↱		↕	
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	
Lane Util. Factor		1.00			1.00	1.00		1.00	1.00		1.00	
Frt		0.96			1.00	0.85		1.00	0.85		0.98	
Flt Protected		0.99			1.00	1.00		0.97	1.00		0.99	
Satd. Flow (prot)		1772			1861	1583		1802	1583		1801	
Flt Permitted		0.94			0.99	1.00		0.63	1.00		0.88	
Satd. Flow (perm)		1668			1847	1583		1177	1583		1601	
Volume (vph)	40	220	125	5	285	65	260	125	10	45	160	45
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	44	244	139	6	317	72	289	139	11	50	178	50
RTOR Reduction (vph)	0	0	0	0	0	48	0	0	6	0	0	0
Lane Group Flow (vph)	0	427	0	0	323	24	0	428	5	0	278	0
Turn Type	Perm			Perm		Perm	Perm		Perm	Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)		19.5			19.5	19.5		26.9	26.9		26.9	
Effective Green, g (s)		20.5			20.5	20.5		27.9	27.9		27.9	
Actuated g/C Ratio		0.33			0.33	0.33		0.46	0.46		0.46	
Clearance Time (s)		5.0			5.0	5.0		5.0	5.0		5.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)		559			619	530		537	722		730	
v/s Ratio Prot												
v/s Ratio Perm		c0.26			0.17	0.02		c0.36	0.00		0.17	
v/c Ratio		0.76			0.52	0.05		0.80	0.01		0.38	
Uniform Delay, d1		18.2			16.4	13.7		14.2	9.1		11.0	
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2		6.1			0.8	0.0		8.1	0.0		0.3	
Delay (s)		24.3			17.2	13.8		22.3	9.1		11.3	
Level of Service		C			B	B		C	A		B	
Approach Delay (s)		24.3			16.6			22.0			11.3	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	61.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
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	
Lane Util. Factor		1.00			1.00	1.00		1.00	1.00		1.00	
Frt		0.97			1.00	0.85		1.00	0.85		0.99	
Flt Protected		1.00			0.99	1.00		0.97	1.00		0.99	
Satd. Flow (prot)		1803			1845	1583		1806	1583		1820	
Flt Permitted		0.99			0.87	1.00		0.67	1.00		0.85	
Satd. Flow (perm)		1780			1629	1583		1239	1583		1561	
Volume (vph)	10	260	80	70	295	35	150	90	70	65	150	15
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	289	89	78	328	39	167	100	78	72	167	17
RTOR Reduction (vph)	0	0	0	0	0	24	0	0	50	0	0	0
Lane Group Flow (vph)	0	389	0	0	406	15	0	267	28	0	256	0
Turn Type	Perm			Perm		Perm	Perm		Perm	Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)		19.4			19.4	19.4		17.2	17.2		17.2	
Effective Green, g (s)		20.4			20.4	20.4		18.2	18.2		18.2	
Actuated g/C Ratio		0.40			0.40	0.40		0.35	0.35		0.35	
Clearance Time (s)		5.0			5.0	5.0		5.0	5.0		5.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)		706			647	628		439	561		553	
v/s Ratio Prot												
v/s Ratio Perm		0.22			c0.25	0.01		c0.22	0.02		0.16	
v/c Ratio		0.55			0.63	0.02		0.61	0.05		0.46	
Uniform Delay, d1		12.0			12.4	9.4		13.7	10.9		12.8	
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2		0.9			1.9	0.0		2.4	0.0		0.6	
Delay (s)		12.9			14.4	9.5		16.1	10.9		13.4	
Level of Service		B			B	A		B	B		B	
Approach Delay (s)		12.9			13.9			14.9			13.4	
Approach LOS		B			B			B			B	

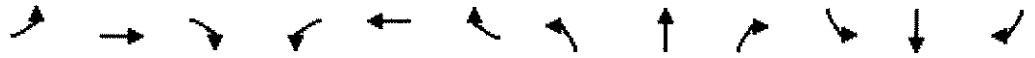
Intersection Summary			
HCM Average Control Delay	13.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	51.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	12	11	11	11	12	11	12	11	11	11
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.89			0.99			0.99			1.00	
Flt Protected		1.00			0.98			0.99			1.00	
Satd. Flow (prot)		1595			1751			1766			1797	
Flt Permitted		1.00			0.47			0.83			0.99	
Satd. Flow (perm)		1588			832			1479			1779	
Volume (vph)	5	50	300	80	100	10	85	470	55	10	600	5
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	6	56	333	89	111	11	94	522	61	11	667	6
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	395	0	0	211	0	0	677	0	0	684	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		23.3			23.3			50.5			50.5	
Effective Green, g (s)		24.3			24.3			51.5			51.5	
Actuated g/C Ratio		0.27			0.27			0.57			0.57	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		429			225			846			1018	
v/s Ratio Prot												
v/s Ratio Perm		0.25			c0.25			c0.46			0.38	
v/c Ratio		0.92			0.94			0.80			0.67	
Uniform Delay, d1		31.9			32.1			15.2			13.4	
Progression Factor		1.00			1.00			1.00			1.03	
Incremental Delay, d2		25.0			42.5			7.8			3.0	
Delay (s)		56.9			74.6			23.0			16.7	
Level of Service		E			E			C			B	
Approach Delay (s)		56.9			74.6			23.0			16.7	
Approach LOS		E			E			C			B	

Intersection Summary			
HCM Average Control Delay	33.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.2
Intersection Capacity Utilization	110.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	12	11	11	11	12	11	12	11	11	11
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.92			0.95			0.99			1.00	
Flt Protected		1.00			0.98			0.99			0.99	
Satd. Flow (prot)		1650			1688			1764			1787	
Flt Permitted		0.99			0.53			0.78			0.87	
Satd. Flow (perm)		1635			913			1390			1567	
Volume (vph)	10	145	245	80	85	90	110	495	60	55	475	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	161	272	89	94	100	122	550	67	61	528	11
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	444	0	0	283	0	0	739	0	0	600	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		37.0			37.0			66.8			66.8	
Effective Green, g (s)		38.0			38.0			67.8			67.8	
Actuated g/C Ratio		0.32			0.32			0.56			0.56	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		518			289			785			885	
v/s Ratio Prot												
v/s Ratio Perm		0.27			c0.31			c0.53			0.38	
v/c Ratio		0.86			0.98			0.94			0.68	
Uniform Delay, d1		38.5			40.6			24.3			18.4	
Progression Factor		1.00			1.00			1.00			1.03	
Incremental Delay, d2		13.2			46.7			20.7			3.5	
Delay (s)		51.6			87.3			44.9			22.5	
Level of Service		D			F			D			C	
Approach Delay (s)		51.6			87.3			44.9			22.5	
Approach LOS		D			F			D			C	

Intersection Summary			
HCM Average Control Delay	45.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	14.2
Intersection Capacity Utilization	103.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.92			0.98			0.98			1.00	
Flt Protected		1.00			0.99			0.99			1.00	
Satd. Flow (prot)		1705			1805			1823			1854	
Flt Permitted		0.99			0.64			0.90			0.96	
Satd. Flow (perm)		1689			1175			1644			1779	
Volume (vph)	10	105	185	35	105	25	60	365	55	25	395	5
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	117	206	39	117	28	67	406	61	28	439	6
RTOR Reduction (vph)	0	67	0	0	7	0	0	3	0	0	0	0
Lane Group Flow (vph)	0	267	0	0	177	0	0	531	0	0	473	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		17.2			17.2			56.6			56.6	
Effective Green, g (s)		18.2			18.2			57.6			57.6	
Actuated g/C Ratio		0.20			0.20			0.64			0.64	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		342			238			1052			1139	
v/s Ratio Prot												
v/s Ratio Perm		c0.16			0.15			c0.32			0.27	
v/c Ratio		0.78			0.74			0.50			0.41	
Uniform Delay, d1		34.0			33.7			8.6			7.9	
Progression Factor		1.00			1.00			0.31			0.72	
Incremental Delay, d2		11.0			11.8			0.4			0.8	
Delay (s)		45.0			45.5			3.1			6.5	
Level of Service		D			D			A			A	
Approach Delay (s)		45.0			45.5			3.1			6.5	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.2
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.92			0.98			0.99			1.00	
Flt Protected		1.00			0.99			0.98			1.00	
Satd. Flow (prot)		1711			1813			1824			1847	
Flt Permitted		0.99			0.60			0.75			0.91	
Satd. Flow (perm)		1703			1099			1385			1693	
Volume (vph)	5	130	200	50	160	30	185	390	25	30	290	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	6	144	222	56	178	33	206	433	28	33	322	11
RTOR Reduction (vph)	0	46	0	0	5	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	326	0	0	262	0	0	666	0	0	365	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		28.2			28.2			75.6			75.6	
Effective Green, g (s)		29.2			29.2			76.6			76.6	
Actuated g/C Ratio		0.24			0.24			0.64			0.64	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		414			267			884			1081	
v/s Ratio Prot												
v/s Ratio Perm		0.19			c0.24			c0.48			0.22	
v/c Ratio		0.79			0.98			0.75			0.34	
Uniform Delay, d1		42.5			45.2			15.1			10.0	
Progression Factor		1.00			1.00			0.33			0.75	
Incremental Delay, d2		9.5			50.0			0.6			0.7	
Delay (s)		52.0			95.2			5.5			8.2	
Level of Service		D			F			A			A	
Approach Delay (s)		52.0			95.2			5.5			8.2	
Approach LOS		D			F			A			A	

Intersection Summary			
HCM Average Control Delay	30.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	14.2
Intersection Capacity Utilization	95.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
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	
Lane Util. Factor		1.00			1.00	1.00		1.00	1.00		1.00	
Frt		0.93			1.00	0.85		1.00	0.85		0.98	
Flt Protected		1.00			1.00	1.00		0.97	1.00		0.99	
Satd. Flow (prot)		1729			1859	1583		1811	1583		1812	
Flt Permitted		0.95			0.97	1.00		0.61	1.00		0.83	
Satd. Flow (perm)		1648			1816	1583		1144	1583		1513	
Volume (vph)	40	185	225	10	235	60	215	165	20	45	190	40
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	44	206	250	11	261	67	239	183	22	50	211	44
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	500	0	0	272	67	0	422	22	0	305	0
Turn Type	Perm			Perm		Perm	Perm		Perm	Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)		32.5			32.5	32.5		35.3	35.3		35.3	
Effective Green, g (s)		36.5			36.5	36.5		39.3	39.3		39.3	
Actuated g/C Ratio		0.41			0.41	0.41		0.44	0.44		0.44	
Clearance Time (s)		8.0			8.0	8.0		8.0	8.0		8.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)		668			736	642		500	691		661	
v/s Ratio Prot												
v/s Ratio Perm		c0.30			0.15	0.04		c0.37	0.01		0.20	
v/c Ratio		0.75			0.37	0.10		0.84	0.03		0.46	
Uniform Delay, d1		22.8			18.7	16.6		22.6	14.5		17.9	
Progression Factor		1.00			1.00	1.00		0.61	0.69		1.00	
Incremental Delay, d2		4.6			0.3	0.1		14.0	0.1		0.5	
Delay (s)		27.4			19.0	16.7		27.8	10.1		18.4	
Level of Service		C			B	B		C	B		B	
Approach Delay (s)		27.4			18.6			26.9			18.4	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM Average Control Delay	23.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.2
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
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	
Lane Util. Factor		1.00			1.00	1.00		1.00	1.00		1.00	
Frt		0.96			1.00	0.85		1.00	0.85		0.99	
Flt Protected		1.00			0.99	1.00		0.97	1.00		0.99	
Satd. Flow (prot)		1794			1846	1583		1799	1583		1824	
Flt Permitted		0.99			0.78	1.00		0.60	1.00		0.74	
Satd. Flow (perm)		1770			1457	1583		1111	1583		1375	
Volume (vph)	10	255	95	65	290	40	260	105	60	65	170	15
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	283	106	72	322	44	289	117	67	72	189	17
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	400	0	0	394	44	0	406	67	0	278	0
Turn Type	Perm			Perm		Perm	Perm		Perm	Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)		42.2			42.2	42.2		55.6	55.6		55.6	
Effective Green, g (s)		46.2			46.2	46.2		59.6	59.6		59.6	
Actuated g/C Ratio		0.39			0.39	0.39		0.50	0.50		0.50	
Clearance Time (s)		8.0			8.0	8.0		8.0	8.0		8.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)		681			561	609		552	786		683	
v/s Ratio Prot												
v/s Ratio Perm		0.23			c0.27	0.03		c0.37	0.04		0.20	
v/c Ratio		0.59			0.70	0.07		0.74	0.09		0.41	
Uniform Delay, d1		29.3			31.1	23.3		23.9	15.9		19.1	
Progression Factor		1.00			1.00	1.00		0.55	0.55		1.00	
Incremental Delay, d2		1.3			4.0	0.1		4.9	0.1		0.4	
Delay (s)		30.6			35.1	23.4		18.2	8.8		19.4	
Level of Service		C			D	C		B	A		B	
Approach Delay (s)		30.6			33.9			16.8			19.4	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	25.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	14.2
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			