BILLINGS AIRPORT ROAD & MAIN STREET Concept

TECHNICAL MEMORANDUM #3A

Date: November 27, 2015

Project #: 18460

To: Wade Salyards, PE
Montana Department of Transportation

From: Brett Korporaal and Andy Daleiden, PE

Project: Airport Road/Main Street – Billings, CM 1099(102), UPN 8718000

Subject: Tier I: Evaluation and Screening of Initial Alternatives

---

This technical memorandum summarizes the Tier I evaluation and screening of the initial alternatives that were developed for the Airport Road and Main Street intersection in Billings, MT and presented in Technical Memorandum (TM) #2 and at the PAC Meeting #1. We performed a fatal flaw analysis to determine and eliminate alternatives. The fatal flaw analysis evaluated the initial twenty alternatives against three evaluation criteria, which are presented below along with the methodology used in the evaluation.

Traffic Operations - Does the alternative accommodate the future year 2040 critical volumes?

An operational analysis was performed for the twenty initial alternatives included in TM #2 using CAP-X and Synchro 8 traffic analysis software tools. This memorandum documents the Highway Capacity Manual (HCM) operations for each alternative under year 2040 traffic conditions during the weekday a.m. and p.m. peak hours. The operational analysis included the following assumptions: year 2040 traffic volumes as presented in TM #1 during the weekday a.m. and p.m. peak hours, optimized signal timings, and a peak hour factor of 1.0 (given the 20-year planning horizon). All other assumptions presented in TM #1 were maintained for this analysis. Attachments A and B includes the year 2040 traffic conditions operational analysis for all of the alternatives during the weekday a.m. and p.m. peak hours, respectively.

In the future conditions operations analysis, we identified an operational benefit at the Airport Road/Main Street intersection by adding a southbound right-turn lane and providing either dual or triple eastbound left-turn lanes with protected left-turn phasing. With this in mind, we analyzed these improvements as standalone alternatives (2B, 2C, 2D, and 2E), as well as included the southbound right-turn lane and one of the eastbound left-turn lane improvements with the other alternatives being considered.

Alternatives that were projected to operate at a LOS E or better and an intersection volume-to-capacity ratio of less than or equal to 1.10 during both the weekday a.m. and p.m. peak periods were

considered operationally acceptable. All other alternatives were dismissed based on the operational criteria, except for Alternatives 2D and 2E as they are considered low cost alternatives and could be considered potential near-term improvements.

Table 1 (shown on the next page) presents the operations results for the initial alternatives under year 2040 traffic conditions during the weekday a.m. and p.m. peak hours. The operational analysis evaluated the study intersections impacted by each alternative. However, for purposes of the fatal flaw analysis, the operational results were presented for the critical intersections, which include Airport Road/Main Street and Aronson Avenue/Main Street for most of the alternatives. A few of the alternatives create new intersections or have significant changes to the existing intersections and those operational results are included in Table 1.

As shown in Table 1, the alternatives with northbound left-turns and unsignalized traffic control at the intersection of Aronson Avenue and Main Street are projected to operate at LOS F and a v/c ratio of greater than 1.0. To meet the future traffic demand, the Aronson Avenue and Main Street intersection will need to be signalized or the northbound left-turns will need to be rerouted and accommodated at another intersection.

As shown in Table 1, the following alternatives are projected to operate at a LOS E or better and an intersection volume-to-capacity ratio of less than or equal to 1.10 under year 2040 traffic conditions:

- Alternative 2D – Dual Eastbound Left-Turn Lanes and Signal Phasing Modification (*Note: This alternative has a LOS F and v/c of 1.22 during the weekday p.m. peak, but is a low-cost alternative and should be considered for further evaluation or as a potential near-term improvement.*)
- Alternative 2E – Triple Eastbound Left-Turn Lanes (*Note: This alternative has a v/c of 1.11 during the weekday p.m. peak, but is a lower cost alternative and should be considered for further evaluation or as a potential near-term improvement.*)
- Alternative 3B – Signalized Southwest Quadrant
- Alternative 3C – Signalized Southwest Quadrant (Signal at Swords Lane)
- Alternative 4B - Signalized Southwest Quadrant (One-Way Eastbound Airport Road)
- Alternative 5A – Median U-Turn (North-South)
- Alternative 5B – Partial Displaced Left-Turn (Southwest Quadrant)
- Alternative 6A – Eastbound Left Flyover
- Alternative 6B – Loop Ramp in Southeast Quadrant

As this study moves forward into Tier 2, the study alternatives should consider capacity improvements at the Lake Elmo Drive/Main Street intersection, as it is projected to be over capacity in the year 2040 future conditions. Potential improvement strategies include extending the

eastbound right-turn lane, adding a second eastbound right-turn lane (*v/c projected to be equal to 1.0 or less with improvement in place during both time periods*), and extending the northbound left-turn lane. Given the close proximity of this intersection to the Airport Road/Main Street intersection, these improvements provide an operational benefit (e.g. reduce queues and improve coordination by adding more green time to Main Street) to Main Street corridor.

Table 1. Initial Alternatives - Year 2040 Traffic Conditions, Weekday AM and PM Peak Hour

Alternative Strategy	Alternative #	Intersection	AM PEAK HOUR			PM PEAK HOUR		
			LOS	Delay	v/c ratio	LOS	Delay	v/c ratio
No Build	1	Lake Elmo Dr/Main St	F	88.2	1.30	C	31.5	1.07
		Airport Rd/Main St	F	148.1	1.27	F	146.1	1.33
		Aronson Ave/Main St	F	>80.0	1.73	F	>80.0	0.80
Conventional Intersection	2A	Airport Rd/Main St	F	126.1	1.22	F	146.1	1.27
	2B	Airport Rd/Main St	F	84.0	1.11	F	143.9	1.31
	2C	Airport Rd/Main St	E	68.3	1.05	E	112.7	1.21
	2D	**Airport Rd/Main St**	**E**	**55.6**	**1.05**	**F**	**115.1**	**1.22**
	2E	**Airport Rd/Main St**	**D**	**45.5**	**1.00**	**E**	**77.1**	**1.11**
Quadrant Intersection	3A	Airport Rd/Main St	D	39.9	0.98	F	89.0	1.16
		Aronson Ave/Main St	F	>80.0	>2.00	F	>80.0	>2.00
	3B	**Airport Rd/Main St**	**C**	**29.3**	**0.93**	**E**	**68.3**	**1.10**
		Aronson Ave/Main St	**B**	**12.0**	**0.87**	**B**	**10.0**	**0.76**
	3C	**Airport Rd/Swords Ln**	**D**	**45.0**	**0.58**	**D**	**45.5**	**0.75**
		Airport Rd/Main St	**B**	**11.4**	**0.82**	**B**	**17.5**	**0.91**
		Aronson Ave/Main St	**D**	**43.6**	**1.04**	**E**	**58.7**	**1.07**
	3D	Airport Rd/Aronson Ave	B	17.1	0.35	C	23.3	0.49
		Airport Rd/Main St	C	18.0	0.90	F	125.0	1.28
		Aronson Ave/Main St	C	18.5	0.47	F	>200.0	>2.00
One-Way Intersection or Couplet	4A	Airport Rd/Main St	C	22.2	0.85	C	34.0	0.97
		Aronson Ave/Main St	F	>80.0	>2.00	F	>80.0	0.80
	4B	**Airport Rd/Main St**	**B**	**10.8**	**0.82**	**C**	**25.1**	**0.92**
		Aronson Ave/Main St	**B**	**13.1**	**0.88**	**B**	**11.2**	**0.74**
	4C	Airport Rd/Main St	D	48.8	1.02	F	103.3	1.12
		Aronson Ave/Main St	B	12.4	0.92	A	6.9	0.75
	4D	Airport Rd/Main St	D	49.2	1.07	D	54.6	1.11
		Aronson Ave/Main St	B	14.5	0.86	F	82.3	1.12
Alternative Intersection (High-Volume)	**5A**	**Airport Rd/Main St**	**C**	**34.8**	**0.93**	**E**	**60.0**	**1.06**
		Aronson Ave/Main St	**B**	**12.2**	**0.88**	**B**	**14.3**	**0.77**
	5B	**Airport Rd/Main St**	**D**	**44.3**	**0.93**	**E**	**60.8**	**1.06**
		Aronson Ave/Main St	**B**	**11.5**	**0.87**	**A**	**9.4**	**0.74**
	5C	Airport Rd/Main St	F	-	>4.00	F	-	>4.00
Grade Separated	**6A**	**Airport Rd/Main St**	**E**	**70.8**	**1.08**	**C**	**33.2**	**0.99**
	6B	**Airport Rd/Main St**	**A**	**-**	**-**	**A**	**-**	**-**
		Aronson Ave/Main St	**B**	**-**	**-**	**C**	**-**	**-**
	6C	Airport Rd/Main St	A	-	-	A	-	-
		Airport Rd/Bench Blvd	F	92.5	1.07	F	96.8	1.05

Note: Gray shading and **bold text** represent an alternative with LOS E or better and a v/c ratio of less than or equal to 1.10.

Environmental - Does the alternative have a significant impact to an environmental resource or topographical constraint?

Based on the environmental scan presented in TM #1, an evaluation was performed to identify if any of the alternatives would have a major impact to any of the 4(f) sites, historical properties, or floodplain areas. The alternative was considered a fatal flaw if it impacted an environmental element (e.g. new structure would be located on or near the environmental element). According to MDT, there is a historical resource (e.g. rock shelter and pictographs) located in the southeast quadrant of the Airport Road and Main Street intersection. The alternatives that included new structures and connections in this quadrant were considered a fatal flaw due to this environmental resource.

We also performed an assessment of the alternatives in relationship to the surrounding topography. The northeast quadrant includes Alkali Creek and a significant grade change sloping away from the intersection, which becomes a challenge for any alternatives using this quadrant. The southeast quadrant has a significant grade change sloping away from the intersection, which becomes a challenge for any alternatives using this quadrant. Alternatives were dismissed based on an alternative requiring new structure in the southeast and northeast quadrants of the Airport Road and Main Street intersection. Table 2 summarizes the alternatives eliminated based on the environmental criteria.

Project Advisory Committee - Was the alternative dismissed at the PAC Meeting #1?

At our PAC Meeting #1, we asked the PAC about any of the alternatives being a fatal flaw from an agency perspective. At that time, Alternatives 3C and 5C were identified as fatal flaws. Alternative 3C was considered to be fatally flawed due to the addition of a new signal on Airport Road in close proximity to the Airport Road/Main Street intersection. Alternative 5C was considered to be fatally flawed due to an operational deficiency and impacts to signal progression on Main Street with a multilane roundabout.

Tier I – Evaluation and Screening of Alternatives

Table 2 summarizes the screening of the alternatives based on the operations, environmental, and PAC criteria.

Table 2. Tier I – Evaluation and Screening of Alternatives

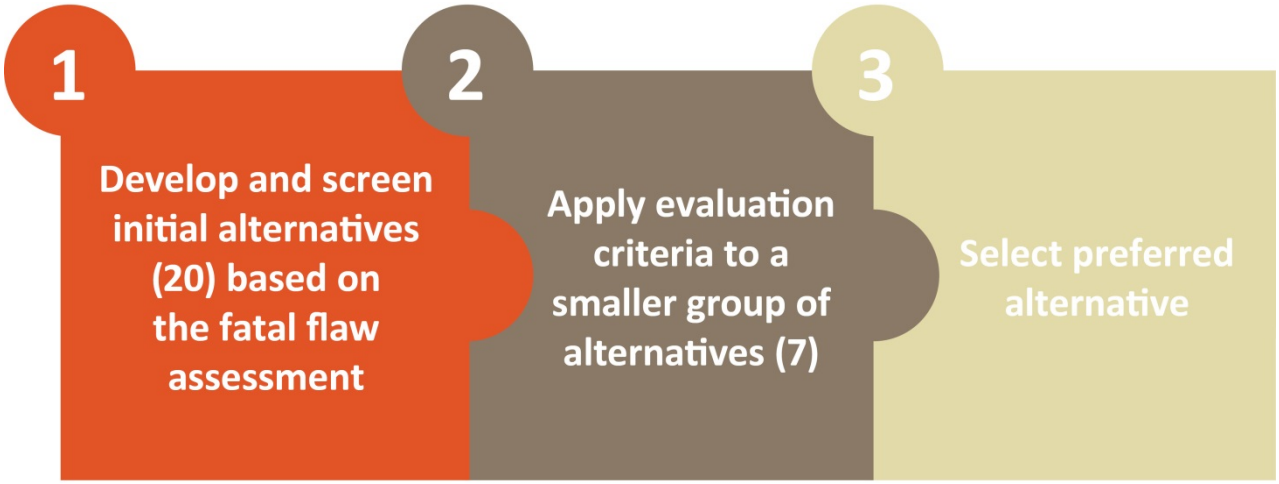
No.	Alternative	Fatal Flaw Criteria			
		Oper-ations	Environ-mental	PAC	Why?
1	No-Build	X	-	-	▪ Does not address critical traffic volumes.
2A	Operational Strategies	X	-	-	▪ Modifications to signal timing does not address critical traffic volumes. ▪ Strategies should be considered with other alternatives.
2B	Add Southbound Right-Turn Lane	X	-	-	▪ Provides operational benefit, but does not fully address critical traffic volumes. ▪ Strategy should be considered with other alternatives.
2C	Eastbound Approach Lane Reconfiguration	X	-	-	▪ Does not address critical traffic volumes.
2D	Dual Eastbound Left-Turn Lanes and Signal Phasing Modification	-	-	-	▪ Provides operational benefit, but does not fully address critical traffic volumes. ▪ Strategy should be considered with other alternatives. ▪ Recommended for Tier II evaluation.
2E	Triple Eastbound Left-Turn Lanes	-	-	-	▪ Provides operational benefit, but does not fully address critical traffic volumes. ▪ Strategy should be considered with other alternatives. ▪ Recommended for Tier II evaluation.
3A	Unsignalized Southwest Quadrant	X	-		▪ Does not address critical traffic volumes at Aronson Avenue.
3B	Signalized Southwest Quadrant	-	-	-	▪ Recommended for Tier II evaluation.
3C	Signalized Southwest Quadrant (Signal at Swords Lane)	-	-	X	▪ Dismissed by PAC due to new signal too close to the existing interchange.
3D	Signalized Southeast Quadrant	X	X	-	▪ Significant environmental impacts.
4A	Airport Road One-Way Eastbound	X	-	-	▪ Does not address critical traffic volumes.
4B	Signalize Southwest Quadrant - Removal of Northbound Left-Turns and One-Way Eastbound Airport Road	-	-	-	▪ Recommended for Tier II evaluation.
4C	One-Way Couplet (Westbound - Aronson Avenue)	X	-	-	▪ Does not address critical traffic volumes.
4D	One-Way Couplet (Eastbound - Aronson Avenue)	X	-	-	▪ Does not address critical traffic volumes.
5A	Median U-Turn (MUT) - North/South	-	-	-	▪ Recommended for Tier II evaluation.
5B	Partial Displaced Left-Turn (DLT) – Southwest Quadrant	-	-	-	▪ Recommended for Tier II evaluation.
5C	Multilane Roundabout	X	-	X	▪ Does not address critical traffic volumes. ▪ Dismissed by PAC due to operational deficiency and impacts to signal progression.
6A	Eastbound Left Flyover at Airport Road/Main Street	-	X	-	▪ Significant impacts to Main Street, alignment, and signal at Lake Elmo Drive
6B	Loop Ramp in Southeast Quadrant	-	X	-	▪ Significant environmental impacts.
6C	Airport Road Overpass to Bench Boulevard	X	X	-	▪ Does not address critical traffic volumes. ▪ Significant environmental impacts.

Based on the Tier I screening shown In Table 2, we recommend carrying forward six alternatives (highlighted in gray shading) and the no build alternative to the Tier II evaluation for further consideration and refinement.

Recommendations and Next Steps

It is recommended that Alternatives 1, 2D, 2E, 3B, 4B, 5A, and 5B be carried forward into the Tier II evaluation for further consideration and refinement. The process for further refinement is outlined in Exhibit 1. Figures 1 through 7 provide a high-level schematic of the recommended alternatives, including lane configurations and call-outs at the critical intersections. Additionally, improvement strategies at the Lake Elmo Drive/Main Street intersection, such as extending the eastbound right-turn lane, adding a second eastbound right-turn lane, and/or extending the northbound left-turn lane are recommended for consideration with the alternatives in Tier II.

Exhibit 1. Tiered Approach to Alternatives Evaluation



Under Tier II, the seven alternatives will be further refined into concept designs and evaluated based on the detailed evaluation criteria presented in TM #2. The Tier II evaluation will be summarized in TM #3B and presented to the PAC in December 2015.

If you have any questions, please contact Andy Daleiden via email at adaleiden@kittelson.com or by phone at 208.338.2683.

MONTANA MDT DEPARTMENT OF TRANSPORTATION

BILLINGS AIRPORT ROAD & MAIN STREET Concept

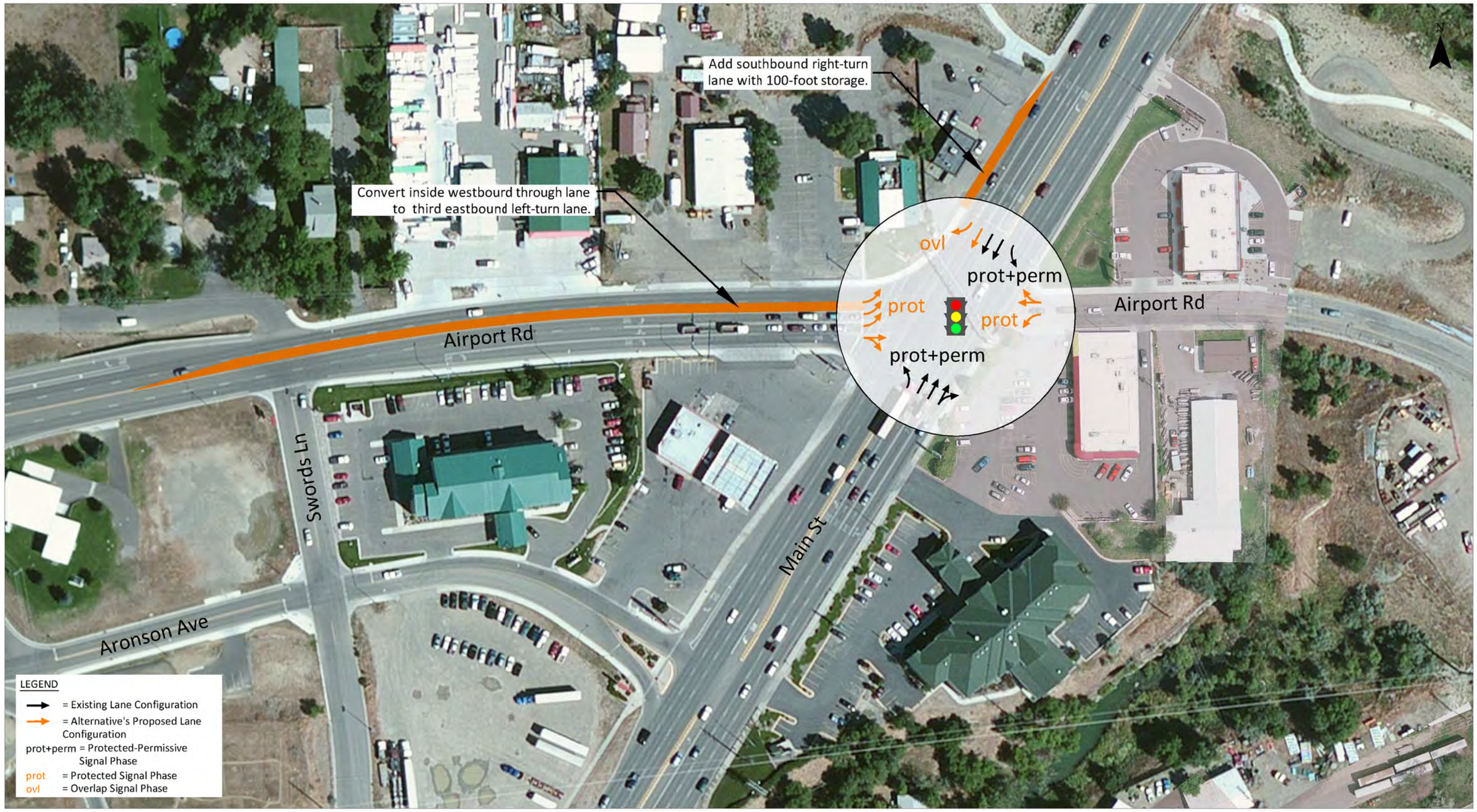
ALTERNATIVE 2D - DUAL EASTBOUND LEFT-TURN LANES AND SIGNAL PHASING MODIFICATION
TIER I: EVALUATION AND SCREENING OF INITIAL ALTERNATIVES
BILLINGS, MONTANA

SCALE: 1" = 100'

0 100' 200'

FIGURE 2

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING



MONTANA MDT DEPARTMENT OF TRANSPORTATION

BILLINGS AIRPORT ROAD & MAIN STREET Concept

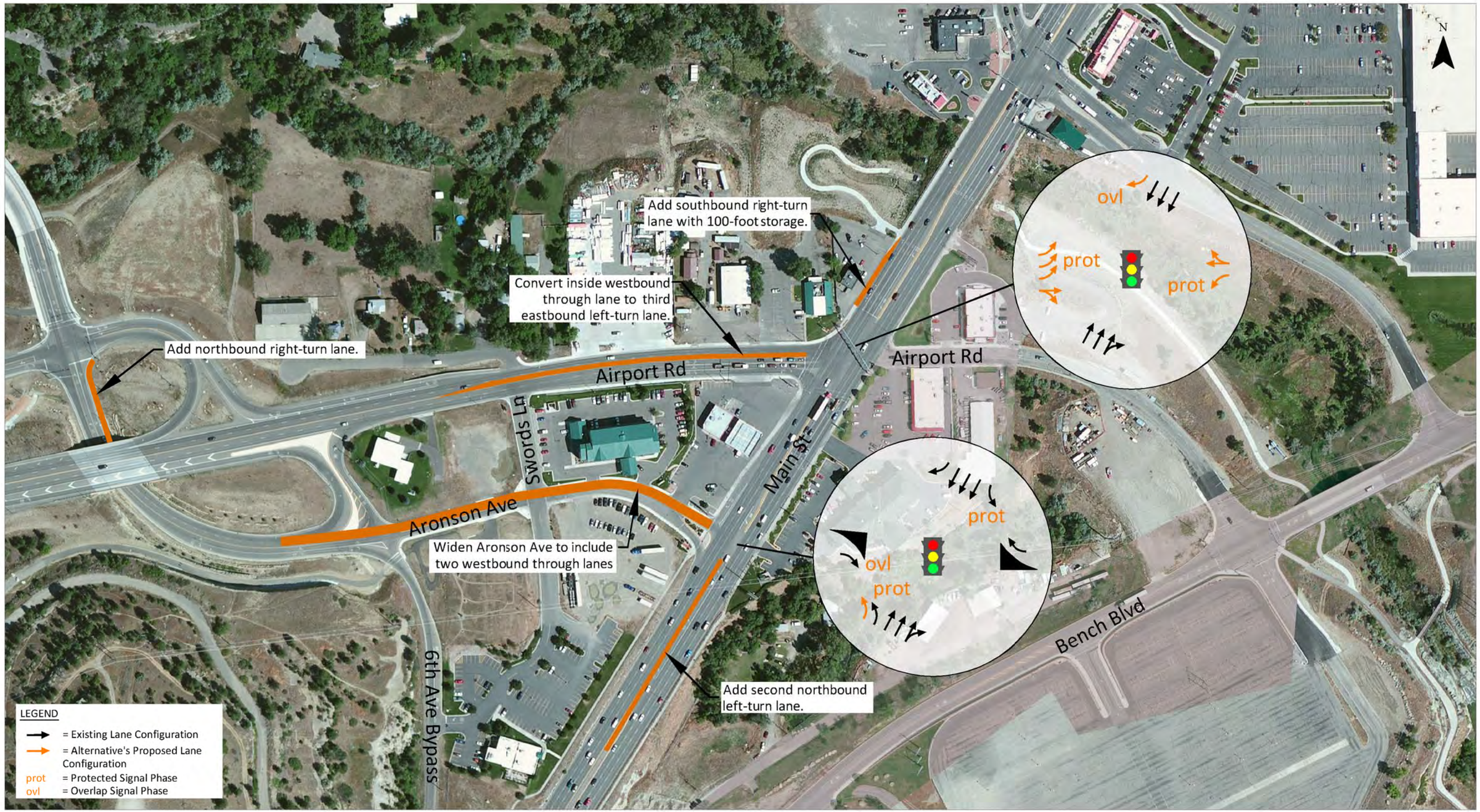
ALTERNATIVE 2E - TRIPLE EASTBOUND LEFT-TURN LANES
TIER I: EVALUATION AND SCREENING OF INITIAL ALTERNATIVES
BILLINGS, MONTANA

SCALE: 1" = 100'

0 100' 200'

FIGURE 3

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING



MONTANA MDT DEPARTMENT OF TRANSPORTATION

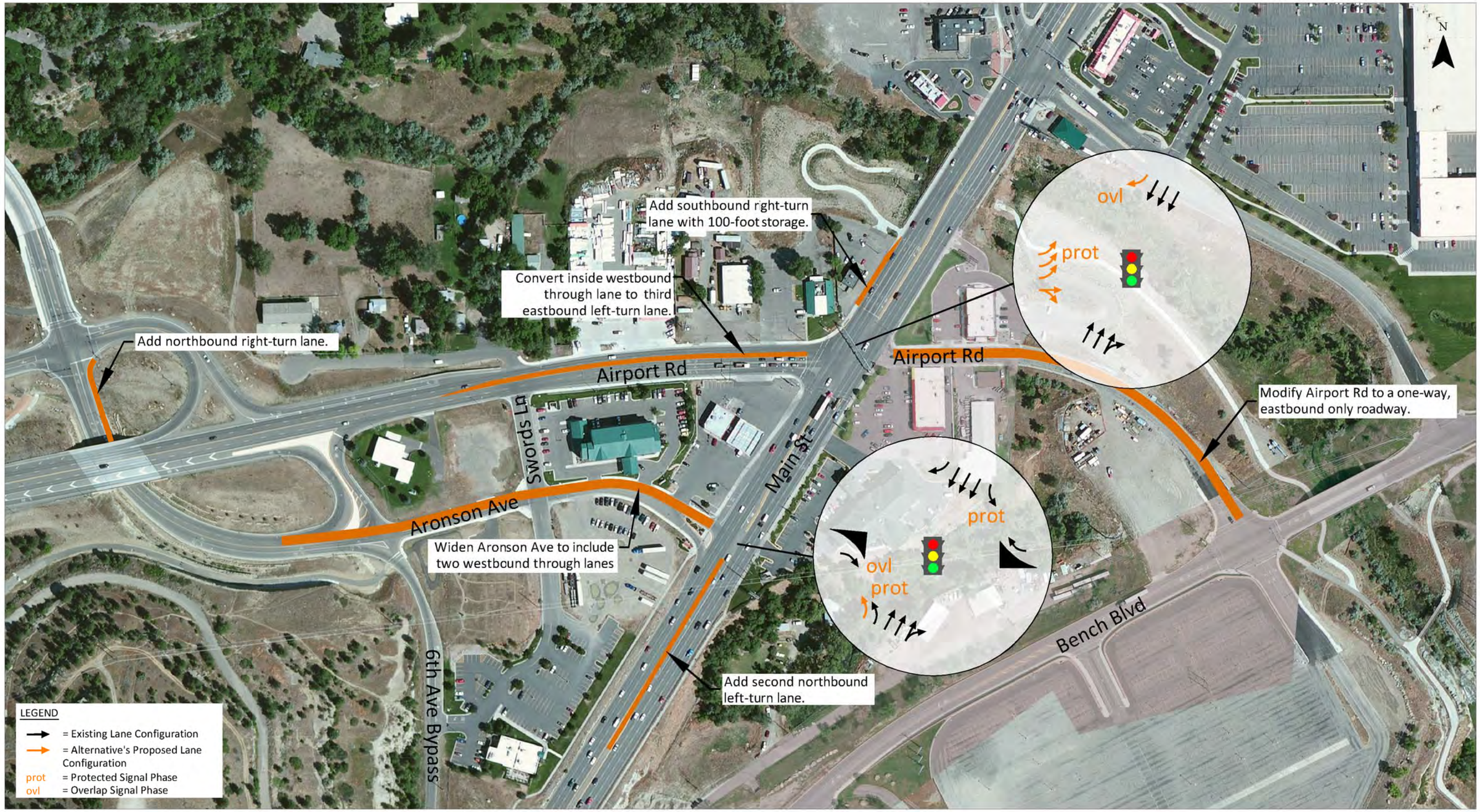
BILLINGS AIRPORT ROAD & MAIN STREET Concept

ALTERNATIVE 3B - SIGNALIZED SOUTHWEST QUADRANT
TIER I: EVALUATION AND SCREENING OF INITIAL ALTERNATIVES
BILLINGS, MONTANA

SCALE: 1" = 200'
0 200' 400'

FIGURE 4

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING



MONTANA MDT DEPARTMENT OF TRANSPORTATION

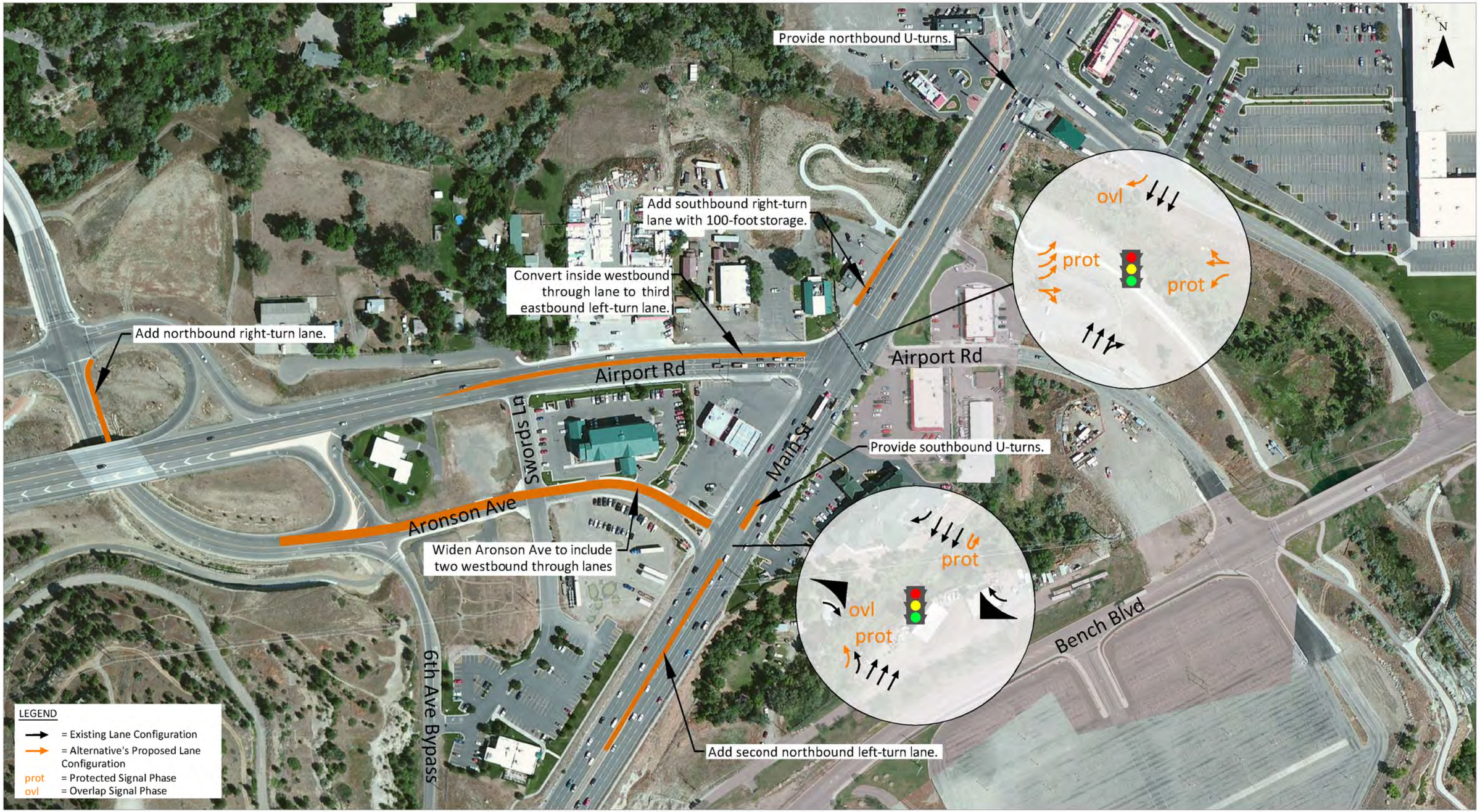
BILLINGS AIRPORT ROAD & MAIN STREET Concept

ALTERNATIVE 4B - SIGNALIZED SOUTHWEST QUADRANT (ONE-WAY EASTBOUND ALKALI CREEK RD)
TIER I: EVALUATION AND SCREENING OF INITIAL ALTERNATIVES
BILLINGS, MONTANA

SCALE: 1" = 200'
0 200' 400'

FIGURE 5

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING



MONTANA MDT DEPARTMENT OF TRANSPORTATION

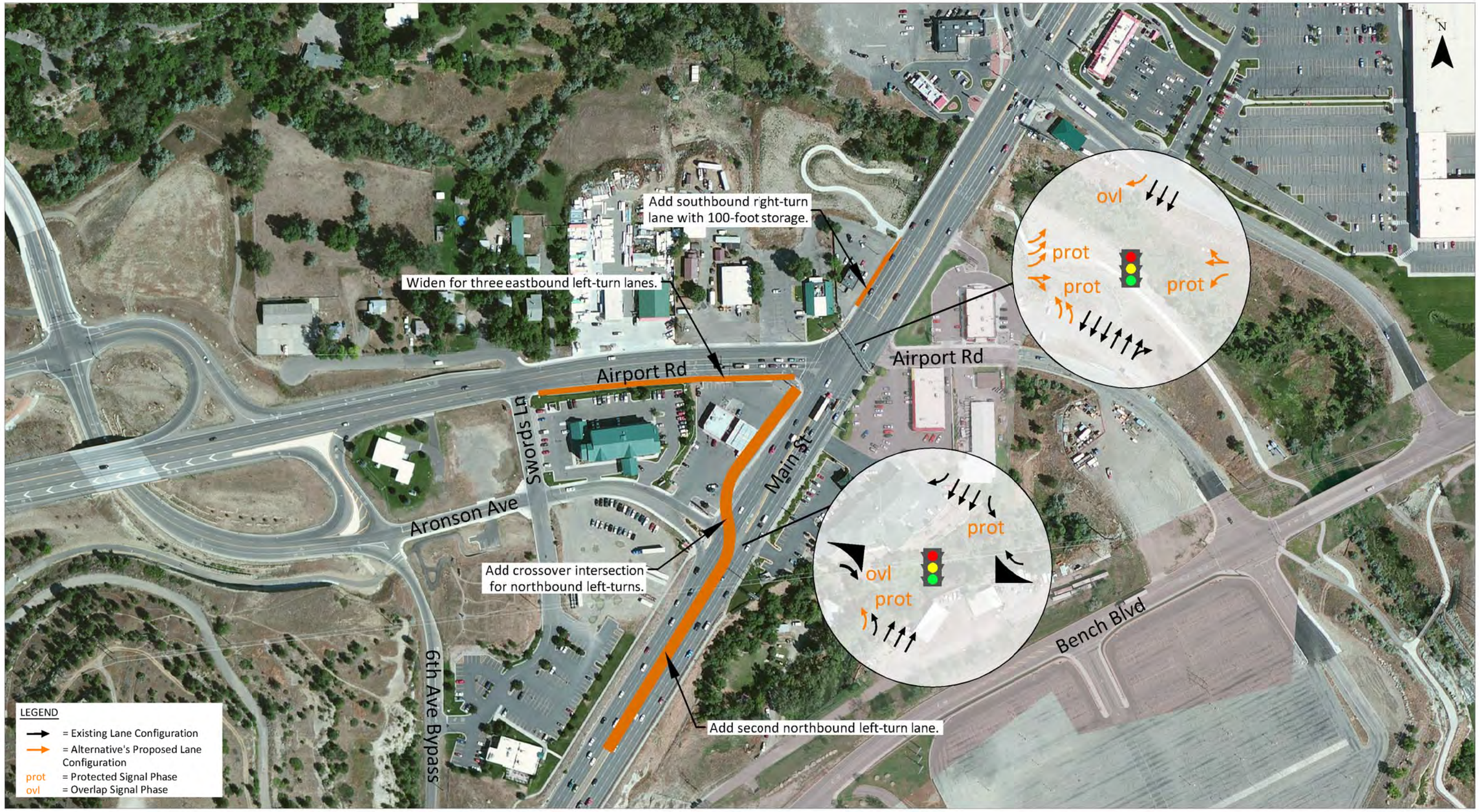
BILLINGS AIRPORT ROAD & MAIN STREET Concept

ALTERNATIVE 5A - MEDIAN U-TURN (NORTH AND SOUTH)
TIER I: EVALUATION AND SCREENING OF INITIAL ALTERNATIVES
BILLINGS, MONTANA

SCALE: 1" = 200'
0 200' 400'

FIGURE 6

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING



MONTANA MDT DEPARTMENT OF TRANSPORTATION

BILLINGS AIRPORT ROAD MAIN STREET Concept

ALTERNATIVE 5B - PARTIAL DISPLACED LEFT-TURN (SOUTHWEST QUADRANT)
TIER I: EVALUATION AND SCREENING OF INITIAL ALTERNATIVES
BILLINGS, MONTANA

SCALE: 1" = 200'
0 200' 400'

FIGURE 7

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

Attachment A Alternatives Operational Analysis - Year 2040 Traffic Conditions, Weekday AM Peak Hour

HCM Signalized Intersection Capacity Analysis
1: Main St (Hwy 87) & Lake Elmo Dr

Future Year 2040 AM Peak Hour - Alt 1 (No Build)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	3	29	854	66	16	29	114	1024	59	24	2465	2
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.5	4.5	4.5	4.5	4.5	4.5	4.8		4.5	4.8	
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91		1.00	0.91	
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1591	1389	1615	1604	1428	1509	4129		1524	4462	
Flt Permitted		0.98	1.00	0.74	1.00	1.00	0.05	1.00		0.25	1.00	
Satd. Flow (perm)		1566	1389	1252	1604	1428	83	4129		404	4462	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	3	29	854	66	16	29	114	1024	59	24	2465	2
RTOR Reduction (vph)	0	0	10	0	0	25	0	3	0	0	0	0
Lane Group Flow (vph)	0	32	844	66	16	4	114	1080	0	24	2467	0
Confl. Peds. (#/hr)	2					2	1					1
Confl. Bikes (#/hr)									1			1
Heavy Vehicles (%)	0%	7%	4%	0%	6%	0%	7%	12%	0%	6%	4%	0%
Turn Type	Perm	NA	pm+ov	Perm	NA	pm+ov	pm+pt	NA		pm+pt	NA	
Protected Phases		8	5		4	1	5	2		1	6	
Permitted Phases	8		8	4		4	2			6		
Actuated Green, G (s)		12.3	43.9	12.3	12.3	17.2	108.4	99.0		77.2	72.3	
Effective Green, g (s)		12.3	43.9	12.3	12.3	17.2	108.4	99.0		77.2	72.3	
Actuated g/C Ratio		0.09	0.34	0.09	0.09	0.13	0.83	0.76		0.59	0.56	
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	4.8		4.5	4.8	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		148	517	118	151	238	415	3144		282	2481	
v/s Ratio Prot			c0.40		0.01	0.00	0.07	0.26		0.00	c0.55	
v/s Ratio Perm		0.02	0.21	0.05		0.00	0.16			0.05		
v/c Ratio		0.22	1.63	0.56	0.11	0.02	0.27	0.34		0.09	0.99	
Uniform Delay, d1		54.4	43.0	56.3	53.8	49.0	24.5	5.0		11.4	28.6	
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.61	0.11		1.00	1.00	
Incremental Delay, d2		0.7	293.4	5.6	0.3	0.0	0.3	0.3		0.1	16.8	
Delay (s)		55.1	336.4	61.9	54.1	49.1	39.6	0.8		11.5	45.4	
Level of Service		E	F	E	D	D	D	A		B	D	
Approach Delay (s)		326.3			57.4			4.5			45.1	
Approach LOS		F			E			A			D	

Intersection Summary			
HCM 2000 Control Delay	88.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	128.0%	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												
Volume (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	
Lane Util. Factor	0.95	0.95	1.00		1.00	1.00	1.00	0.91		1.00	0.91	
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00		1.00	0.98	
Flt Protected	0.95	0.96	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1461	1468	1198		1595	1445	1154	4219		1614	4386	
Flt Permitted	0.95	0.96	1.00		0.99	1.00	0.05	1.00		0.30	1.00	
Satd. Flow (perm)	1461	1468	1198		1595	1445	63	4219		511	4386	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
RTOR Reduction (vph)	0	0	74	0	0	7	0	0	0	0	21	0
Lane Group Flow (vph)	239	245	31	0	211	0	70	845	0	38	3320	0
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Split	NA	Perm	Split	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			3	2			6		
Actuated Green, G (s)	23.6	23.6	23.6		6.4	6.4	82.8	77.3		80.6	76.2	
Effective Green, g (s)	23.6	23.6	23.6		6.4	6.4	82.8	77.3		80.6	76.2	
Actuated g/C Ratio	0.18	0.18	0.18		0.05	0.05	0.64	0.59		0.62	0.59	
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	0.2		3.0	0.2	
Lane Grp Cap (vph)	265	266	217		78	71	86	2508		354	2570	
v/s Ratio Prot	0.16	c0.17			c0.13		c0.03	0.20		0.00	c0.76	
v/s Ratio Perm			0.03			0.00	0.48			0.06		
v/c Ratio	0.90	0.92	0.14		2.71	0.00	0.81	0.34		0.11	1.29	
Uniform Delay, d1	52.1	52.3	44.7		61.8	58.8	34.1	13.4		9.7	26.9	
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.01	1.94		0.65	0.67	
Incremental Delay, d2	30.9	34.8	0.3		802.3	0.0	36.3	0.3		0.0	131.6	
Delay (s)	82.9	87.1	45.0		864.1	58.8	70.6	26.2		6.4	149.5	
Level of Service	F	F	D		F	E	E	C		A	F	
Approach Delay (s)		77.9			838.3			29.6			147.9	
Approach LOS		E			F			C			F	

Intersection Summary			
HCM 2000 Control Delay	148.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	113.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	464

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	404	0	0	0	387	987	3	0	2903	18
Conflicting Peds, #/hr	0	0	0	0	0	0	3	0	0	0	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Stop	-	-	None	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	-	290	-	-	60	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	4	0	0	0	6	14	0	0	5	17
Mvmt Flow	0	0	404	0	0	0	387	987	3	0	2903	18

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	4072	4667	1455	2924	4666	495	2903	0	0	990	0	0
Stage 1	2903	2903	-	1763	1763	-	-	-	-	-	-	-
Stage 2	1169	1764	-	1161	2903	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	7.18	6.4	6.5	7.1	5.42	-	-	5.3	-	-
Critical Hdwy Stg 1	7.3	5.5	-	7.3	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.7	5.5	-	6.7	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.8	4	3.94	3.8	4	3.9	3.16	-	-	3.1	-	-
Pot Cap-1 Maneuver	3	1	~ 100	17	1	449	~ 40	-	-	402	-	0
Stage 1	8	36	-	58	139	-	-	-	-	-	-	0
Stage 2	187	139	-	189	36	-	-	-	-	-	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	3	1	~ 100	-	1	449	~ 40	-	-	402	-	-
Mov Cap-2 Maneuver	3	1	-	-	1	-	-	-	-	-	-	-
Stage 1	8	36	-	58	139	-	-	-	-	-	-	-
Stage 2	187	139	-	-	36	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 1455.3	0	$ 1151.4	0
HCM LOS	F	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT
Capacity (veh/h)	~ 40	-	-	100	-	402	-
HCM Lane V/C Ratio	9.675	-	-	4.04	-	-	-
HCM Control Delay (s)	$ 4096.7	-	-	$ 1455.3	0	0	-
HCM Lane LOS	F	-	-	F	A	A	-
HCM 95th %tile Q(veh)	46.5	-	-	41.6	-	0	-

Notes

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

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 2A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	
Lane Util. Factor	0.95	0.95	1.00		1.00	1.00	1.00	0.91		1.00	0.91	
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00		1.00	0.98	
Flt Protected	0.95	0.96	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1461	1468	1197		1595	1445	1154	4219		1614	4385	
Flt Permitted	0.95	0.96	1.00		0.99	1.00	0.04	1.00		0.30	1.00	
Satd. Flow (perm)	1461	1468	1197		1595	1445	43	4219		514	4385	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
RTOR Reduction (vph)	0	0	90	0	0	6	0	0	0	0	15	0
Lane Group Flow (vph)	239	245	15	0	211	1	70	845	0	38	3326	0
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Split	NA	Perm	Split	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			3	2			6		
Actuated Green, G (s)	26.5	26.5	26.5		18.5	18.5	118.9	113.4		114.5	111.2	
Effective Green, g (s)	26.5	26.5	26.5		18.5	18.5	118.9	113.4		114.5	111.2	
Actuated g/C Ratio	0.15	0.15	0.15		0.10	0.10	0.66	0.63		0.64	0.62	
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	0.2		3.0	0.2	
Lane Grp Cap (vph)	215	216	176		163	148	62	2657		347	2708	
v/s Ratio Prot	0.16	c0.17			c0.13		c0.03	0.20		0.00	c0.76	
v/s Ratio Perm			0.01			0.00	0.71			0.07		
v/c Ratio	1.11	1.13	0.09		1.29	0.00	1.13	0.32		0.11	1.23	
Uniform Delay, d1	76.8	76.8	66.3		80.8	72.5	58.6	15.4		12.3	34.4	
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	94.5	102.1	0.2		170.3	0.0	153.9	0.3		0.1	106.1	
Delay (s)	171.3	178.8	66.5		251.0	72.5	212.5	15.7		12.5	140.5	
Level of Service	F	F	E		F	E	F	B		B	F	
Approach Delay (s)		155.7			245.3			30.8			139.1	
Approach LOS		F			F			C			F	

Intersection Summary			
HCM 2000 Control Delay	126.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	113.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 2B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	4.5
Lane Util. Factor	0.95	0.95	1.00		1.00	1.00	1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00		0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1461	1468	1198		1595	1445	1154	4219		1614	4506	1384
Flt Permitted	0.95	0.96	1.00		0.99	1.00	0.06	1.00		0.29	1.00	1.00
Satd. Flow (perm)	1461	1468	1198		1595	1445	69	4219		492	4506	1384
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
RTOR Reduction (vph)	0	0	86	0	0	6	0	0	0	0	0	50
Lane Group Flow (vph)	239	245	19	0	211	1	70	845	0	38	2812	479
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Split	NA	Perm	Split	NA	Perm	pm+pt	NA		pm+pt	NA	pm+ov
Protected Phases	4	4		3	3		5	2		1	6	4
Permitted Phases			4			3	2			6		6
Actuated Green, G (s)	23.5	23.5	23.5		15.0	15.0	73.9	69.9		72.5	69.2	92.7
Effective Green, g (s)	23.5	23.5	23.5		15.0	15.0	73.9	69.9		72.5	69.2	92.7
Actuated g/C Ratio	0.18	0.18	0.18		0.12	0.12	0.57	0.54		0.56	0.53	0.71
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	0.2		3.0	0.2	3.0
Lane Grp Cap (vph)	264	265	216		184	166	72	2268		302	2398	986
v/s Ratio Prot	0.16	c0.17			c0.13		c0.03	0.20		0.00	c0.62	0.09
v/s Ratio Perm			0.02			0.00	0.51			0.07		0.26
v/c Ratio	0.91	0.92	0.09		1.15	0.00	0.97	0.37		0.13	1.17	0.49
Uniform Delay, d1	52.2	52.4	44.3		57.5	50.9	30.8	17.4		13.2	30.4	8.2
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	31.5	35.5	0.2		111.4	0.0	96.0	0.5		0.2	82.5	0.4
Delay (s)	83.6	87.9	44.5		168.9	50.9	126.8	17.8		13.4	112.9	8.6
Level of Service	F	F	D		F	D	F	B		B	F	A
Approach Delay (s)		78.4			165.1			26.2			95.4	
Approach LOS		E			F			C			F	

Intersection Summary			
HCM 2000 Control Delay	84.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	104.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 2C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.8		4.5	4.8	4.5
Lane Util. Factor	0.91	0.91		1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.92		1.00	0.99		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.99		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2799	1240		1509	1612		1154	4219		1614	4506	1383
Flt Permitted	0.95	0.99		0.95	1.00		0.05	1.00		0.29	1.00	1.00
Satd. Flow (perm)	2799	1240		1509	1612		67	4219		499	4506	1383
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
RTOR Reduction (vph)	0	29	0	0	1	0	0	0	0	0	0	36
Lane Group Flow (vph)	383	177	0	45	172	0	70	845	0	38	2812	493
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Split	NA		Split	NA		pm+pt	NA		pm+pt	NA	pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases							2			6		6
Actuated Green, G (s)	22.6	22.6		12.9	12.9		76.9	72.9		75.5	72.2	94.8
Effective Green, g (s)	22.6	22.6		12.9	12.9		76.9	72.9		75.5	72.2	94.8
Actuated g/C Ratio	0.17	0.17		0.10	0.10		0.59	0.56		0.58	0.56	0.73
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.8		4.5	4.8	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	0.2		3.0	0.2	3.0
Lane Grp Cap (vph)	486	215		149	159		73	2365		318	2502	1008
v/s Ratio Prot	0.14	c0.14		0.03	c0.11		c0.03	0.20		0.00	c0.62	0.09
v/s Ratio Perm							0.54			0.07		0.27
v/c Ratio	0.79	0.82		0.30	1.08		0.96	0.36		0.12	1.12	0.49
Uniform Delay, d1	51.4	51.8		54.4	58.5		32.4	15.7		11.9	28.9	7.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.3	21.8		1.1	95.1		90.1	0.4		0.2	61.7	0.4
Delay (s)	59.7	73.6		55.5	153.6		122.6	16.1		12.0	90.6	7.8
Level of Service	E	E		E	F		F	B		B	F	A
Approach Delay (s)		64.5			133.4			24.2			76.7	
Approach LOS		E			F			C			E	

Intersection Summary			
HCM 2000 Control Delay	68.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 2D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.5		4.0	4.5		4.5	4.8		4.5	4.8	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.90		1.00	0.99		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2984	1319		1509	1612		1154	4219		1614	4506	1382
Flt Permitted	0.95	1.00		0.95	1.00		0.05	1.00		0.30	1.00	1.00
Satd. Flow (perm)	2984	1319		1509	1612		62	4219		513	4506	1382
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
RTOR Reduction (vph)	0	52	0	0	1	0	0	0	0	0	0	48
Lane Group Flow (vph)	426	111	0	45	172	0	70	845	0	38	2812	481
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases							2			6		6
Actuated Green, G (s)	17.0	21.1		9.8	13.9		82.5	78.0		80.1	76.8	93.8
Effective Green, g (s)	17.0	21.1		9.8	13.9		82.5	78.0		80.1	76.8	93.8
Actuated g/C Ratio	0.13	0.16		0.08	0.11		0.63	0.60		0.62	0.59	0.72
Clearance Time (s)	4.0	4.5		4.0	4.5		4.5	4.8		4.5	4.8	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	0.2		3.0	0.2	3.0
Lane Grp Cap (vph)	390	214		113	172		77	2531		344	2662	997
v/s Ratio Prot	c0.14	0.08		0.03	c0.11		c0.03	0.20		0.00	c0.62	0.06
v/s Ratio Perm							0.54			0.07		0.28
v/c Ratio	1.09	0.52		0.40	1.00		0.91	0.33		0.11	1.06	0.48
Uniform Delay, d1	56.5	49.8		57.3	58.0		33.2	13.0		9.9	26.6	7.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	72.7	2.1		2.3	68.8		71.5	0.4		0.1	34.6	0.4
Delay (s)	129.2	51.9		59.6	126.8		104.7	13.4		10.0	61.2	8.1
Level of Service	F	D		E	F		F	B		B	E	A
Approach Delay (s)		107.8			113.0			20.3			52.3	
Approach LOS		F			F			C			D	

Intersection Summary			
HCM 2000 Control Delay	55.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	17.8
Intersection Capacity Utilization	99.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 2E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.5		4.0	4.5		4.5	4.8		4.5	4.8	4.0
Lane Util. Factor	0.94	1.00		1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.90		1.00	0.99		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4337	1319		1509	1612		1154	4219		1614	4506	1381
Flt Permitted	0.95	1.00		0.95	1.00		0.05	1.00		0.31	1.00	1.00
Satd. Flow (perm)	4337	1319		1509	1612		60	4219		521	4506	1381
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	105	45	166	7	70	845	0	38	2812	529
RTOR Reduction (vph)	0	52	0	0	1	0	0	0	0	0	0	59
Lane Group Flow (vph)	426	111	0	45	172	0	70	845	0	38	2812	470
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases							2			6		6
Actuated Green, G (s)	13.0	15.9		12.2	15.1		85.7	80.8		82.5	79.2	92.2
Effective Green, g (s)	13.0	15.9		12.2	15.1		85.7	80.8		82.5	79.2	92.2
Actuated g/C Ratio	0.10	0.12		0.09	0.12		0.66	0.62		0.63	0.61	0.71
Clearance Time (s)	4.0	4.5		4.0	4.5		4.5	4.8		4.5	4.8	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	0.2		3.0	0.2	3.0
Lane Grp Cap (vph)	433	161		141	187		80	2622		358	2745	979
v/s Ratio Prot	c0.10	0.08		0.03	c0.11		c0.03	0.20		0.00	c0.62	0.05
v/s Ratio Perm							0.54			0.06		0.29
v/c Ratio	0.98	0.69		0.32	0.92		0.88	0.32		0.11	1.02	0.48
Uniform Delay, d1	58.4	54.7		55.0	56.9		33.0	11.6		8.9	25.4	8.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	38.7	12.0		1.3	43.7		60.2	0.3		0.1	23.7	0.4
Delay (s)	97.1	66.7		56.3	100.6		93.3	12.0		9.1	49.1	8.7
Level of Service	F	E		E	F		F	B		A	D	A
Approach Delay (s)		88.7			91.4			18.2			42.3	
Approach LOS		F			F			B			D	

Intersection Summary			
HCM 2000 Control Delay	45.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	17.8
Intersection Capacity Utilization	95.4%	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												
Volume (vph)	426	58	105	45	166	7	0	845	0	0	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.0	4.5			4.8			4.8	4.5
Lane Util. Factor	0.97	1.00		1.00	1.00			0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.90		1.00	0.99			1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	2984	1319		1509	1612			4219			4506	1383
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (perm)	2984	1319		1509	1612			4219			4506	1383
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	105	45	166	7	0	845	0	0	2812	529
RTOR Reduction (vph)	0	17	0	0	1	0	0	0	0	0	0	14
Lane Group Flow (vph)	426	146	0	45	172	0	0	845	0	0	2812	515
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Prot	NA		Prot	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases												6
Actuated Green, G (s)	22.7	25.2		11.1	13.1			80.4			80.4	103.1
Effective Green, g (s)	22.7	25.2		11.1	13.1			80.4			80.4	103.1
Actuated g/C Ratio	0.17	0.19		0.09	0.10			0.62			0.62	0.79
Clearance Time (s)	4.5	4.5		4.0	4.5			4.8			4.8	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			0.2			0.2	3.0
Lane Grp Cap (vph)	521	255		128	162			2609			2786	1096
v/s Ratio Prot	c0.14	0.11		0.03	c0.11			0.20			c0.62	0.08
v/s Ratio Perm												0.29
v/c Ratio	0.82	0.57		0.35	1.06			0.32			1.01	0.47
Uniform Delay, d1	51.7	47.5		56.1	58.5			11.8			24.8	4.4
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	9.6	3.1		1.7	88.2			0.3			19.4	0.3
Delay (s)	61.3	50.6		57.7	146.7			12.2			44.2	4.8
Level of Service	E	D		E	F			B			D	A
Approach Delay (s)		58.3			128.3			12.2			37.9	
Approach LOS		E			F			B			D	

Intersection Summary			
HCM 2000 Control Delay	39.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	529.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	230	0	0	0	457	917	3	0	2902	18
Conflicting Peds, #/hr	0	0	0	0	0	0	3	0	0	0	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Stop	-	-	None	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	-	290	-	-	60	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	4	0	0	0	6	14	0	0	5	17
Mvmt Flow	0	0	230	0	0	0	457	917	3	0	2902	18

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	4183	4736	1454	2994	4735	460	2902	0	0	920	0	0
Stage 1	2902	2902	-	1833	1833	-	-	-	-	-	-	-
Stage 2	1281	1834	-	1161	2902	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	7.18	6.4	6.5	7.1	5.42	-	-	5.3	-	-
Critical Hdwy Stg 1	7.3	5.5	-	7.3	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.7	5.5	-	6.7	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.8	4	3.94	3.8	4	3.9	3.16	-	-	3.1	-	-
Pot Cap-1 Maneuver	2	1	~ 100	15	1	473	~ 40	-	-	434	-	0
Stage 1	8	36	-	52	128	-	-	-	-	-	-	0
Stage 2	159	128	-	189	36	-	-	-	-	-	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	2	1	~ 100	-	1	473	~ 40	-	-	434	-	-
Mov Cap-2 Maneuver	2	1	-	-	1	-	-	-	-	-	-	-
Stage 1	8	36	-	52	128	-	-	-	-	-	-	-
Stage 2	159	128	-	-	36	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 684	0	$ 1620.5	0
HCM LOS	F	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT
Capacity (veh/h)	~ 40	-	-	100	-	434	-
HCM Lane V/C Ratio	11.425	-	-	2.3	-	-	-
HCM Control Delay (s)	$ 4882.9	-	-	$ 684	0	0	-
HCM Lane LOS	F	-	-	F	A	A	-
HCM 95th %tile Q(veh)	55.2	-	-	20.5	-	0	-

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												
Volume (vph)	426	78	105	45	166	7	0	900	0	0	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.5
Lane Util. Factor	0.94	1.00		1.00	1.00			0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.91		1.00	0.99			1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	4337	1344		1509	1612			4219			4506	1382
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (perm)	4337	1344		1509	1612			4219			4506	1382
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	78	105	45	166	7	0	900	0	0	2812	529
RTOR Reduction (vph)	0	38	0	0	1	0	0	0	0	0	0	34
Lane Group Flow (vph)	426	145	0	45	172	0	0	900	0	0	2812	495
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Prot	NA		Prot	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases												6
Actuated Green, G (s)	19.1	24.6		13.4	18.9			78.2			78.2	97.3
Effective Green, g (s)	19.1	24.6		13.4	18.9			78.2			78.2	97.3
Actuated g/C Ratio	0.15	0.19		0.10	0.15			0.60			0.60	0.75
Clearance Time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			0.2			0.2	3.0
Lane Grp Cap (vph)	637	254		155	234			2537			2710	1034
v/s Ratio Prot	c0.10	0.11		0.03	c0.11			0.21			c0.62	0.07
v/s Ratio Perm												0.29
v/c Ratio	0.67	0.57		0.29	0.74			0.35			1.04	0.48
Uniform Delay, d1	52.5	47.9		53.9	53.2			13.1			25.9	6.4
Progression Factor	1.00	1.00		1.00	1.00			1.00			0.51	0.30
Incremental Delay, d2	2.7	3.1		1.0	11.4			0.4			18.5	0.0
Delay (s)	55.1	51.0		54.9	64.5			13.5			31.6	1.9
Level of Service	E	D		D	E			B			C	A
Approach Delay (s)		53.9			62.6			13.5			26.9	
Approach LOS		D			E			B			C	

Intersection Summary			
HCM 2000 Control Delay	29.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	91.5%	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												
Volume (vph)	0	0	230	0	0	0	457	917	3	1	2920	18
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)			4.0				4.0	4.0		4.0	4.0	4.0
Lane Util. Factor			1.00				0.97	0.91		1.00	0.91	1.00
Frpb, ped/bikes			1.00				1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes			1.00				1.00	1.00		1.00	1.00	1.00
Frt			0.86				1.00	1.00		1.00	1.00	0.85
Flt Protected			1.00				0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)			1414				2956	4071		1615	4420	1196
Flt Permitted			1.00				0.95	1.00		0.30	1.00	1.00
Satd. Flow (perm)			1414				2956	4071		507	4420	1196
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	230	0	0	0	457	917	3	1	2920	18
RTOR Reduction (vph)	0	0	6	0	0	0	0	0	0	0	0	2
Lane Group Flow (vph)	0	0	224	0	0	0	457	920	0	1	2920	16
Confl. Peds. (#/hr)							3					3
Heavy Vehicles (%)	0%	0%	4%	0%	0%	0%	6%	14%	0%	0%	5%	17%
Turn Type			Over				Prot	NA		Perm	NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases										6		6
Actuated Green, G (s)			26.7				26.7	130.0		95.3	95.3	95.3
Effective Green, g (s)			26.7				26.7	130.0		95.3	95.3	95.3
Actuated g/C Ratio			0.21				0.21	1.00		0.73	0.73	0.73
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)			290				607	4071		371	3240	876
v/s Ratio Prot			c0.16				0.15	0.23			c0.66	
v/s Ratio Perm										0.00		0.01
v/c Ratio			0.77				0.75	0.23		0.00	0.90	0.02
Uniform Delay, d1			48.8				48.5	0.0		4.6	13.6	4.7
Progression Factor			1.00				1.00	1.00		0.19	0.31	0.02
Incremental Delay, d2			12.0				5.3	0.1		0.0	1.2	0.0
Delay (s)			60.7				53.8	0.1		0.9	5.4	0.1
Level of Service			E				D	A		A	A	A
Approach Delay (s)		60.7			0.0			17.9			5.4	
Approach LOS		E			A			B			A	

Intersection Summary			
HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: Swords Ln & E Airport Rd

Future Year 2040 AM Peak Hour - Alt 3C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	586	440	67	706	26	400	14	27	4	2	8
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	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	0.95		1.00	1.00			1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00		1.00	1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90			0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1615	3076	1406	1615	3061		1615	1455			1353	
Flt Permitted	0.19	1.00	1.00	0.22	1.00		0.95	1.00			0.96	
Satd. Flow (perm)	320	3076	1406	379	3061		1615	1455			1321	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	16	586	440	67	706	26	400	14	27	4	2	8
RTOR Reduction (vph)	0	0	320	0	2	0	0	11	0	0	6	0
Lane Group Flow (vph)	16	586	120	67	730	0	400	30	0	0	8	0
Confl. Bikes (#/hr)			5			12						
Heavy Vehicles (%)	0%	5%	0%	0%	5%	0%	0%	0%	8%	50%	0%	0%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Prot	NA		Perm	NA	
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases	4		4	8						6		
Actuated Green, G (s)	37.2	35.6	35.6	43.6	38.8		37.8	77.6			35.8	
Effective Green, g (s)	37.2	35.6	35.6	43.6	38.8		37.8	77.6			35.8	
Actuated g/C Ratio	0.29	0.27	0.27	0.34	0.30		0.29	0.60			0.28	
Clearance Time (s)	4.0	4.0	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	3.0			3.0	
Lane Grp Cap (vph)	107	842	385	172	913		469	868			363	
v/s Ratio Prot	0.00	0.19		c0.01	c0.24		c0.25	c0.02				
v/s Ratio Perm	0.04		0.09	0.12							0.01	
v/c Ratio	0.15	0.70	0.31	0.39	0.80		0.85	0.03			0.02	
Uniform Delay, d1	34.7	42.3	37.5	31.4	42.0		43.5	10.8			34.3	
Progression Factor	1.00	1.00	1.00	1.10	1.07		0.86	0.73			1.00	
Incremental Delay, d2	0.6	2.5	0.5	1.3	4.4		13.9	0.1			0.1	
Delay (s)	35.3	44.9	38.0	35.8	49.3		51.4	7.9			34.5	
Level of Service	D	D	D	D	D		D	A			C	
Approach Delay (s)		41.8			48.2			47.3			34.5	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	45.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	58	105	0	210	7	0	1271	0	0	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.5			4.5			4.8			4.8	4.8
Lane Util. Factor		1.00			1.00			0.91			0.91	1.00
Frpb, ped/bikes		0.99			1.00			1.00			1.00	0.98
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.91			1.00			1.00			1.00	0.85
Flt Protected		1.00			1.00			1.00			1.00	1.00
Satd. Flow (prot)		1333			1614			4219			4506	1377
Flt Permitted		1.00			1.00			1.00			1.00	1.00
Satd. Flow (perm)		1333			1614			4219			4506	1377
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	58	105	0	210	7	0	1271	0	0	2812	529
RTOR Reduction (vph)	0	4	0	0	1	0	0	0	0	0	0	63
Lane Group Flow (vph)	0	159	0	0	216	0	0	1271	0	0	2812	466
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type		NA			NA			NA			NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases												6
Actuated Green, G (s)		21.5			21.5			99.2			99.2	99.2
Effective Green, g (s)		21.5			21.5			99.2			99.2	99.2
Actuated g/C Ratio		0.17			0.17			0.76			0.76	0.76
Clearance Time (s)		4.5			4.5			4.8			4.8	4.8
Vehicle Extension (s)		3.0			3.0			0.2			0.2	0.2
Lane Grp Cap (vph)		220			266			3219			3438	1050
v/s Ratio Prot		0.12			c0.13			0.30			c0.62	
v/s Ratio Perm												0.34
v/c Ratio		0.72			0.81			0.39			0.82	0.44
Uniform Delay, d1		51.4			52.3			5.2			9.7	5.5
Progression Factor		0.20			1.00			2.57			0.69	0.64
Incremental Delay, d2		9.2			17.0			0.3			0.2	0.1
Delay (s)		19.5			69.3			13.7			7.0	3.6
Level of Service		B			E			B			A	A
Approach Delay (s)		19.5			69.3			13.7			6.4	
Approach LOS		B			E			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	9.3
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	426	230	457	917	2902	18
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	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)	3133	1389	2956	4071	4420	1196
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3133	1389	2956	4071	4420	1196
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	230	457	917	2902	18
RTOR Reduction (vph)	0	1	0	0	0	2
Lane Group Flow (vph)	426	229	457	917	2902	16
Confl. Peds. (#/hr)			3			3
Heavy Vehicles (%)	0%	4%	6%	14%	5%	17%
Turn Type	Prot	pm+ov	Prot	NA	NA	Perm
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	16.0	35.0	19.0	106.0	83.0	83.0
Effective Green, g (s)	16.0	35.0	19.0	106.0	83.0	83.0
Actuated g/C Ratio	0.12	0.27	0.15	0.82	0.64	0.64
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)	385	416	432	3319	2822	763
v/s Ratio Prot	c0.14	0.08	c0.15	0.23	c0.66	
v/s Ratio Perm		0.08				0.01
v/c Ratio	1.11	0.55	1.06	0.28	1.03	0.02
Uniform Delay, d1	57.0	40.7	55.5	2.9	23.5	8.6
Progression Factor	1.00	1.00	1.00	1.00	0.49	0.72
Incremental Delay, d2	77.8	1.5	59.4	0.2	20.7	0.0
Delay (s)	134.8	42.2	114.9	3.1	32.1	6.2
Level of Service	F	D	F	A	C	A
Approach Delay (s)	102.4			40.3	32.0	
Approach LOS	F			D	C	

Intersection Summary			
HCM 2000 Control Delay	43.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	100.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 3D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	484	105	0	658	7	0	1342	0	0	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.5	4.5		4.5			4.8			4.8	4.8
Lane Util. Factor		0.95	1.00		0.95			0.91			0.91	1.00
Frpb, ped/bikes		1.00	0.99		1.00			1.00			1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00			1.00			1.00	1.00
Frt		1.00	0.85		1.00			1.00			1.00	0.85
Flt Protected		1.00	1.00		1.00			1.00			1.00	1.00
Satd. Flow (prot)		2963	1198		3073			4219			4506	1377
Flt Permitted		1.00	1.00		1.00			1.00			1.00	1.00
Satd. Flow (perm)		2963	1198		3073			4219			4506	1377
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	484	105	0	658	7	0	1342	0	0	2812	529
RTOR Reduction (vph)	0	0	11	0	1	0	0	0	0	0	0	10
Lane Group Flow (vph)	0	484	94	0	664	0	0	1342	0	0	2812	519
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type		NA	Perm		NA			NA			NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases			4									6
Actuated Green, G (s)		31.3	31.3		31.3			89.4			89.4	89.4
Effective Green, g (s)		31.3	31.3		31.3			89.4			89.4	89.4
Actuated g/C Ratio		0.24	0.24		0.24			0.69			0.69	0.69
Clearance Time (s)		4.5	4.5		4.5			4.8			4.8	4.8
Vehicle Extension (s)		3.0	3.0		3.0			0.2			0.2	0.2
Lane Grp Cap (vph)		713	288		739			2901			3098	946
v/s Ratio Prot		0.16			c0.22			0.32			c0.62	
v/s Ratio Perm			0.08									0.38
v/c Ratio		0.68	0.33		0.90			0.46			0.91	0.55
Uniform Delay, d1		44.8	40.6		47.8			9.3			16.9	10.2
Progression Factor		1.00	1.00		1.00			1.00			0.46	0.41
Incremental Delay, d2		2.6	0.7		13.7			0.5			0.5	0.2
Delay (s)		47.4	41.3		61.5			9.8			8.2	4.4
Level of Service		D	D		E			A			A	A
Approach Delay (s)		46.3			61.5			9.8			7.6	
Approach LOS		D			E			A			A	

Intersection Summary			
HCM 2000 Control Delay	18.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	9.3
Intersection Capacity Utilization	89.1%	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												
Volume (veh/h)	0	0	230	0	0	425	0	917	457	0	2902	18
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	230	0	0	425	0	917	457	0	2902	18
Pedestrians		3										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		0										
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											497	
pX, platoon unblocked	0.46	0.46	0.46	0.46	0.46		0.46					
vC, conflicting volume	3636	4279	970	1884	3822	306	2905			1374		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2616	4018	0	0	3022	306	1023			1374		
tC, single (s)	7.5	6.5	7.0	7.5	6.5	6.9	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	53	100	100	39	100			100		
cM capacity (veh/h)	2	1	493	251	6	696	298			506		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	230	425	306	306	306	457	967	967	967	18
Volume Left	0	0	0	0	0	0	0	0	0	0
Volume Right	230	425	0	0	0	457	0	0	0	18
cSH	493	696	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.47	0.61	0.18	0.18	0.18	0.27	0.57	0.57	0.57	0.01
Queue Length 95th (ft)	61	105	0	0	0	0	0	0	0	0
Control Delay (s)	18.5	17.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	C								
Approach Delay (s)	18.5	17.9	0.0				0.0			
Approach LOS	C	C								

Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	85.3%	ICU Level of Service	E	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	160	425	0	150	457	5
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	0.97	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	1.00	1.00		1.00	0.95	1.00
Satd. Flow (prot)	1667	1417		1667	3072	1417
Flt Permitted	1.00	1.00		1.00	0.95	1.00
Satd. Flow (perm)	1667	1417		1667	3072	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	160	425	0	150	457	5
RTOR Reduction (vph)	0	179	0	0	0	3
Lane Group Flow (vph)	160	247	0	150	457	2
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	58.0	58.0		58.0	34.0	34.0
Effective Green, g (s)	58.0	58.0		58.0	34.0	34.0
Actuated g/C Ratio	0.58	0.58		0.58	0.34	0.34
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)	966	821		966	1044	481
v/s Ratio Prot	0.10			0.09	c0.15	
v/s Ratio Perm		c0.17				0.00
v/c Ratio	0.17	0.30		0.16	0.44	0.00
Uniform Delay, d1	9.8	10.7		9.7	25.6	21.8
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.4	0.9		0.3	1.3	0.0
Delay (s)	10.1	11.6		10.0	26.9	21.8
Level of Service	B	B		B	C	C
Approach Delay (s)	11.2			10.0	26.9	
Approach LOS	B			B	C	

Intersection Summary			
HCM 2000 Control Delay	17.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	32.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	426	58	105	0	0	0	70	845	0	38	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5					4.5	4.8		4.5	4.8	4.5
Lane Util. Factor	0.94	1.00					1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	0.99					1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00					1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.90					1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00					0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4337	1319					1154	4219		1614	4506	1382
Flt Permitted	0.95	1.00					0.04	1.00		0.32	1.00	1.00
Satd. Flow (perm)	4337	1319					53	4219		546	4506	1382
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	105	0	0	0	70	845	0	38	2812	529
RTOR Reduction (vph)	0	44	0	0	0	0	0	0	0	0	0	50
Lane Group Flow (vph)	426	119	0	0	0	0	70	845	0	38	2812	479
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Split	NA					pm+pt	NA		pm+pt	NA	pm+ov
Protected Phases	4	4					5	2		1	6	4
Permitted Phases							2			6		6
Actuated Green, G (s)	20.7	20.7					98.5	91.5		92.5	88.5	109.2
Effective Green, g (s)	20.7	20.7					98.5	91.5		92.5	88.5	109.2
Actuated g/C Ratio	0.16	0.16					0.76	0.70		0.71	0.68	0.84
Clearance Time (s)	4.5	4.5					4.5	4.8		4.5	4.8	4.5
Vehicle Extension (s)	3.0	3.0					3.0	0.2		3.0	0.2	3.0
Lane Grp Cap (vph)	690	210					99	2969		421	3067	1160
v/s Ratio Prot	c0.10	0.09					c0.04	0.20		0.00	c0.62	0.07
v/s Ratio Perm							0.49			0.06		0.28
v/c Ratio	0.62	0.57					0.71	0.28		0.09	0.92	0.41
Uniform Delay, d1	51.0	50.5					32.0	7.1		5.5	17.6	2.5
Progression Factor	1.00	1.00					1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.7	3.5					20.5	0.2		0.1	5.6	0.2
Delay (s)	52.6	54.0					52.5	7.4		5.6	23.3	2.8
Level of Service	D	D					D	A		A	C	A
Approach Delay (s)		53.0			0.0			10.8			19.8	
Approach LOS		D			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	83.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	761

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	230	0	0	0	387	987	3	0	2902	18
Conflicting Peds, #/hr	0	0	0	0	0	0	3	0	0	0	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Stop	-	-	None	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	-	290	-	-	60	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	4	0	0	0	6	14	0	0	5	17
Mvmt Flow	0	0	261	0	0	0	440	1122	3	0	3298	20

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	4626	5303	1652	3322	5301	563	3298	0	0	1125	0	0
Stage 1	3298	3298	-	2003	2003	-	-	-	-	-	-	-
Stage 2	1328	2005	-	1319	3298	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	7.18	6.4	6.5	7.1	5.42	-	-	5.3	-	-
Critical Hdwy Stg 1	7.3	5.5	-	7.3	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.7	5.5	-	6.7	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.8	4	3.94	3.8	4	3.9	3.16	-	-	3.1	-	-
Pot Cap-1 Maneuver	1	0	~ 73	9	0	406	~ 24	-	-	346	-	0
Stage 1	4	22	-	39	105	-	-	-	-	-	-	0
Stage 2	149	105	-	151	22	-	-	-	-	-	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	1	0	~ 73	-	0	406	~ 24	-	-	346	-	-
Mov Cap-2 Maneuver	1	0	-	-	0	-	-	-	-	-	-	-
Stage 1	4	22	-	39	105	-	-	-	-	-	-	-
Stage 2	149	105	-	-	22	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 1280.3	0	$ 2278.2	0
HCM LOS	F	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT
Capacity (veh/h)	~ 24	-	-	73	-	346	-
HCM Lane V/C Ratio	18.324	-	-	3.58	-	-	-
HCM Control Delay (s)	$ 8106.3	-	-	$ 1280.3	0	0	-
HCM Lane LOS	F	-	-	F	A	A	-
HCM 95th %tile Q(veh)	55	-	-	27.2	-	0	-

Notes

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

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 4B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	426	78	105	0	0	0	0	900	15	0	2840	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5						4.8			4.8	4.8
Lane Util. Factor	0.94	1.00						0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99						1.00			1.00	0.98
Flpb, ped/bikes	1.00	1.00						1.00			1.00	1.00
Frt	1.00	0.91						1.00			1.00	0.85
Flt Protected	0.95	1.00						1.00			1.00	1.00
Satd. Flow (prot)	4337	1344						4213			4506	1377
Flt Permitted	0.95	1.00						1.00			1.00	1.00
Satd. Flow (perm)	4337	1344						4213			4506	1377
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	78	105	0	0	0	0	900	15	0	2840	529
RTOR Reduction (vph)	0	4	0	0	0	0	0	1	0	0	0	61
Lane Group Flow (vph)	426	179	0	0	0	0	0	914	0	0	2840	468
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Perm	NA						NA			NA	Perm
Protected Phases		4						2			6	
Permitted Phases	4											6
Actuated Green, G (s)	21.8	21.8						98.9			98.9	98.9
Effective Green, g (s)	21.8	21.8						98.9			98.9	98.9
Actuated g/C Ratio	0.17	0.17						0.76			0.76	0.76
Clearance Time (s)	4.5	4.5						4.8			4.8	4.8
Vehicle Extension (s)	3.0	3.0						0.2			0.2	0.2
Lane Grp Cap (vph)	727	225						3205			3428	1047
v/s Ratio Prot		c0.13						0.22			c0.63	
v/s Ratio Perm	0.10											0.34
v/c Ratio	0.59	0.79						0.29			0.83	0.45
Uniform Delay, d1	49.9	52.0						4.8			10.1	5.6
Progression Factor	1.00	1.00						1.00			0.44	0.13
Incremental Delay, d2	1.2	17.4						0.2			0.2	0.1
Delay (s)	51.1	69.3						5.0			4.6	0.9
Level of Service	D	E						A			A	A
Approach Delay (s)		56.6			0.0			5.0			4.1	
Approach LOS		E			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	9.3
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	230	457	921	2920	18
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	0.97	0.91	0.91	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00
Frt		0.86	1.00	1.00	1.00	0.85
Flt Protected		1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)		1414	2956	4071	4420	1196
Flt Permitted		1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)		1414	2956	4071	4420	1196
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	230	457	921	2920	18
RTOR Reduction (vph)	0	2	0	0	0	2
Lane Group Flow (vph)	0	228	457	921	2920	16
Confl. Peds. (#/hr)			3			3
Heavy Vehicles (%)	0%	4%	6%	14%	5%	17%
Turn Type		Over	Prot	NA	NA	Perm
Protected Phases		5	5	2	6	
Permitted Phases						6
Actuated Green, G (s)		26.8	26.8	130.0	95.2	95.2
Effective Green, g (s)		26.8	26.8	130.0	95.2	95.2
Actuated g/C Ratio		0.21	0.21	1.00	0.73	0.73
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)		291	609	4071	3236	875
v/s Ratio Prot		c0.16	0.15	0.23	c0.66	
v/s Ratio Perm						0.01
v/c Ratio		0.78	0.75	0.23	0.90	0.02
Uniform Delay, d1		48.9	48.5	0.0	13.7	4.7
Progression Factor		1.00	1.00	1.00	0.32	0.64
Incremental Delay, d2		13.0	5.2	0.1	2.6	0.0
Delay (s)		61.8	53.6	0.1	7.1	3.0
Level of Service		E	D	A	A	A
Approach Delay (s)	61.8			17.9	7.0	
Approach LOS	E			B	A	

Intersection Summary			
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 4C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	426	58	335	45	165	5	0	845	0	0	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5	4.5	4.0	4.0			4.8			4.8	4.5
Lane Util. Factor	0.94	1.00	1.00	1.00	1.00			0.91			0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00			1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	4337	1560	1198	1509	1614			4219			4506	1382
Flt Permitted	0.95	1.00	1.00	0.95	1.00			1.00			1.00	1.00
Satd. Flow (perm)	4337	1560	1198	1509	1614			4219			4506	1382
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	335	45	165	5	0	845	0	0	2812	529
RTOR Reduction (vph)	0	0	35	0	1	0	0	0	0	0	0	75
Lane Group Flow (vph)	426	58	300	45	169	0	0	845	0	0	2812	454
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Prot	NA	Perm	Prot	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases			4									6
Actuated Green, G (s)	19.1	36.3	36.3	7.1	24.3			73.3			73.3	92.4
Effective Green, g (s)	19.1	36.3	36.3	7.1	24.3			73.3			73.3	92.4
Actuated g/C Ratio	0.15	0.28	0.28	0.05	0.19			0.56			0.56	0.71
Clearance Time (s)	4.5	4.5	4.5	4.0	4.0			4.8			4.8	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			0.2			0.2	3.0
Lane Grp Cap (vph)	637	435	334	82	301			2378			2540	982
v/s Ratio Prot	0.10	0.04		0.03	c0.10			0.20			c0.62	0.07
v/s Ratio Perm			c0.25									0.26
v/c Ratio	0.67	0.13	0.90	0.55	0.56			0.36			1.11	0.46
Uniform Delay, d1	52.5	35.1	45.1	59.9	48.0			15.5			28.4	8.1
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00			0.53	0.16
Incremental Delay, d2	2.7	0.1	25.1	7.3	2.4			0.4			48.8	0.0
Delay (s)	55.1	35.2	70.2	67.2	50.4			15.9			64.0	1.3
Level of Service	E	D	E	E	D			B			E	A
Approach Delay (s)		59.9			53.9			15.9			54.1	
Approach LOS		E			D			B			D	

Intersection Summary			
HCM 2000 Control Delay	48.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.3
Intersection Capacity Utilization	98.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	0	457	917	3127	18
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)			4.0	4.0	4.0	4.0
Lane Util. Factor			0.97	0.91	0.91	1.00
Frpb, ped/bikes			1.00	1.00	1.00	0.98
Flpb, ped/bikes			1.00	1.00	1.00	1.00
Frt			1.00	1.00	1.00	0.85
Flt Protected			0.95	1.00	1.00	1.00
Satd. Flow (prot)			2956	4071	4420	1211
Flt Permitted			0.95	1.00	1.00	1.00
Satd. Flow (perm)			2956	4071	4420	1211
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	457	917	3127	18
RTOR Reduction (vph)	0	0	0	0	0	2
Lane Group Flow (vph)	0	0	457	917	3127	16
Confl. Peds. (#/hr)			3			3
Heavy Vehicles (%)	0%	4%	6%	14%	5%	17%
Turn Type			Prot	NA	NA	Perm
Protected Phases			5	2	6	
Permitted Phases						6
Actuated Green, G (s)			21.7	130.0	100.3	100.3
Effective Green, g (s)			21.7	130.0	100.3	100.3
Actuated g/C Ratio			0.17	1.00	0.77	0.77
Clearance Time (s)			4.0	4.0	4.0	4.0
Vehicle Extension (s)			3.0	3.0	3.0	3.0
Lane Grp Cap (vph)			493	4071	3410	934
v/s Ratio Prot			c0.15	0.23	c0.71	
v/s Ratio Perm						0.01
v/c Ratio			0.93	0.23	0.92	0.02
Uniform Delay, d1			53.4	0.0	11.6	3.4
Progression Factor			1.00	1.00	0.52	0.08
Incremental Delay, d2			23.5	0.1	0.5	0.0
Delay (s)			76.9	0.1	6.6	0.3
Level of Service			E	A	A	A
Approach Delay (s)	0.0			25.7	6.6	
Approach LOS	A			C	A	

Intersection Summary			
HCM 2000 Control Delay	12.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 4D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	45	166	7	457	1360	60	38	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)					4.5	4.5	4.5	4.8		4.5	4.8	4.8
Lane Util. Factor					1.00	1.00	0.97	0.91		1.00	0.91	1.00
Frpb, ped/bikes					1.00	1.00	1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes					1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt					1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected					0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)					1595	1445	2238	4204		1615	4506	1377
Flt Permitted					0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)					1595	1445	2238	4204		1615	4506	1377
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	45	166	7	457	1360	60	38	2812	529
RTOR Reduction (vph)	0	0	0	0	0	6	0	3	0	0	0	48
Lane Group Flow (vph)	0	0	0	0	211	1	457	1417	0	38	2812	481
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type				Perm	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases					3		5	2		1	6	
Permitted Phases				3		3						6
Actuated Green, G (s)					16.5	16.5	24.9	93.7		6.0	74.8	74.8
Effective Green, g (s)					16.5	16.5	24.9	93.7		6.0	74.8	74.8
Actuated g/C Ratio					0.13	0.13	0.19	0.72		0.05	0.58	0.58
Clearance Time (s)					4.5	4.5	4.5	4.8		4.5	4.8	4.8
Vehicle Extension (s)					3.0	3.0	3.0	0.2		3.0	0.2	0.2
Lane Grp Cap (vph)					202	183	428	3030		74	2592	792
v/s Ratio Prot							c0.20	0.34		0.02	c0.62	
v/s Ratio Perm					0.13	0.00						0.35
v/c Ratio					1.04	0.00	1.07	0.47		0.51	1.08	0.61
Uniform Delay, d1					56.8	49.6	52.5	7.6		60.6	27.6	18.0
Progression Factor					1.00	1.00	1.02	0.80		0.96	0.72	0.68
Incremental Delay, d2					75.5	0.0	60.1	0.5		1.9	40.9	1.1
Delay (s)					132.3	49.6	113.6	6.6		60.1	60.6	13.4
Level of Service					F	D	F	A		E	E	B
Approach Delay (s)		0.0			129.6			32.6			53.2	
Approach LOS		A			F			C			D	

Intersection Summary			
HCM 2000 Control Delay	49.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	106.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	506	341	0	1378	2860	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.94	0.86		0.91	0.91	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	
Frt	0.97	0.85		1.00	1.00	
Flt Protected	0.96	1.00		1.00	1.00	
Satd. Flow (prot)	4423	1195		4071	4420	
Flt Permitted	0.96	1.00		1.00	1.00	
Satd. Flow (perm)	4423	1195		4071	4420	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	506	341	0	1378	2860	0
RTOR Reduction (vph)	2	2	0	0	0	0
Lane Group Flow (vph)	647	196	0	1378	2860	0
Confl. Peds. (#/hr)			3			3
Heavy Vehicles (%)	0%	4%	6%	14%	5%	17%
Turn Type	Perm	Perm		NA	NA	
Protected Phases				2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	26.6	26.6		95.4	95.4	
Effective Green, g (s)	26.6	26.6		95.4	95.4	
Actuated g/C Ratio	0.20	0.20		0.73	0.73	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	905	244		2987	3243	
v/s Ratio Prot				0.34	c0.65	
v/s Ratio Perm	0.15	c0.16				
v/c Ratio	0.71	0.80		0.46	0.88	
Uniform Delay, d1	48.2	49.2		7.0	13.1	
Progression Factor	1.00	1.00		1.00	0.44	
Incremental Delay, d2	2.7	17.0		0.5	0.4	
Delay (s)	50.9	66.2		7.5	6.1	
Level of Service	D	E		A	A	
Approach Delay (s)	54.5			7.5	6.1	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.2%	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												
Volume (vph)	426	58	105	45	166	7	0	960	0	0	2832	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.5
Lane Util. Factor	0.94	1.00		1.00	1.00			0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.90		1.00	0.99			1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	4337	1319		1509	1612			4219			4506	1382
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (perm)	4337	1319		1509	1612			4219			4506	1382
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	105	45	166	7	0	960	0	0	2832	529
RTOR Reduction (vph)	0	48	0	0	1	0	0	0	0	0	0	31
Lane Group Flow (vph)	426	115	0	45	172	0	0	960	0	0	2832	498
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Prot	NA		Prot	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases												6
Actuated Green, G (s)	19.1	22.8		15.1	18.8			78.3			78.3	97.4
Effective Green, g (s)	19.1	22.8		15.1	18.8			78.3			78.3	97.4
Actuated g/C Ratio	0.15	0.18		0.12	0.14			0.60			0.60	0.75
Clearance Time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			0.2			0.2	3.0
Lane Grp Cap (vph)	637	231		175	233			2541			2713	1035
v/s Ratio Prot	c0.10	0.09		0.03	c0.11			0.23			c0.63	0.07
v/s Ratio Perm												0.29
v/c Ratio	0.67	0.50		0.26	0.74			0.38			1.04	0.48
Uniform Delay, d1	52.5	48.4		52.3	53.2			13.3			25.9	6.4
Progression Factor	1.00	1.00		1.00	1.00			0.99			0.71	0.45
Incremental Delay, d2	2.7	1.7		0.8	11.6			0.4			23.5	0.1
Delay (s)	55.1	50.1		53.1	64.8			13.6			41.9	3.0
Level of Service	E	D		D	E			B			D	A
Approach Delay (s)		53.7			62.4			13.6			35.7	
Approach LOS		D			E			B			D	

Intersection Summary			
HCM 2000 Control Delay	34.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR
Lane Configurations							
Volume (vph)	0	230	432	942	20	2940	18
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	0.97	0.91	1.00	0.91	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.86	1.00	1.00	1.00	1.00	0.85
Flt Protected		1.00	0.95	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1414	2956	4071	1583	4420	1196
Flt Permitted		1.00	0.95	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1414	2956	4071	1583	4420	1196
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	230	432	942	20	2940	18
RTOR Reduction (vph)	0	2	0	0	0	0	2
Lane Group Flow (vph)	0	228	432	942	20	2940	16
Confl. Peds. (#/hr)			3				3
Heavy Vehicles (%)	0%	4%	6%	14%	2%	5%	17%
Turn Type		Over	Prot	NA	Prot	NA	Perm
Protected Phases		5	5	2	1	6	
Permitted Phases							6
Actuated Green, G (s)		26.6	26.6	118.4	3.6	95.4	95.4
Effective Green, g (s)		26.6	26.6	118.4	3.6	95.4	95.4
Actuated g/C Ratio		0.20	0.20	0.91	0.03	0.73	0.73
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)		289	604	3707	43	3243	877
v/s Ratio Prot		c0.16	0.15	0.23	0.01	c0.67	
v/s Ratio Perm							0.01
v/c Ratio		0.79	0.72	0.25	0.47	0.91	0.02
Uniform Delay, d1		49.1	48.2	0.7	62.3	13.8	4.7
Progression Factor		1.00	1.00	1.00	0.77	0.33	0.08
Incremental Delay, d2		13.7	4.0	0.2	1.8	1.2	0.0
Delay (s)		62.7	52.2	0.8	49.8	5.8	0.4
Level of Service		E	D	A	D	A	A
Approach Delay (s)	62.7			17.0		6.0	
Approach LOS	E			B		A	

Intersection Summary			
HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.1%	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												
Volume (vph)	426	58	105	45	166	7	0	870	0	0	2832	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.8
Lane Util. Factor	0.94	1.00		1.00	1.00			0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.90		1.00	0.99			1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	4337	1319		1509	1612			4219			4506	1377
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (perm)	4337	1319		1509	1612			4219			4506	1377
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	426	58	105	45	166	7	0	870	0	0	2832	529
RTOR Reduction (vph)	0	48	0	0	1	0	0	0	0	0	0	71
Lane Group Flow (vph)	426	115	0	45	172	0	0	870	0	0	2832	458
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type	Prot	NA		Prot	NA			NA			NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases												6
Actuated Green, G (s)	18.4	22.8		15.0	19.4			78.4			78.4	78.4
Effective Green, g (s)	18.4	22.8		15.0	19.4			78.4			78.4	78.4
Actuated g/C Ratio	0.14	0.18		0.12	0.15			0.60			0.60	0.60
Clearance Time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.8
Vehicle Extension (s)	3.0	3.0		3.0	3.0			0.2			0.2	0.2
Lane Grp Cap (vph)	613	231		174	240			2544			2717	830
v/s Ratio Prot	c0.10	0.09		0.03	c0.11			0.21			c0.63	
v/s Ratio Perm												0.33
v/c Ratio	0.69	0.50		0.26	0.72			0.34			1.04	0.55
Uniform Delay, d1	53.1	48.4		52.4	52.7			12.9			25.8	15.3
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	3.4	1.7		0.8	9.8			0.4			29.6	2.6
Delay (s)	56.5	50.1		53.2	62.5			13.3			55.4	18.0
Level of Service	E	D		D	E			B			E	B
Approach Delay (s)		54.8			60.6			13.3			49.5	
Approach LOS		D			E			B			D	

Intersection Summary			
HCM 2000 Control Delay	44.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	230	432	942	2902	18
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	0.97	0.91	0.91	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00
Frt		0.86	1.00	1.00	1.00	0.85
Flt Protected		1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)		1414	2956	4071	4420	1196
Flt Permitted		1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)		1414	2956	4071	4420	1196
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	230	432	942	2902	18
RTOR Reduction (vph)	0	2	0	0	0	2
Lane Group Flow (vph)	0	228	432	942	2902	16
Confl. Peds. (#/hr)			3			3
Heavy Vehicles (%)	0%	4%	6%	14%	5%	17%
Turn Type		Over	Prot	NA	NA	Perm
Protected Phases		5	5	2	6	
Permitted Phases						6
Actuated Green, G (s)		26.7	26.7	130.0	95.3	95.3
Effective Green, g (s)		26.7	26.7	130.0	95.3	95.3
Actuated g/C Ratio		0.21	0.21	1.00	0.73	0.73
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)		290	607	4071	3240	876
v/s Ratio Prot		c0.16	0.15	0.23	c0.66	
v/s Ratio Perm						0.01
v/c Ratio		0.79	0.71	0.23	0.90	0.02
Uniform Delay, d1		49.0	48.1	0.0	13.5	4.7
Progression Factor		1.00	1.00	1.00	0.31	0.16
Incremental Delay, d2		13.2	3.9	0.1	1.1	0.0
Delay (s)		62.2	52.0	0.1	5.2	0.7
Level of Service		E	D	A	A	A
Approach Delay (s)	62.2			16.4	5.2	
Approach LOS	E			B	A	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 6A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	58	105	45	166	7	70	845	0	38	2812	529
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.5			4.5	4.5	4.5	4.8		4.5	4.8	
Lane Util. Factor		1.00			1.00	1.00	1.00	0.91		1.00	0.91	
Frpb, ped/bikes		0.99			1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.91			1.00	0.85	1.00	1.00		1.00	0.98	
Flt Protected		1.00			0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1333			1595	1445	1154	4219		1614	4386	
Flt Permitted		1.00			0.77	1.00	0.05	1.00		0.31	1.00	
Satd. Flow (perm)		1333			1244	1445	55	4219		533	4386	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	58	105	45	166	7	70	845	0	38	2812	529
RTOR Reduction (vph)	0	51	0	0	0	6	0	0	0	0	21	0
Lane Group Flow (vph)	0	112	0	0	211	1	70	845	0	38	3320	0
Confl. Peds. (#/hr)			1	1			4		2	2		4
Heavy Vehicles (%)	5%	9%	19%	7%	5%	0%	40%	10%	0%	0%	3%	3%
Turn Type		NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases				8		8	2			6		
Actuated Green, G (s)		23.5			23.5	23.5	94.2	88.3		91.2	86.8	
Effective Green, g (s)		23.5			23.5	23.5	94.2	88.3		91.2	86.8	
Actuated g/C Ratio		0.18			0.18	0.18	0.72	0.68		0.70	0.67	
Clearance Time (s)		4.5			4.5	4.5	4.5	4.8		4.5	4.8	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	0.2		3.0	0.2	
Lane Grp Cap (vph)		240			224	261	89	2865		410	2928	
v/s Ratio Prot		0.08					c0.04	0.20		0.00	c0.76	
v/s Ratio Perm					c0.17	0.00	0.53			0.06		
v/c Ratio		0.47			0.94	0.00	0.79	0.29		0.09	1.13	
Uniform Delay, d1		47.7			52.6	43.7	39.8	8.4		6.0	21.6	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.4			43.9	0.0	35.5	0.3		0.1	65.1	
Delay (s)		49.1			96.5	43.7	75.3	8.6		6.1	86.7	
Level of Service		D			F	D	E	A		A	F	
Approach Delay (s)		49.1			94.8			13.7			85.8	
Approach LOS		D			F			B			F	

Intersection Summary			
HCM 2000 Control Delay	70.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	109.0%	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												
Volume (veh/h)	0	0	0	0	0	0	0	1342	0	0	2812	529
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	1342	0	0	2812	529
Pedestrians		4			2			1				
Lane Width (ft)		0.0			0.0			12.0				
Walking Speed (ft/s)		4.0			4.0			4.0				
Percent Blockage		0			0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											686	
pX, platoon unblocked	0.56	0.56	0.56	0.56	0.56		0.56					
vC, conflicting volume	3263	4160	942	2282	4689	449	3345			1344		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2276	3888	0	511	4840	449	2423			1344		
tC, single (s)	7.6	6.7	7.3	7.6	6.6	6.9	4.9			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.1	3.5	3.6	4.0	3.3	2.6			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	12	2	573	241	0	563	60			519		

Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4
Volume Total	537	537	268	937	937	937	529
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	529
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.32	0.32	0.16	0.55	0.55	0.55	0.31
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0			0.0			
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Brett Korporaal	Freeway/Dir of Travel	Main St
Agency or Company	Kittelson & Associates, Inc.	Junction	Alkali Creek Rd
Date Performed	7/29/2015	Jurisdiction	MDT
Analysis Time Period	AM Peak Hour	Analysis Year	Future 2040

Project Description Airport Rd/Main St - Billings

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 917	
	Ramp Volume, V_R: 425	
	Freeway Free-Flow Speed, S_{FF}: 45.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	917	0.82	Rolling	5	0	0.930	1.00	1202
Ramp	425	0.82	Rolling	7	0	0.905	1.00	573
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.594 using Equation (Exhibit 13-6)

V_{12} = 714 pc/h

V_3 or V_{av34} 488 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 714 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1775	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1287	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 11.5 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.305 (Exibit 13-11)

S_R= 44.1 mph (Exhibit 13-11)

S_0= 45.0 mph (Exhibit 13-11)

S = 44.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2014 University of Florida, All Rights Reserved

HCS2010™ Version 6.65 Generated: 9/30/2015 11:41 AM

HCM Unsignalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 AM Peak Hour - Alt 6C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	845	0	0	2812	529
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	0	0	0	0	0	0	960	0	0	3195	601
Pedestrians		4			2			1				
Lane Width (ft)		0.0			0.0			12.0				
Walking Speed (ft/s)		4.0			4.0			4.0				
Percent Blockage		0			0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											686	
pX, platoon unblocked	0.57	0.57	0.57	0.57	0.57		0.57					
vC, conflicting volume	3520	4162	1070	2028	4763	322	3801			962		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2783	3907	0	171	4960	322	3275			962		
tC, single (s)	7.6	6.7	7.3	7.6	6.6	6.9	4.9			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.1	3.5	3.6	4.0	3.3	2.6			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	5	2	588	435	0	680	24			723		

Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4
Volume Total	320	320	320	1065	1065	1065	601
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	601
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.19	0.19	0.19	0.63	0.63	0.63	0.35
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0			0.0			
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	457	251	0	0	1190	150	2	0	0	535	0	162
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	6.0			6.0		4.0			4.0	5.0	
Lane Util. Factor	0.97	0.95			0.95		1.00			0.97	1.00	
Frpb, ped/bikes	1.00	1.00			1.00		1.00			1.00	0.97	
Flpb, ped/bikes	1.00	1.00			1.00		1.00			1.00	1.00	
Frt	1.00	1.00			0.98		1.00			1.00	0.85	
Flt Protected	0.95	1.00			1.00		0.95			0.95	1.00	
Satd. Flow (prot)	3133	3106			3103		804			2984	1407	
Flt Permitted	0.95	1.00			1.00		0.95			0.95	1.00	
Satd. Flow (perm)	3133	3106			3103		804			2984	1407	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	531	292	0	0	1384	174	2	0	0	622	0	188
RTOR Reduction (vph)	0	0	0	0	6	0	0	0	0	0	149	0
Lane Group Flow (vph)	531	292	0	0	1552	0	2	0	0	622	39	0
Confl. Peds. (#/hr)			4	4			3					3
Confl. Bikes (#/hr)						2						
Heavy Vehicles (%)	0%	4%	0%	0%	2%	3%	100%	0%	0%	5%	0%	0%
Turn Type	Prot	NA		Prot	NA		Prot			Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	15.2	71.8			52.6		0.7			19.2	22.6	
Effective Green, g (s)	15.2	71.8			52.6		0.7			19.2	22.6	
Actuated g/C Ratio	0.14	0.65			0.48		0.01			0.17	0.21	
Clearance Time (s)	4.0	6.0			6.0		4.0			4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0			3.0	3.0	
Lane Grp Cap (vph)	432	2025			1482		5			520	288	
v/s Ratio Prot	c0.17	0.09			c0.50		0.00			c0.21	c0.03	
v/s Ratio Perm												
v/c Ratio	1.23	0.14			1.05		0.40			1.20	0.13	
Uniform Delay, d1	47.4	7.4			28.7		54.5			45.4	35.8	
Progression Factor	1.00	1.00			1.00		1.00			1.00	1.00	
Incremental Delay, d2	122.0	0.0			36.7		45.2			105.9	0.2	
Delay (s)	169.5	7.4			65.5		99.7			151.3	36.0	
Level of Service	F	A			E		F			F	D	
Approach Delay (s)		112.0			65.5			99.7			124.5	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM 2000 Control Delay	92.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	110.1	Sum of lost time (s)	19.0
Intersection Capacity Utilization	92.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Attachment B Alternatives Operational Analysis - Year 2040 Traffic Conditions, Weekday PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	24	56	445	127	88	97	641	3138	101	29	1364	11
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.5	4.5	4.5	4.5	4.5	4.5	4.8		4.5	4.8	
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91		1.00	0.91	
Frpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.99	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1675	1363	1568	1700	1417	1583	4483		1615	4458	
Flt Permitted		0.90	1.00	0.66	1.00	1.00	0.10	1.00		0.06	1.00	
Satd. Flow (perm)		1522	1363	1082	1700	1417	171	4483		101	4458	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	24	56	445	127	88	97	641	3138	101	29	1364	11
RTOR Reduction (vph)	0	0	9	0	0	38	0	2	0	0	1	0
Lane Group Flow (vph)	0	80	436	127	88	59	641	3237	0	29	1374	0
Confl. Peds. (#/hr)							1		1	1		1
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	0%	0%	6%	3%	0%	2%	2%	3%	2%	0%	4%	0%
Turn Type	Perm	NA	pm+ov	Perm	NA	pm+ov	pm+pt	NA		pm+pt	NA	
Protected Phases		8	5		4	1	5	2		1	6	
Permitted Phases	8		8	4		4	2			6		
Actuated Green, G (s)		21.2	69.0	21.2	21.2	26.4	119.5	109.8		72.4	67.2	
Effective Green, g (s)		21.2	69.0	21.2	21.2	26.4	119.5	109.8		72.4	67.2	
Actuated g/C Ratio		0.14	0.46	0.14	0.14	0.18	0.80	0.73		0.48	0.45	
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	4.8		4.5	4.8	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		215	667	152	240	291	586	3281		101	1997	
v/s Ratio Prot			0.21		0.05	0.01	c0.35	0.72		0.01	0.31	
v/s Ratio Perm		0.05	0.11	c0.12		0.03	c0.52			0.13		
v/c Ratio		0.37	0.65	0.84	0.37	0.20	1.09	0.99		0.29	0.69	
Uniform Delay, d1		58.4	31.3	62.7	58.3	52.8	40.7	19.4		46.1	33.0	
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.31	0.48		1.00	1.00	
Incremental Delay, d2		1.1	2.3	30.9	1.0	0.3	45.2	2.5		1.6	2.0	
Delay (s)		59.5	33.6	93.6	59.3	53.2	98.7	11.8		47.6	35.0	
Level of Service		E	C	F	E	D	F	B		D	D	
Approach Delay (s)		37.5			71.3			26.1			35.3	
Approach LOS		D			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	31.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	99.6%	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												
Volume (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	
Lane Util. Factor	0.95	0.95	1.00		1.00	1.00	1.00	0.91		1.00	0.91	
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00		1.00	0.97	
Flt Protected	0.95	0.97	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1490	1528	1218		1653	1445	1442	4501		1615	4284	
Flt Permitted	0.95	0.97	1.00		0.99	1.00	0.05	1.00		0.05	1.00	
Satd. Flow (perm)	1490	1528	1218		1653	1445	74	4501		88	4284	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
RTOR Reduction (vph)	0	0	62	0	0	40	0	0	0	0	30	0
Lane Group Flow (vph)	539	552	18	0	169	2	140	2980	0	53	1865	0
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Split	NA	Perm	Split	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			3	2			6		
Actuated Green, G (s)	33.5	33.5	33.5		5.5	5.5	97.2	86.3		84.0	77.6	
Effective Green, g (s)	33.5	33.5	33.5		5.5	5.5	97.2	86.3		84.0	77.6	
Actuated g/C Ratio	0.22	0.22	0.22		0.04	0.04	0.65	0.58		0.56	0.52	
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	0.2		3.0	0.2	
Lane Grp Cap (vph)	332	341	272		60	52	185	2589		114	2216	
v/s Ratio Prot	c0.36	0.36			c0.10		c0.08	c0.66		0.02	0.44	
v/s Ratio Perm			0.01			0.00	0.41			0.24		
v/c Ratio	1.62	1.62	0.07		2.82	0.03	0.76	1.15		0.46	0.84	
Uniform Delay, d1	58.2	58.2	45.9		72.2	69.7	43.1	31.9		33.7	30.9	
Progression Factor	1.00	1.00	1.00		1.00	1.00	0.72	1.48		1.31	0.65	
Incremental Delay, d2	294.0	291.6	0.1		861.6	0.2	1.6	68.4		2.2	3.0	
Delay (s)	352.3	349.9	46.0		933.9	69.9	32.6	115.4		46.1	23.3	
Level of Service	F	F	D		F	E	C	F		D	C	
Approach Delay (s)		330.2			761.9			111.7			23.9	
Approach LOS		F			F			F			C	

Intersection Summary			
HCM 2000 Control Delay	146.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	126.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	162

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	439	0	0	0	723	3136	6	0	1555	45
Conflicting Peds, #/hr	0	0	0	0	0	0	6	0	0	0	0	6
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Stop	-	-	None	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	-	290	-	-	60	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	8	0	0	0	0	3	0	0	5	0
Mvmt Flow	0	0	439	0	0	0	723	3136	6	0	1555	45

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	4255	6143	784	5207	6140	1571	1555	0	0	3142	0	0
Stage 1	1555	1555	-	4585	4585	-	-	-	-	-	-	-
Stage 2	2700	4588	-	622	1555	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	7.26	6.4	6.5	7.1	5.3	-	-	5.3	-	-
Critical Hdwy Stg 1	7.3	5.5	-	7.3	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.7	5.5	-	6.7	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.8	4	3.98	3.8	4	3.9	3.1	-	-	3.1	-	-
Pot Cap-1 Maneuver	2	0	~ 278	0	0	87	~ 214	-	-	33	-	0
Stage 1	82	176	-	0	4	-	-	-	-	-	-	0
Stage 2	19	4	-	406	176	-	-	-	-	-	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	2	0	~ 277	-	0	87	~ 213	-	-	33	-	-
Mov Cap-2 Maneuver	2	0	-	-	0	-	-	-	-	-	-	-
Stage 1	82	176	-	0	4	-	-	-	-	-	-	-
Stage 2	19	4	-	-	176	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 312.6	0	210	0
HCM LOS	F	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT
Capacity (veh/h)	~ 213	-	-	277	-	33	-
HCM Lane V/C Ratio	3.394	-	-	1.585	-	-	-
HCM Control Delay (s)	$ 1122.8	-	-	$ 312.6	0	0	-
HCM Lane LOS	F	-	-	F	A	A	-
HCM 95th %tile Q(veh)	67.8	-	-	26.5	-	0	-

Notes

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

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 PM Peak Hour - Alt 2A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	
Lane Util. Factor	0.95	0.95	1.00		1.00	1.00	1.00	0.91		1.00	0.91	
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00		1.00	0.97	
Flt Protected	0.95	0.97	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1490	1528	1215		1653	1445	1442	4501		1615	4282	
Flt Permitted	0.95	0.97	1.00		0.99	1.00	0.04	1.00		0.05	1.00	
Satd. Flow (perm)	1490	1528	1215		1653	1445	65	4501		77	4282	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
RTOR Reduction (vph)	0	0	57	0	0	39	0	0	0	0	26	0
Lane Group Flow (vph)	539	552	23	0	169	3	140	2980	0	53	1869	0
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Split	NA	Perm	Split	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			3	2			6		
Actuated Green, G (s)	56.5	56.5	56.5		15.5	15.5	109.2	100.7		92.8	88.8	
Effective Green, g (s)	56.5	56.5	56.5		15.5	15.5	109.2	100.7		92.8	88.8	
Actuated g/C Ratio	0.29	0.29	0.29		0.08	0.08	0.56	0.52		0.48	0.46	
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	0.2		3.0	0.2	
Lane Grp Cap (vph)	431	442	352		131	114	148	2324		68	1949	
v/s Ratio Prot	c0.36	0.36			c0.10		c0.08	c0.66		0.02	0.44	
v/s Ratio Perm			0.02			0.00	0.45			0.36		
v/c Ratio	1.25	1.25	0.07		1.29	0.03	0.95	1.28		0.78	0.96	
Uniform Delay, d1	69.2	69.2	50.1		89.8	82.8	65.3	47.1		46.7	51.3	
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	130.7	129.6	0.1		175.9	0.1	57.3	130.4		41.9	12.8	
Delay (s)	200.0	198.9	50.2		265.6	82.9	122.6	177.5		88.7	64.1	
Level of Service	F	F	D		F	F	F	F		F	E	
Approach Delay (s)		189.2			229.3			175.0			64.8	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	146.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	195.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	126.5%	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												
Volume (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	4.5
Lane Util. Factor	0.95	0.95	1.00		1.00	1.00	1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.97	1.00		0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1490	1528	1218		1653	1445	1442	4501		1615	4420	1400
Flt Permitted	0.95	0.97	1.00		0.99	1.00	0.08	1.00		0.06	1.00	1.00
Satd. Flow (perm)	1490	1528	1218		1653	1445	120	4501		104	4420	1400
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
RTOR Reduction (vph)	0	0	57	0	0	39	0	1	0	0	0	52
Lane Group Flow (vph)	539	552	23	0	169	3	140	2979	0	53	1480	363
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Split	NA	Perm	Split	NA	Perm	pm+pt	NA		pm+pt	NA	pm+ov
Protected Phases	4	4		3	3		5	2		1	6	4
Permitted Phases			4			3	2			6		6
Actuated Green, G (s)	42.5	42.5	42.5		11.5	11.5	82.2	74.5		68.3	65.1	107.6
Effective Green, g (s)	42.5	42.5	42.5		11.5	11.5	82.2	74.5		68.3	65.1	107.6
Actuated g/C Ratio	0.28	0.28	0.28		0.08	0.08	0.55	0.50		0.46	0.43	0.72
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.8		4.5	4.8	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	0.2		3.0	0.2	3.0
Lane Grp Cap (vph)	422	432	345		126	110	176	2235		79	1918	1004
v/s Ratio Prot	c0.36	0.36			c0.10		c0.07	c0.66		0.01	0.33	0.10
v/s Ratio Perm			0.02			0.00	0.37			0.29		0.16
v/c Ratio	1.28	1.28	0.07		1.34	0.03	0.80	1.33		0.67	0.77	0.36
Uniform Delay, d1	53.8	53.8	39.3		69.2	64.1	31.4	37.8		35.8	36.1	8.1
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.16	1.44		1.51	0.75	0.61
Incremental Delay, d2	142.0	141.9	0.1		197.3	0.1	2.3	150.2		15.1	2.3	0.2
Delay (s)	195.8	195.6	39.3		266.5	64.2	38.8	204.4		69.2	29.3	5.1
Level of Service	F	F	D		F	E	D	F		E	C	A
Approach Delay (s)		185.0			226.3			197.0			25.2	
Approach LOS		F			F			F			C	

Intersection Summary			
HCM 2000 Control Delay	143.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	126.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 PM Peak Hour - Alt 2C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.8		4.5	4.8	4.5
Lane Util. Factor	0.91	0.91		1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.97		1.00	0.96		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.99		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2854	1404		1509	1637		1442	4501		1615	4420	1398
Flt Permitted	0.95	0.99		0.95	1.00		0.09	1.00		0.06	1.00	1.00
Satd. Flow (perm)	2854	1404		1509	1637		136	4501		97	4420	1398
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
RTOR Reduction (vph)	0	6	0	0	8	0	0	0	0	0	0	81
Lane Group Flow (vph)	783	382	0	40	163	0	140	2980	0	53	1480	334
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Split	NA		Split	NA		pm+pt	NA		pm+pt	NA	pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases							2			6		6
Actuated Green, G (s)	35.5	35.5		12.5	12.5		88.2	80.5		73.2	70.0	105.5
Effective Green, g (s)	35.5	35.5		12.5	12.5		88.2	80.5		73.2	70.0	105.5
Actuated g/C Ratio	0.24	0.24		0.08	0.08		0.59	0.54		0.49	0.47	0.70
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.8		4.5	4.8	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	0.2		3.0	0.2	3.0
Lane Grp Cap (vph)	675	332		125	136		199	2415		79	2062	983
v/s Ratio Prot	c0.27	0.27		0.03	c0.10		c0.06	c0.66		0.01	0.33	0.08
v/s Ratio Perm							0.35			0.31		0.16
v/c Ratio	1.16	1.15		0.32	1.20		0.70	1.23		0.67	0.72	0.34
Uniform Delay, d1	57.2	57.2		64.7	68.8		23.8	34.8		35.3	32.1	8.7
Progression Factor	1.00	1.00		1.00	1.00		1.15	1.47		1.42	0.76	0.82
Incremental Delay, d2	87.8	96.7		1.5	139.6		1.0	105.5		15.1	1.6	0.2
Delay (s)	145.1	153.9		66.2	208.3		28.4	156.6		65.1	25.9	7.3
Level of Service	F	F		E	F		C	F		E	C	A
Approach Delay (s)		148.0			181.4			150.9			23.0	
Approach LOS		F			F			F			C	

Intersection Summary			
HCM 2000 Control Delay	112.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	117.6%	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												
Volume (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.5		4.0	4.5		4.5	4.8		4.5	4.8	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.96		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3042	1535		1509	1637		1442	4501		1615	4420	1398
Flt Permitted	0.95	1.00		0.95	1.00		0.09	1.00		0.06	1.00	1.00
Satd. Flow (perm)	3042	1535		1509	1637		138	4501		96	4420	1398
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
RTOR Reduction (vph)	0	9	0	0	8	0	0	0	0	0	0	85
Lane Group Flow (vph)	870	292	0	40	163	0	140	2980	0	53	1480	330
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases							2			6		6
Actuated Green, G (s)	34.0	38.3		10.0	14.3		88.4	79.5		75.0	70.6	104.6
Effective Green, g (s)	34.0	38.3		10.0	14.3		88.4	79.5		75.0	70.6	104.6
Actuated g/C Ratio	0.23	0.26		0.07	0.10		0.59	0.53		0.50	0.47	0.70
Clearance Time (s)	4.0	4.5		4.0	4.5		4.5	4.8		4.5	4.8	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	0.2		3.0	0.2	3.0
Lane Grp Cap (vph)	689	391		100	156		196	2385		92	2080	974
v/s Ratio Prot	c0.29	0.19		0.03	c0.10		c0.06	c0.66		0.02	0.33	0.08
v/s Ratio Perm							0.36			0.27		0.16
v/c Ratio	1.26	0.75		0.40	1.04		0.71	1.25		0.58	0.71	0.34
Uniform Delay, d1	58.0	51.4		67.1	67.8		23.2	35.2		34.6	31.6	9.0
Progression Factor	1.00	1.00		1.00	1.00		1.16	1.45		1.32	0.72	0.78
Incremental Delay, d2	129.7	7.6		2.6	84.2		1.1	112.5		6.2	1.5	0.2
Delay (s)	187.7	59.0		69.7	152.0		28.1	163.5		52.1	24.3	7.1
Level of Service	F	E		E	F		C	F		D	C	A
Approach Delay (s)		154.6			136.4			157.4			21.4	
Approach LOS		F			F			F			C	

Intersection Summary			
HCM 2000 Control Delay	115.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.8
Intersection Capacity Utilization	120.8%	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												
Volume (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.5		4.0	4.5		4.5	4.8		4.5	4.8	4.0
Lane Util. Factor	0.94	1.00		1.00	1.00		1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.96		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4422	1535		1509	1637		1442	4501		1615	4420	1396
Flt Permitted	0.95	1.00		0.95	1.00		0.11	1.00		0.05	1.00	1.00
Satd. Flow (perm)	4422	1535		1509	1637		164	4501		84	4420	1396
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	40	129	42	140	2956	24	53	1480	415
RTOR Reduction (vph)	0	8	0	0	8	0	0	0	0	0	0	82
Lane Group Flow (vph)	870	293	0	40	163	0	140	2980	0	53	1480	333
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases							2			6		6
Actuated Green, G (s)	25.0	34.8		4.5	14.3		97.4	89.7		83.9	80.7	105.7
Effective Green, g (s)	25.0	34.8		4.5	14.3		97.4	89.7		83.9	80.7	105.7
Actuated g/C Ratio	0.17	0.23		0.03	0.10		0.65	0.60		0.56	0.54	0.70
Clearance Time (s)	4.0	4.5		4.0	4.5		4.5	4.8		4.5	4.8	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	0.2		3.0	0.2	3.0
Lane Grp Cap (vph)	737	356		45	156		210	2691		79	2377	983
v/s Ratio Prot	c0.20	0.19		0.03	c0.10		c0.05	c0.66		0.01	0.33	0.06
v/s Ratio Perm							0.38			0.36		0.18
v/c Ratio	1.18	0.82		0.89	1.04		0.67	1.11		0.67	0.62	0.34
Uniform Delay, d1	62.5	54.7		72.5	67.8		16.8	30.1		35.3	24.1	8.6
Progression Factor	1.00	1.00		1.00	1.00		1.38	1.42		1.45	0.65	0.79
Incremental Delay, d2	94.9	14.1		91.4	84.2		0.7	48.9		15.1	0.9	0.1
Delay (s)	157.4	68.8		163.9	152.0		23.9	91.6		66.4	16.7	6.9
Level of Service	F	E		F	F		C	F		E	B	A
Approach Delay (s)		134.6			154.3			88.6			15.9	
Approach LOS		F			F			F			B	

Intersection Summary			
HCM 2000 Control Delay	77.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.8
Intersection Capacity Utilization	111.5%	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												
Volume (vph)	870	221	80	40	129	42	0	2956	24	0	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.0	4.5			4.8			4.8	4.5
Lane Util. Factor	0.97	1.00		1.00	1.00			0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.96		1.00	0.96			1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	3042	1535		1509	1637			4501			4420	1398
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (perm)	3042	1535		1509	1637			4501			4420	1398
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	40	129	42	0	2956	24	0	1480	415
RTOR Reduction (vph)	0	9	0	0	4	0	0	0	0	0	0	31
Lane Group Flow (vph)	870	292	0	40	167	0	0	2980	0	0	1480	384
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Prot	NA		Prot	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases												6
Actuated Green, G (s)	38.5	40.5		12.8	14.3			83.4			83.4	121.9
Effective Green, g (s)	38.5	40.5		12.8	14.3			83.4			83.4	121.9
Actuated g/C Ratio	0.26	0.27		0.09	0.10			0.56			0.56	0.81
Clearance Time (s)	4.5	4.5		4.0	4.5			4.8			4.8	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			0.2			0.2	3.0
Lane Grp Cap (vph)	780	414		128	156			2502			2457	1136
v/s Ratio Prot	c0.29	0.19		0.03	c0.10			c0.66			0.33	0.09
v/s Ratio Perm												0.19
v/c Ratio	1.12	0.71		0.31	1.07			1.19			0.60	0.34
Uniform Delay, d1	55.8	49.4		64.5	67.8			33.3			22.2	3.6
Progression Factor	1.00	1.00		1.00	1.00			1.23			0.65	0.06
Incremental Delay, d2	68.8	5.4		1.4	92.8			86.3			0.7	0.1
Delay (s)	124.5	54.8		65.9	160.7			127.2			15.3	0.3
Level of Service	F	D		E	F			F			B	A
Approach Delay (s)		106.6			142.7			127.2			12.0	
Approach LOS		F			F			F			B	

Intersection Summary			
HCM 2000 Control Delay	89.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	114.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	213.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	200	0	0	0	863	3136	6	0	1555	45
Conflicting Peds, #/hr	0	0	0	0	0	0	6	0	0	0	0	6
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Stop	-	-	None	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	-	290	-	-	60	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	8	0	0	0	0	3	0	0	5	0
Mvmt Flow	0	0	200	0	0	0	863	3136	6	0	1555	45

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	4535	6423	784	5487	6420	1571	1555	0	0	3142	0	0
Stage 1	1555	1555	-	4865	4865	-	-	-	-	-	-	-
Stage 2	2980	4868	-	622	1555	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	7.26	6.4	6.5	7.1	5.3	-	-	5.3	-	-
Critical Hdwy Stg 1	7.3	5.5	-	7.3	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.7	5.5	-	6.7	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.8	4	3.98	3.8	4	3.9	3.1	-	-	3.1	-	-
Pot Cap-1 Maneuver	1	0	278	0	0	87	~ 214	-	-	33	-	0
Stage 1	82	176	-	0	3	-	-	-	-	-	-	0
Stage 2	12	3	-	406	176	-	-	-	-	-	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	1	0	277	0	0	87	~ 213	-	-	33	-	-
Mov Cap-2 Maneuver	1	0	-	0	0	-	-	-	-	-	-	-
Stage 1	82	176	-	0	3	-	-	-	-	-	-	-
Stage 2	12	3	-	112	176	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	45.6	0	$ 305.4	0
HCM LOS	E	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT
Capacity (veh/h)	~ 213	-	-	277	-	33	-
HCM Lane V/C Ratio	4.052	-	-	0.722	-	-	-
HCM Control Delay (s)	$ 1417.2	-	-	45.6	0	0	-
HCM Lane LOS	F	-	-	E	A	A	-
HCM 95th %tile Q(veh)	85.1	-	-	5.1	-	0	-

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												
Volume (vph)	870	221	80	40	129	42	0	3100	24	0	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.5
Lane Util. Factor	0.94	1.00		1.00	1.00			0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.96		1.00	0.96			1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	4422	1535		1509	1637			4501			4420	1381
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (perm)	4422	1535		1509	1637			4501			4420	1381
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	40	129	42	0	3100	24	0	1480	415
RTOR Reduction (vph)	0	8	0	0	1	0	0	0	0	0	0	37
Lane Group Flow (vph)	870	293	0	40	170	0	0	3124	0	0	1480	378
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Prot	NA		Prot	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases												6
Actuated Green, G (s)	27.5	36.8		6.1	15.4			93.3			93.3	120.8
Effective Green, g (s)	27.5	36.8		6.1	15.4			93.3			93.3	120.8
Actuated g/C Ratio	0.18	0.25		0.04	0.10			0.62			0.62	0.81
Clearance Time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			0.2			0.2	3.0
Lane Grp Cap (vph)	810	376		61	168			2799			2749	1112
v/s Ratio Prot	c0.20	0.19		0.03	c0.10			c0.69			0.33	0.06
v/s Ratio Perm												0.21
v/c Ratio	1.07	0.78		0.66	1.01			1.12			0.54	0.34
Uniform Delay, d1	61.2	52.8		70.9	67.3			28.4			16.1	3.9
Progression Factor	1.00	1.00		1.00	1.00			1.13			0.59	0.08
Incremental Delay, d2	53.4	9.8		22.6	72.7			56.2			0.5	0.1
Delay (s)	114.7	62.6		93.5	140.0			88.4			10.1	0.4
Level of Service	F	E		F	F			F			B	A
Approach Delay (s)		101.3			131.2			88.4			8.0	
Approach LOS		F			F			F			A	

Intersection Summary			
HCM 2000 Control Delay	68.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	108.0%	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												
Volume (vph)	0	0	200	0	0	0	863	3136	6	0	1555	45
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)			4.0				4.0	4.0			4.0	4.0
Lane Util. Factor			1.00				0.97	0.91			0.91	1.00
Frpb, ped/bikes			1.00				1.00	1.00			1.00	0.97
Flpb, ped/bikes			1.00				1.00	1.00			1.00	1.00
Frt			0.86				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			1362				3133	4505			4420	1404
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			1362				3133	4505			4420	1404
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	200	0	0	0	863	3136	6	0	1555	45
RTOR Reduction (vph)	0	0	8	0	0	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	0	192	0	0	0	863	3142	0	0	1555	38
Confl. Peds. (#/hr)							6					6
Heavy Vehicles (%)	0%	0%	8%	0%	0%	0%	0%	3%	0%	0%	5%	0%
Turn Type			Over				Prot	NA		Perm	NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases										6		6
Actuated Green, G (s)			50.5				50.5	150.0			91.5	91.5
Effective Green, g (s)			50.5				50.5	150.0			91.5	91.5
Actuated g/C Ratio			0.34				0.34	1.00			0.61	0.61
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)			458				1054	4505			2696	856
v/s Ratio Prot			0.14				c0.28	c0.70			0.35	
v/s Ratio Perm												0.03
v/c Ratio			0.42				0.82	0.70			0.58	0.04
Uniform Delay, d1			38.4				45.6	0.0			17.6	11.7
Progression Factor			1.00				0.72	1.00			0.72	1.00
Incremental Delay, d2			0.6				0.5	0.1			0.8	0.1
Delay (s)			39.0				33.1	0.1			13.5	11.8
Level of Service			D				C	A			B	B
Approach Delay (s)		39.0			0.0			7.2			13.4	
Approach LOS		D			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.9%	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												
Volume (vph)	5	1053	906	58	613	33	896	6	47	21	2	13
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	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	0.95		0.97	1.00			1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.87			0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.97	
Satd. Flow (prot)	1615	3136	1411	1615	3132		2928	1436			1571	
Flt Permitted	0.32	1.00	1.00	0.11	1.00		0.95	1.00			0.84	
Satd. Flow (perm)	541	3136	1411	194	3132		2928	1436			1362	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	5	1053	906	58	613	33	896	6	47	21	2	13
RTOR Reduction (vph)	0	0	431	0	2	0	0	24	0	0	11	0
Lane Group Flow (vph)	5	1053	475	58	644	0	896	29	0	0	25	0
Confl. Bikes (#/hr)			4			7						
Heavy Vehicles (%)	0%	3%	0%	0%	2%	6%	7%	0%	3%	0%	0%	0%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Prot	NA		Perm	NA	
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases	4		4	8						6		
Actuated Green, G (s)	63.0	62.2	62.2	67.8	64.6		49.0	72.6			19.6	
Effective Green, g (s)	63.0	62.2	62.2	67.8	64.6		49.0	72.6			19.6	
Actuated g/C Ratio	0.42	0.41	0.41	0.45	0.43		0.33	0.48			0.13	
Clearance Time (s)	4.0	4.0	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	3.0			3.0	
Lane Grp Cap (vph)	232	1300	585	118	1348		956	695			177	
v/s Ratio Prot	0.00	0.34		c0.01	0.21		c0.31	0.02				
v/s Ratio Perm	0.01		c0.34	0.21							c0.02	
v/c Ratio	0.02	0.81	0.81	0.49	0.48		0.94	0.04			0.14	
Uniform Delay, d1	25.9	38.7	38.7	28.7	30.6		49.0	20.4			57.7	
Progression Factor	1.00	1.00	1.00	0.81	0.82		0.98	0.95			1.00	
Incremental Delay, d2	0.0	3.9	8.4	3.0	0.3		16.0	0.1			1.6	
Delay (s)	26.0	42.6	47.2	26.3	25.5		64.1	19.5			59.4	
Level of Service	C	D	D	C	C		E	B			E	
Approach Delay (s)		44.7			25.5			61.6			59.4	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	45.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	81.4%	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												
Volume (vph)	0	221	80	0	169	42	0	2956	24	0	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.5			4.5			4.8			4.8	4.8
Lane Util. Factor		1.00			1.00			0.91			0.91	1.00
Frpb, ped/bikes		0.99			1.00			1.00			1.00	0.98
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.96			0.97			1.00			1.00	0.85
Flt Protected		1.00			1.00			1.00			1.00	1.00
Satd. Flow (prot)		1541			1654			4501			4420	1390
Flt Permitted		1.00			1.00			1.00			1.00	1.00
Satd. Flow (perm)		1541			1654			4501			4420	1390
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	221	80	0	169	42	0	2956	24	0	1480	415
RTOR Reduction (vph)	0	9	0	0	2	0	0	1	0	0	0	85
Lane Group Flow (vph)	0	292	0	0	209	0	0	2979	0	0	1480	330
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type		NA			NA			NA			NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases												6
Actuated Green, G (s)		31.7			31.7			109.0			109.0	109.0
Effective Green, g (s)		31.7			31.7			109.0			109.0	109.0
Actuated g/C Ratio		0.21			0.21			0.73			0.73	0.73
Clearance Time (s)		4.5			4.5			4.8			4.8	4.8
Vehicle Extension (s)		3.0			3.0			0.2			0.2	0.2
Lane Grp Cap (vph)		325			349			3270			3211	1010
v/s Ratio Prot		c0.19			0.13			c0.66			0.33	
v/s Ratio Perm												0.24
v/c Ratio		0.90			0.60			0.91			0.46	0.33
Uniform Delay, d1		57.6			53.4			16.6			8.4	7.3
Progression Factor		0.36			1.00			1.14			0.74	0.80
Incremental Delay, d2		18.0			2.7			0.5			0.4	0.7
Delay (s)		38.9			56.1			19.5			6.6	6.6
Level of Service		D			E			B			A	A
Approach Delay (s)		38.9			56.1			19.5			6.6	
Approach LOS		D			E			B			A	

Intersection Summary			
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	9.3
Intersection Capacity Utilization	91.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	890	200	863	3136	1555	45
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	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)	3133	1338	3133	4506	4420	1376
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3133	1338	3133	4506	4420	1376
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	890	200	863	3136	1555	45
RTOR Reduction (vph)	0	1	0	0	0	10
Lane Group Flow (vph)	890	199	863	3136	1555	36
Confl. Peds. (#/hr)			6			6
Heavy Vehicles (%)	0%	8%	0%	3%	5%	0%
Turn Type	Prot	pm+ov	Prot	NA	NA	Perm
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	41.0	83.0	42.0	101.0	55.0	55.0
Effective Green, g (s)	41.0	83.0	42.0	101.0	55.0	55.0
Actuated g/C Ratio	0.27	0.55	0.28	0.67	0.37	0.37
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)	856	776	877	3034	1620	504
v/s Ratio Prot	c0.28	0.07	0.28	c0.70	0.35	
v/s Ratio Perm		0.08				0.03
v/c Ratio	1.04	0.26	0.98	1.03	0.96	0.07
Uniform Delay, d1	54.5	17.4	53.7	24.5	46.4	30.9
Progression Factor	1.00	1.00	0.61	1.65	0.95	1.13
Incremental Delay, d2	41.6	0.2	6.0	16.6	13.6	0.2
Delay (s)	96.1	17.6	38.6	57.0	57.7	35.2
Level of Service	F	B	D	E	E	D
Approach Delay (s)	81.7			53.1	57.1	
Approach LOS	F			D	E	

Intersection Summary			
HCM 2000 Control Delay	58.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.8%	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												
Volume (vph)	0	1091	80	0	1038	42	0	3826	24	0	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.5	4.5		4.5			4.8			4.8	4.8
Lane Util. Factor		0.95	1.00		0.95			0.91			0.91	1.00
Frpb, ped/bikes		1.00	0.98		1.00			1.00			1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00			1.00			1.00	1.00
Frt		1.00	0.85		0.99			1.00			1.00	0.85
Flt Protected		1.00	1.00		1.00			1.00			1.00	1.00
Satd. Flow (prot)		3167	1218		3211			4502			4420	1390
Flt Permitted		1.00	1.00		1.00			1.00			1.00	1.00
Satd. Flow (perm)		3167	1218		3211			4502			4420	1390
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1091	80	0	1038	42	0	3826	24	0	1480	415
RTOR Reduction (vph)	0	0	37	0	0	0	0	0	0	0	0	4
Lane Group Flow (vph)	0	1091	43	0	1080	0	0	3850	0	0	1480	411
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type		NA	Perm		NA			NA			NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases			4									6
Actuated Green, G (s)		42.5	42.5		42.5			98.2			98.2	98.2
Effective Green, g (s)		42.5	42.5		42.5			98.2			98.2	98.2
Actuated g/C Ratio		0.28	0.28		0.28			0.65			0.65	0.65
Clearance Time (s)		4.5	4.5		4.5			4.8			4.8	4.8
Vehicle Extension (s)		3.0	3.0		3.0			0.2			0.2	0.2
Lane Grp Cap (vph)		897	345		909			2947			2893	909
v/s Ratio Prot		c0.34			0.34			c0.86			0.33	
v/s Ratio Perm			0.04									0.30
v/c Ratio		1.22	0.12		1.19			1.31			0.51	0.45
Uniform Delay, d1		53.8	39.9		53.8			25.9			13.4	12.7
Progression Factor		1.00	1.00		1.00			1.06			0.70	0.71
Incremental Delay, d2		107.5	0.2		95.7			138.8			0.5	1.2
Delay (s)		161.3	40.1		149.5			166.3			9.9	10.2
Level of Service		F	D		F			F			A	B
Approach Delay (s)		153.0			149.5			166.3			10.0	
Approach LOS		F			F			F			A	

Intersection Summary			
HCM 2000 Control Delay	125.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	9.3
Intersection Capacity Utilization	124.7%	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												
Volume (veh/h)	0	0	200	0	0	870	0	2997	869	0	1555	45
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	200	0	0	870	0	2997	869	0	1555	45
Pedestrians		6										
Lane Width (ft)		12.0										
Walking Speed (ft/s)		4.0										
Percent Blockage		1										
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											497	
pX, platoon unblocked	0.84	0.84	0.84	0.84	0.84		0.84					
vC, conflicting volume	3430	5427	524	3515	4558	999	1561			3866		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	3223	5606	0	3325	4569	999	993			3866		
tC, single (s)	7.5	6.5	7.1	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	77	100	100	0	100			100		
cM capacity (veh/h)	0	0	888	2	1	245	587			52		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	200	870	999	999	999	869	518	518	518	45
Volume Left	0	0	0	0	0	0	0	0	0	0
Volume Right	200	870	0	0	0	869	0	0	0	45
cSH	888	245	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.23	3.54	0.59	0.59	0.59	0.51	0.30	0.30	0.30	0.03
Queue Length 95th (ft)	22	Err	0	0	0	0	0	0	0	0
Control Delay (s)	10.2	Err	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	F								
Approach Delay (s)	10.2	Err	0.0				0.0			
Approach LOS	B	F								

Intersection Summary			
Average Delay	1331.3		
Intersection Capacity Utilization	131.6%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	221	870	0	150	869	5
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	0.97	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	1.00	1.00		1.00	0.95	1.00
Satd. Flow (prot)	1667	1417		1667	3072	1417
Flt Permitted	1.00	1.00		1.00	0.95	1.00
Satd. Flow (perm)	1667	1417		1667	3072	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	221	870	0	150	869	5
RTOR Reduction (vph)	0	627	0	0	0	2
Lane Group Flow (vph)	221	243	0	150	869	3
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	27.9	27.9		27.9	64.1	64.1
Effective Green, g (s)	27.9	27.9		27.9	64.1	64.1
Actuated g/C Ratio	0.28	0.28		0.28	0.64	0.64
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)	465	395		465	1969	908
v/s Ratio Prot	0.13			0.09	c0.28	
v/s Ratio Perm		c0.17				0.00
v/c Ratio	0.48	0.61		0.32	0.44	0.00
Uniform Delay, d1	30.0	31.4		28.6	9.0	6.5
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.8	2.8		0.4	0.7	0.0
Delay (s)	30.7	34.2		29.0	9.7	6.5
Level of Service	C	C		C	A	A
Approach Delay (s)	33.5			29.0	9.7	
Approach LOS	C			C	A	

Intersection Summary			
HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	870	221	80	0	0	0	140	2956	24	53	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5					4.5	4.8		4.5	4.8	4.5
Lane Util. Factor	0.94	1.00					1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	0.99					1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00					1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96					1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00					0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4422	1535					1442	4501		1615	4420	1396
Flt Permitted	0.95	1.00					0.13	1.00		0.04	1.00	1.00
Satd. Flow (perm)	4422	1535					191	4501		72	4420	1396
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	0	0	0	140	2956	24	53	1480	415
RTOR Reduction (vph)	0	9	0	0	0	0	0	1	0	0	0	67
Lane Group Flow (vph)	870	292	0	0	0	0	140	2979	0	53	1480	348
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Split	NA					pm+pt	NA		pm+pt	NA	pm+ov
Protected Phases	4	4					5	2		1	6	4
Permitted Phases							2			6		6
Actuated Green, G (s)	31.5	31.5					109.2	101.3		97.6	94.2	125.7
Effective Green, g (s)	31.5	31.5					109.2	101.3		97.6	94.2	125.7
Actuated g/C Ratio	0.21	0.21					0.73	0.68		0.65	0.63	0.84
Clearance Time (s)	4.5	4.5					4.5	4.8		4.5	4.8	4.5
Vehicle Extension (s)	3.0	3.0					3.0	0.2		3.0	0.2	3.0
Lane Grp Cap (vph)	928	322					226	3039		81	2775	1169
v/s Ratio Prot	c0.20	0.19					c0.04	c0.66		0.01	0.33	0.06
v/s Ratio Perm							0.41			0.41		0.19
v/c Ratio	0.94	0.91					0.62	0.98		0.65	0.53	0.30
Uniform Delay, d1	58.3	57.8					10.4	23.4		27.0	15.6	2.6
Progression Factor	1.00	1.00					1.67	1.34		1.41	0.67	0.02
Incremental Delay, d2	16.3	27.7					0.5	2.1		13.0	0.5	0.1
Delay (s)	74.6	85.5					17.8	33.5		51.0	11.0	0.2
Level of Service	E	F					B	C		D	B	A
Approach Delay (s)		77.4			0.0			32.8			9.8	
Approach LOS		E			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	34.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	98.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	146

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	200	0	0	0	723	3136	6	0	1555	45
Conflicting Peds, #/hr	0	0	0	0	0	0	6	0	0	0	0	6
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Stop	-	-	None	-	-	None	-	-	Free
Storage Length	-	-	0	-	-	-	290	-	-	60	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	8	0	0	0	0	3	0	0	5	0
Mvmt Flow	0	0	200	0	0	0	723	3136	6	0	1555	45

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	4255	6143	784	5207	6140	1571	1555	0	0	3142	0	0
Stage 1	1555	1555	-	4585	4585	-	-	-	-	-	-	-
Stage 2	2700	4588	-	622	1555	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	7.26	6.4	6.5	7.1	5.3	-	-	5.3	-	-
Critical Hdwy Stg 1	7.3	5.5	-	7.3	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.7	5.5	-	6.7	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.8	4	3.98	3.8	4	3.9	3.1	-	-	3.1	-	-
Pot Cap-1 Maneuver	2	0	278	0	0	87	~ 214	-	-	33	-	0
Stage 1	82	176	-	0	4	-	-	-	-	-	-	0
Stage 2	19	4	-	406	176	-	-	-	-	-	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	2	0	277	0	0	87	~ 213	-	-	33	-	-
Mov Cap-2 Maneuver	2	0	-	0	0	-	-	-	-	-	-	-
Stage 1	82	176	-	0	4	-	-	-	-	-	-	-
Stage 2	19	4	-	112	176	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	45.6	0	210	0
HCM LOS	E	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT
Capacity (veh/h)	~ 213	-	-	277	-	33	-
HCM Lane V/C Ratio	3.394	-	-	0.722	-	-	-
HCM Control Delay (s)	$ 1122.8	-	-	45.6	0	0	-
HCM Lane LOS	F	-	-	E	A	A	-
HCM 95th %tile Q(veh)	67.8	-	-	5.1	-	0	-

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												
Volume (vph)	870	180	80	0	0	0	0	2956	24	0	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5						4.8			4.8	4.8
Lane Util. Factor	0.94	1.00						0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99						1.00			1.00	0.97
Flpb, ped/bikes	1.00	1.00						1.00			1.00	1.00
Frt	1.00	0.95						1.00			1.00	0.85
Flt Protected	0.95	1.00						1.00			1.00	1.00
Satd. Flow (prot)	4422	1515						4501			4420	1372
Flt Permitted	0.95	1.00						1.00			1.00	1.00
Satd. Flow (perm)	4422	1515						4501			4420	1372
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	180	80	0	0	0	0	2956	24	0	1480	415
RTOR Reduction (vph)	0	11	0	0	0	0	0	1	0	0	0	90
Lane Group Flow (vph)	870	249	0	0	0	0	0	2979	0	0	1480	325
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Perm	NA						NA			NA	Perm
Protected Phases		4						2			6	
Permitted Phases	4											6
Actuated Green, G (s)	33.8	33.8						106.9			106.9	106.9
Effective Green, g (s)	33.8	33.8						106.9			106.9	106.9
Actuated g/C Ratio	0.23	0.23						0.71			0.71	0.71
Clearance Time (s)	4.5	4.5						4.8			4.8	4.8
Vehicle Extension (s)	3.0	3.0						0.2			0.2	0.2
Lane Grp Cap (vph)	996	341						3207			3149	977
v/s Ratio Prot		0.16						c0.66			0.33	
v/s Ratio Perm	c0.20											0.24
v/c Ratio	0.87	0.73						0.93			0.47	0.33
Uniform Delay, d1	56.0	53.9						18.3			9.3	8.1
Progression Factor	1.00	1.00						1.06			0.39	0.09
Incremental Delay, d2	8.6	7.8						4.7			0.3	0.6
Delay (s)	64.6	61.7						24.2			3.9	1.4
Level of Service	E	E						C			A	A
Approach Delay (s)		64.0			0.0			24.2			3.4	
Approach LOS		E			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	25.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	9.3
Intersection Capacity Utilization	90.7%	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												
Volume (vph)	0	0	200	0	0	0	863	2997	6	0	1510	45
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)			4.0				4.0	4.0			4.0	4.0
Lane Util. Factor			1.00				0.97	0.91			0.91	1.00
Frpb, ped/bikes			1.00				1.00	1.00			1.00	0.97
Flpb, ped/bikes			1.00				1.00	1.00			1.00	1.00
Frt			0.86				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			1362				3133	4505			4420	1404
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			1362				3133	4505			4420	1404
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	200	0	0	0	863	2997	6	0	1510	45
RTOR Reduction (vph)	0	0	8	0	0	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	0	192	0	0	0	863	3003	0	0	1510	38
Confl. Peds. (#/hr)							6					6
Heavy Vehicles (%)	0%	0%	8%	0%	0%	0%	0%	3%	0%	0%	5%	0%
Turn Type			Over				Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases												6
Actuated Green, G (s)			50.6				50.6	150.0			91.4	91.4
Effective Green, g (s)			50.6				50.6	150.0			91.4	91.4
Actuated g/C Ratio			0.34				0.34	1.00			0.61	0.61
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)			459				1056	4505			2693	855
v/s Ratio Prot			0.14				c0.28	c0.67			0.34	
v/s Ratio Perm												0.03
v/c Ratio			0.42				0.82	0.67			0.56	0.04
Uniform Delay, d1			38.3				45.5	0.0			17.4	11.8
Progression Factor			1.00				0.71	1.00			0.95	1.29
Incremental Delay, d2			0.6				0.5	0.1			0.8	0.1
Delay (s)			39.0				32.9	0.1			17.2	15.2
Level of Service			D				C	A			B	B
Approach Delay (s)		39.0			0.0			7.4			17.1	
Approach LOS		D			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	11.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	870	221	261	40	129	42	0	2956	24	0	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.0	4.0			4.8			4.8	4.5
Lane Util. Factor	0.94	1.00		1.00	1.00			0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.92		1.00	0.96			1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	4422	1409		1509	1637			4501			4420	1398
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (perm)	4422	1409		1509	1637			4501			4420	1398
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	261	40	129	42	0	2956	24	0	1480	415
RTOR Reduction (vph)	0	19	0	0	2	0	0	0	0	0	0	87
Lane Group Flow (vph)	870	463	0	40	169	0	0	2980	0	0	1480	328
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Prot	NA		Prot	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases												6
Actuated Green, G (s)	34.0	54.0		5.3	25.3			77.4			77.4	111.4
Effective Green, g (s)	34.0	54.0		5.3	25.3			77.4			77.4	111.4
Actuated g/C Ratio	0.23	0.36		0.04	0.17			0.52			0.52	0.74
Clearance Time (s)	4.5	4.5		4.0	4.0			4.8			4.8	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			0.2			0.2	3.0
Lane Grp Cap (vph)	1002	507		53	276			2322			2280	1038
v/s Ratio Prot	0.20	c0.33		0.03	c0.10			c0.66			0.33	0.07
v/s Ratio Perm												0.16
v/c Ratio	0.87	0.91		0.75	0.61			1.28			0.65	0.32
Uniform Delay, d1	55.8	45.8		71.7	57.8			36.3			26.4	6.5
Progression Factor	1.00	1.00		1.00	1.00			1.35			0.65	0.09
Incremental Delay, d2	8.1	20.8		45.2	4.0			130.0			0.9	0.1
Delay (s)	63.9	66.6		116.9	61.8			179.0			18.1	0.7
Level of Service	E	E		F	E			F			B	A
Approach Delay (s)		64.9			72.3			179.0			14.3	
Approach LOS		E			E			F			B	

Intersection Summary			
HCM 2000 Control Delay	103.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.3
Intersection Capacity Utilization	110.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	0	863	2997	1316	45
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)			4.0	4.0	4.0	4.0
Lane Util. Factor			0.97	0.91	0.91	1.00
Frpb, ped/bikes			1.00	1.00	1.00	0.97
Flpb, ped/bikes			1.00	1.00	1.00	1.00
Frt			1.00	1.00	1.00	0.85
Flt Protected			0.95	1.00	1.00	1.00
Satd. Flow (prot)			3133	4506	4420	1404
Flt Permitted			0.95	1.00	1.00	1.00
Satd. Flow (perm)			3133	4506	4420	1404
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	863	2997	1316	45
RTOR Reduction (vph)	0	0	0	0	0	9
Lane Group Flow (vph)	0	0	863	2997	1316	36
Confl. Peds. (#/hr)			6			6
Heavy Vehicles (%)	0%	8%	0%	3%	5%	0%
Turn Type			Prot	NA	NA	Perm
Protected Phases			5	2	6	
Permitted Phases						6
Actuated Green, G (s)			48.8	150.0	93.2	93.2
Effective Green, g (s)			48.8	150.0	93.2	93.2
Actuated g/C Ratio			0.33	1.00	0.62	0.62
Clearance Time (s)			4.0	4.0	4.0	4.0
Vehicle Extension (s)			3.0	3.0	3.0	3.0
Lane Grp Cap (vph)			1019	4506	2746	872
v/s Ratio Prot			c0.28	c0.67	0.30	
v/s Ratio Perm						0.03
v/c Ratio			0.85	0.67	0.48	0.04
Uniform Delay, d1			47.1	0.0	15.3	11.0
Progression Factor			0.66	1.00	0.39	0.22
Incremental Delay, d2			0.6	0.1	0.4	0.1
Delay (s)			31.7	0.1	6.3	2.5
Level of Service			C	A	A	A
Approach Delay (s)	0.0			7.1	6.2	
Approach LOS	A			A	A	

Intersection Summary			
HCM 2000 Control Delay	6.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	40	129	42	863	3880	24	53	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)					4.5	4.5	4.5	4.8		4.5	4.8	4.8
Lane Util. Factor					1.00	1.00	0.97	0.91		1.00	0.91	1.00
Frpb, ped/bikes					1.00	1.00	1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes					1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt					1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected					0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)					1647	1445	2797	4502		1615	4420	1390
Flt Permitted					0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)					1647	1445	2797	4502		1615	4420	1390
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	40	129	42	863	3880	24	53	1480	415
RTOR Reduction (vph)	0	0	0	0	0	38	0	0	0	0	0	40
Lane Group Flow (vph)	0	0	0	0	169	4	863	3904	0	53	1480	375
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type				Perm	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases					3		5	2		1	6	
Permitted Phases				3		3						6
Actuated Green, G (s)					14.5	14.5	49.7	117.2		4.5	72.0	72.0
Effective Green, g (s)					14.5	14.5	49.7	117.2		4.5	72.0	72.0
Actuated g/C Ratio					0.10	0.10	0.33	0.78		0.03	0.48	0.48
Clearance Time (s)					4.5	4.5	4.5	4.8		4.5	4.8	4.8
Vehicle Extension (s)					3.0	3.0	3.0	0.2		3.0	0.2	0.2
Lane Grp Cap (vph)					159	139	926	3517		48	2121	667
v/s Ratio Prot							c0.31	c0.87		0.03	0.33	
v/s Ratio Perm					0.10	0.00						0.27
v/c Ratio					1.06	0.03	0.93	1.11		1.10	0.70	0.56
Uniform Delay, d1					67.8	61.4	48.5	16.4		72.8	30.5	27.8
Progression Factor					1.00	1.00	0.98	0.93		0.89	0.67	0.64
Incremental Delay, d2					89.1	0.1	2.0	49.9		143.8	1.5	2.6
Delay (s)					156.8	61.5	49.5	65.2		208.7	21.8	20.5
Level of Service					F	E	D	E		F	C	C
Approach Delay (s)		0.0			137.8			62.3			26.6	
Approach LOS		A			F			E			C	

Intersection Summary			
HCM 2000 Control Delay	54.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	115.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	909	270	0	3865	1555	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.94	0.86		0.91	0.91	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	4542	1151		4506	4420	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	4542	1151		4506	4420	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	909	270	0	3865	1555	0
RTOR Reduction (vph)	2	36	0	0	0	0
Lane Group Flow (vph)	934	207	0	3865	1555	0
Confl. Peds. (#/hr)			6			6
Heavy Vehicles (%)	0%	8%	0%	3%	5%	0%
Turn Type	Prot	Prot		NA	NA	
Protected Phases	4	4		2	6	
Permitted Phases						
Actuated Green, G (s)	37.0	37.0		105.0	105.0	
Effective Green, g (s)	37.0	37.0		105.0	105.0	
Actuated g/C Ratio	0.25	0.25		0.70	0.70	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1120	283		3154	3094	
v/s Ratio Prot	c0.21	0.18		c0.86	0.35	
v/s Ratio Perm						
v/c Ratio	0.83	0.73		1.23	0.50	
Uniform Delay, d1	53.6	51.9		22.5	10.4	
Progression Factor	1.00	1.00		0.90	0.02	
Incremental Delay, d2	5.5	9.3		101.7	0.4	
Delay (s)	59.0	61.3		122.1	0.6	
Level of Service	E	E		F	A	
Approach Delay (s)	59.5			122.1	0.6	
Approach LOS	E			F	A	

Intersection Summary			
HCM 2000 Control Delay	82.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	111.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 PM Peak Hour - Alt 5A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	870	221	80	40	129	42	0	2975	24	0	1500	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.5
Lane Util. Factor	0.94	1.00		1.00	1.00			0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.96		1.00	0.96			1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	4422	1535		1509	1637			4501			4420	1396
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (perm)	4422	1535		1509	1637			4501			4420	1396
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	40	129	42	0	2975	24	0	1500	415
RTOR Reduction (vph)	0	8	0	0	1	0	0	0	0	0	0	40
Lane Group Flow (vph)	870	293	0	40	170	0	0	2999	0	0	1500	375
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Prot	NA		Prot	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases												6
Actuated Green, G (s)	28.7	37.1		7.6	16.0			91.5			91.5	120.2
Effective Green, g (s)	28.7	37.1		7.6	16.0			91.5			91.5	120.2
Actuated g/C Ratio	0.19	0.25		0.05	0.11			0.61			0.61	0.80
Clearance Time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			0.2			0.2	3.0
Lane Grp Cap (vph)	846	379		76	174			2745			2696	1118
v/s Ratio Prot	c0.20	0.19		0.03	c0.10			c0.67			0.34	0.06
v/s Ratio Perm												0.20
v/c Ratio	1.03	0.77		0.53	0.98			1.09			0.56	0.34
Uniform Delay, d1	60.6	52.5		69.4	66.8			29.2			17.3	4.0
Progression Factor	1.00	1.00		1.00	1.00			1.00			0.57	0.07
Incremental Delay, d2	38.4	9.4		6.4	61.0			48.3			0.5	0.1
Delay (s)	99.1	61.9		75.9	127.8			77.5			10.4	0.4
Level of Service	F	E		E	F			E			B	A
Approach Delay (s)		89.5			118.0			77.5			8.3	
Approach LOS		F			F			E			A	

Intersection Summary			
HCM 2000 Control Delay	60.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	105.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBU	SBT	SBR
Lane Configurations							
Volume (vph)	0	200	863	2997	20	1555	45
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	0.97	0.91	1.00	0.91	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	0.96
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.86	1.00	1.00	1.00	1.00	0.85
Flt Protected		1.00	0.95	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1362	3133	4506	1583	4420	1382
Flt Permitted		1.00	0.95	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1362	3133	4506	1583	4420	1382
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	200	863	2997	20	1555	45
RTOR Reduction (vph)	0	7	0	0	0	0	8
Lane Group Flow (vph)	0	193	863	2997	20	1555	37
Confl. Peds. (#/hr)			6				6
Heavy Vehicles (%)	0%	8%	0%	3%	2%	5%	0%
Turn Type		Over	Prot	NA	Prot	NA	Perm
Protected Phases		5	5	2	1	6	
Permitted Phases							6
Actuated Green, G (s)		44.5	44.5	118.4	3.6	77.5	77.5
Effective Green, g (s)		44.5	44.5	118.4	3.6	77.5	77.5
Actuated g/C Ratio		0.34	0.34	0.91	0.03	0.60	0.60
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)		466	1072	4103	43	2635	823
v/s Ratio Prot		0.14	c0.28	c0.67	0.01	0.35	
v/s Ratio Perm							0.03
v/c Ratio		0.42	0.81	0.73	0.47	0.59	0.04
Uniform Delay, d1		32.8	38.8	1.5	62.3	16.4	10.9
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.6	4.5	1.2	7.8	1.0	0.1
Delay (s)		33.4	43.3	2.7	70.0	17.3	11.0
Level of Service		C	D	A	E	B	B
Approach Delay (s)	33.4			11.8		17.8	
Approach LOS	C			B		B	

Intersection Summary			
HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.7%	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												
Volume (vph)	870	221	80	40	129	42	0	2956	24	0	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.5
Lane Util. Factor	0.94	1.00		1.00	1.00			0.91			0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00			1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.96		1.00	0.96			1.00			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	4422	1535		1509	1637			4501			4420	1396
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (perm)	4422	1535		1509	1637			4501			4420	1396
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	870	221	80	40	129	42	0	2956	24	0	1480	415
RTOR Reduction (vph)	0	8	0	0	1	0	0	0	0	0	0	40
Lane Group Flow (vph)	870	293	0	40	170	0	0	2980	0	0	1480	375
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type	Prot	NA		Prot	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases												6
Actuated Green, G (s)	28.7	37.1		7.6	16.0			91.5			91.5	120.2
Effective Green, g (s)	28.7	37.1		7.6	16.0			91.5			91.5	120.2
Actuated g/C Ratio	0.19	0.25		0.05	0.11			0.61			0.61	0.80
Clearance Time (s)	4.5	4.5		4.5	4.5			4.8			4.8	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			0.2			0.2	3.0
Lane Grp Cap (vph)	846	379		76	174			2745			2696	1118
v/s Ratio Prot	c0.20	0.19		0.03	c0.10			c0.66			0.33	0.06
v/s Ratio Perm												0.20
v/c Ratio	1.03	0.77		0.53	0.98			1.09			0.55	0.34
Uniform Delay, d1	60.6	52.5		69.4	66.8			29.2			17.2	4.0
Progression Factor	1.00	1.00		1.00	1.00			1.16			0.67	0.32
Incremental Delay, d2	38.4	9.4		6.4	61.0			43.9			0.6	0.1
Delay (s)	99.1	61.9		75.9	127.8			77.8			12.1	1.4
Level of Service	F	E		E	F			E			B	A
Approach Delay (s)		89.5			118.0			77.8			9.8	
Approach LOS		F			F			E			A	

Intersection Summary			
HCM 2000 Control Delay	60.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	104.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	200	863	2997	1555	45
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	0.97	0.91	0.91	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00
Frt		0.86	1.00	1.00	1.00	0.85
Flt Protected		1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)		1362	3133	4506	4420	1376
Flt Permitted		1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)		1362	3133	4506	4420	1376
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	200	863	2997	1555	45
RTOR Reduction (vph)	0	8	0	0	0	7
Lane Group Flow (vph)	0	192	863	2997	1555	38
Confl. Peds. (#/hr)			6			6
Heavy Vehicles (%)	0%	8%	0%	3%	5%	0%
Turn Type		Over	Prot	NA	NA	Perm
Protected Phases		5	5	2	6	
Permitted Phases						6
Actuated Green, G (s)		50.5	50.5	150.0	91.5	91.5
Effective Green, g (s)		50.5	50.5	150.0	91.5	91.5
Actuated g/C Ratio		0.34	0.34	1.00	0.61	0.61
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)		458	1054	4506	2696	839
v/s Ratio Prot		0.14	c0.28	c0.67	0.35	
v/s Ratio Perm						0.03
v/c Ratio		0.42	0.82	0.67	0.58	0.05
Uniform Delay, d1		38.4	45.6	0.0	17.6	11.7
Progression Factor		1.00	0.71	1.00	0.55	0.71
Incremental Delay, d2		0.6	0.5	0.1	0.8	0.1
Delay (s)		39.0	32.6	0.1	10.5	8.4
Level of Service		D	C	A	B	A
Approach Delay (s)	39.0			7.3	10.5	
Approach LOS	D			A	B	

Intersection Summary			
HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 PM Peak Hour - Alt 6A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	221	80	40	129	42	140	2956	24	53	1480	415
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)		4.5			4.5	4.5	4.5	4.8		4.5	4.8	
Lane Util. Factor		1.00			1.00	1.00	1.00	0.91		1.00	0.91	
Frpb, ped/bikes		0.99			1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.96			1.00	0.85	1.00	1.00		1.00	0.97	
Flt Protected		1.00			0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1541			1651	1445	1442	4501		1615	4284	
Flt Permitted		1.00			0.48	1.00	0.06	1.00		0.04	1.00	
Satd. Flow (perm)		1541			807	1445	98	4501		75	4284	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	221	80	40	129	42	140	2956	24	53	1480	415
RTOR Reduction (vph)	0	9	0	0	0	33	0	1	0	0	30	0
Lane Group Flow (vph)	0	292	0	0	169	9	140	2979	0	53	1865	0
Confl. Peds. (#/hr)			5	5			4					4
Confl. Bikes (#/hr)			1						1			
Heavy Vehicles (%)	3%	2%	16%	7%	0%	0%	12%	3%	0%	0%	5%	2%
Turn Type		NA		Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases				8		8	2			6		
Actuated Green, G (s)		31.5			31.5	31.5	109.2	101.3		93.9	90.5	
Effective Green, g (s)		31.5			31.5	31.5	109.2	101.3		93.9	90.5	
Actuated g/C Ratio		0.21			0.21	0.21	0.73	0.68		0.63	0.60	
Clearance Time (s)		4.5			4.5	4.5	4.5	4.8		4.5	4.8	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	0.2		3.0	0.2	
Lane Grp Cap (vph)		323			169	303	198	3039		81	2584	
v/s Ratio Prot		0.19					c0.07	c0.66		0.01	0.44	
v/s Ratio Perm					c0.21	0.01	0.45			0.39		
v/c Ratio		0.90			1.00	0.03	0.71	0.98		0.65	0.72	
Uniform Delay, d1		57.8			59.2	47.1	32.2	23.4		26.4	20.9	
Progression Factor		1.00			1.00	1.00	0.82	1.40		1.21	0.59	
Incremental Delay, d2		27.2			69.2	0.0	1.1	2.1		13.0	1.3	
Delay (s)		85.0			128.5	47.1	27.5	34.9		44.8	13.6	
Level of Service		F			F	D	C	C		D	B	
Approach Delay (s)		85.0			112.3			34.5			14.5	
Approach LOS		F			F			C			B	

Intersection Summary			
HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.8
Intersection Capacity Utilization	111.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 PM Peak Hour - Alt 6B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	3826	24	0	1480	415
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	3826	24	0	1480	415
Pedestrians		4						5				
Lane Width (ft)		0.0						12.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											686	
pX, platoon unblocked	0.81	0.81	0.81	0.81	0.81		0.81					
vC, conflicting volume	2759	5334	502	4336	5737	1287	1899			3850		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2342	5534	0	4297	6033	1287	1276			3850		
tC, single (s)	7.6	6.5	7.2	7.6	6.5	6.9	4.3			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.5	3.6	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	15	0	836	0	0	158	394			53		

Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4
Volume Total	1530	1530	789	493	493	493	415
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	24	0	0	0	415
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.90	0.90	0.46	0.29	0.29	0.29	0.24
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0			0.0			
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Brett Korporaal	Freeway/Dir of Travel	Main St
Agency or Company	Kittelson & Associates, Inc.	Junction	Alkali Creek Rd
Date Performed	7/29/2015	Jurisdiction	MDT
Analysis Time Period	PM Peak Hour	Analysis Year	Future 2040

Project Description Airport Rd/Main St - Billings

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2997	
	Ramp Volume, V_R: 870	
	Freeway Free-Flow Speed, S_{FF}: 45.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2997	0.93	Rolling	4	0	0.943	1.00	3416
Ramp	870	0.93	Rolling	4	0	0.943	1.00	992
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.594 using Equation (Exhibit 13-6)

V_{12} = 2030 pc/h

V_3 or V_{av34} 1386 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2030 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4408	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3022	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.371 (Exibit 13-11)

S_R= 43.9 mph (Exhibit 13-11)

S_0= 41.8 mph (Exhibit 13-11)

S = 43.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2014 University of Florida, All Rights Reserved

HCM Unsignalized Intersection Capacity Analysis
6: Main St (Hwy 87) & E Airport Rd/Alkali Creek Rd

Future Year 2040 PM Peak Hour - Alt 6C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	2956	0	0	1480	415
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	2956	0	0	1480	415
Pedestrians		4						5				
Lane Width (ft)		0.0						12.0				
Walking Speed (ft/s)		4.0						4.0				
Percent Blockage		0						0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											686	
pX, platoon unblocked	0.77	0.77	0.77	0.77	0.77		0.77					
vC, conflicting volume	2469	4440	502	3454	4855	985	1899			2956		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1879	4423	0	3151	4958	985	1144			2956		
tC, single (s)	7.6	6.5	7.2	7.6	6.5	6.9	4.3			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.5	3.6	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	33	1	803	3	0	251	428			122		

Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4
Volume Total	985	985	985	493	493	493	415
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	415
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.58	0.58	0.58	0.29	0.29	0.29	0.24
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0			0.0			
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	884	1128	0	5	589	171	4	2	2	1155	0	109
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.95		0.97	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.97		1.00	0.93		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3133	3167		1614	3035		1214	2954		3133	1414	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3133	3167		1614	3035		1214	2954		3133	1414	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	884	1128	0	5	589	171	4	2	2	1155	0	109
RTOR Reduction (vph)	0	0	0	0	16	0	0	4	0	0	73	0
Lane Group Flow (vph)	884	1128	0	5	744	0	4	0	0	1155	36	0
Confl. Peds. (#/hr)	1		1	1		1			1	1		
Confl. Bikes (#/hr)												1
Heavy Vehicles (%)	0%	2%	0%	0%	3%	0%	33%	0%	0%	0%	0%	0%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	31.2	69.2		0.7	38.7		0.7	4.2		40.3	43.8	
Effective Green, g (s)	31.2	69.2		0.7	38.7		0.7	4.2		40.3	43.8	
Actuated g/C Ratio	0.23	0.52		0.01	0.29		0.01	0.03		0.30	0.33	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	732	1642		8	880		6	93		946	464	
v/s Ratio Prot	c0.28	0.36		0.00	c0.25		0.00	0.00		c0.37	c0.03	
v/s Ratio Perm												
v/c Ratio	1.21	0.69		0.62	0.85		0.67	0.00		1.22	0.08	
Uniform Delay, d1	51.1	24.0		66.2	44.5		66.2	62.6		46.6	30.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	106.0	1.2		97.8	7.5		145.1	0.0		109.0	0.1	
Delay (s)	157.1	25.2		164.0	52.0		211.4	62.6		155.6	30.9	
Level of Service	F	C		F	D		F	E		F	C	
Approach Delay (s)		83.2			52.8			137.0			144.8	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM 2000 Control Delay	96.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	133.4	Sum of lost time (s)	19.0
Intersection Capacity Utilization	108.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group