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MEMORANDUM

TO: Pat Horn, Martin & Martin

FROM: Christopher J. Fasching PE, PTOE, Principal
Philip J. Dunham PE

DATE: January 6th, 2020

SUBJECT: **E-470/64th Avenue Interchange Traffic Analysis**
FHU Project Numbers 119161

This memorandum specifically provides traffic projection and operation information for the E-470/64th Avenue interchange, informing its design. This information accounts for the latest High Point FDP plan dated December 20th, 2019. Intersection operational analyses were conducted using the methodology outlined in the 6th Edition of the Highway Capacity Manual. Levels of Service (LOS) and 95th percentile queuing analyses were referenced to provide lane geometry recommendations. The recommendations are presented graphically near the end of the memorandum.

2040 Traffic Projections

The High Point FDP Traffic Impact Study is currently being updated to reflect uses and acreages identified in the December 20, 2019 plan. The foundation study used in that analysis is the City's NEATS Refresh study with respect to developing background traffic numbers. The traffic projections shown here are subset of the projections that will be shown in the updated High Point FDP Traffic Impact Study.

There are four intersections being analyzed in this memorandum including:

- The two E-470 ramp intersections
- Gun Club Road just east of E-470
- Tibet Street just west of E-470

Figure 1 presents the final set of 2040 traffic projections used to inform the interchange design. The peak hour traffic forecasts are indicative of forecasts that are greater than the 2040 daily volumes presented in the NEATS Refresh document but slightly less than the NEATS Buildout traffic volumes.

2040 Traffic Analysis

Using the peak hour projections shown on **Figure 1**, intersection LOS were calculated to help identify appropriate lane geometry. A seven-lane wide bridge will be needed based on the forecasts. City criteria with respect to the State Highway Access Code (*SHAC*) was referenced to determine the need for left- and right-turn lanes along 64th Avenue. LOS results also report the 95th percentile queue lengths. The 95th percentile queue lengths were used to inform storage length recommendations for study area intersections. There is also a fundamental assumption to assess the corridor with 64th Avenue providing four through-lanes. The City has recognized that providing four-through lanes along 64th Avenue might work acceptably in the long-term planning horizon, and as such the City is open to an initial construction in which only four through-lanes being built.

Figure 1 also includes the LOS results as are the lane geometrics (analysis worksheets are shown in the appendix). Each intersection will require signalization. Major patterns include:

- 64th Avenue/Tibet Street
  - Left and right turns to/from the south leg
- E-470/64th Avenue Interchange
  - Left and right turns to/from the south
- 64th Avenue/Gun Club Road just east of E-470
  - Eastbound left (AM) and southbound right (PM)

Dual left turn lanes will be needed at 64th Avenue and:

- Gun Club Road (eastbound approach, northbound approach, and southbound approach)
- E-470/64th Interchange (northbound ramp approach, southbound ramp approach, westbound approach, and the eastbound approach)
- Tibet Street (northbound approach, westbound approach)

Exclusive right-turn lanes will be needed at nearly all of the intersection approaches as well. Analysis worksheets for the LOS calculations are attached. These analyses were conducted assuming left-turn/ right-turn overlap phasing where appropriate. A 120-second cycle length was used consistent with the City's signal timing plan.

The results of this analysis are indicative of providing four lanes for through traffic along 64th Avenue. A four-lane cross-section should function adequately provided that the turn lanes depicted on **Figure 1** are provided. The one segment in which the volume will exceed that of regular four-lane arterial is between E-470 and the first intersection to its east. This segment will require auxiliary lanes beyond the four through lanes between the interchange and the first intersection to the east to properly function. The right-turn auxiliary lanes should be continuous between the E-470 east ramp intersection and Gun Club Road.

Queueing Analysis

Table 1 displays 2040 peak hour 95th percentile queue lengths and recommended storage lengths based on both the estimated vehicle queues and guidance contained in the *CDOT SHAC* using an NR-B classification. Heavy vehicle percentage at the intersections is conservatively assumed to be 15 percent for the purposes of determining queue length (which is more conservative than that used in the FDP traffic studies). The recommended storage lengths were developed to contain the maximum anticipated peak hour vehicle queues.

Table 1. E-470/64th Avenue Interchange Turning Movement Queuing Results

Intersection	Approach	Movement	95th Percentile Queue Length (ft) [1]		Recommended Storage Length	SHAC Recommended Storage Length[2]
			AM	PM		
Tibet Street/ 64th Avenue	Eastbound	Left-Turn	93	283	300	325
		Through	10	110	Continuous	Continuous
		Right-Turn	3	80	100	700
	Westbound	Left-Turn*	138	305	325	325
		Through	5	575	Continuous	Continuous
		Right-Turn	0	45	50	75
	Northbound	Left-Turn*	188	283	300	250
		Through	30	70	Continuous	Continuous
		Right-Turn	55	378	400	350
	Southbound	Left-Turn	48	220	225	300
		Through	20	73	Continuous	Continuous
		Right-Turn	0	120	125	300
64th Avenue/ E-470 West Ramps	Eastbound	Through	3	18	Continuous	Continuous
		Right-Turn	3	13	50	550
	Westbound	Left-Turn	143	240	250	375
		Through	5	10	Continuous	Continuous
	Southbound	Through /Left-Turn*	278	178	300	550
		Right Turn	133	235	Continuous	Continuous
64th Avenue/ E-470 East Ramps	Eastbound	Left-Turn*	130	243	250	225
		Through	15	8	Continuous	Continuous
	Westbound	Through	245	200	Continuous	Continuous
		Right-Turn	0	108	175	675
	Northbound	Through/Left-Turn*	165	273	275 and Continuous	275 and Continuous
		Right-Turn	408	285	Continuous	Continuous

Intersection	Approach	Movement	95th Percentile Queue Length (ft) [1]		Recommended Storage Length	SHAC Recommended Storage Length[2]
			AM	PM		
Gun Club Road/ 64th Avenue	Eastbound	Left-Turn*	310	243	325	325
		Through	400	320	Continuous	Continuous
		Right-Turn	5	70	Continuous	Continuous
	Westbound	Left-Turn	73	140	150	150
		Through	328	580	Continuous	Continuous
		Right-Turn	43	0	50	175
	Northbound	Left-Turn*	48	250	250	175
		Through/Right Turn	0	173	Continuous	Continuous
	Southbound	Left-Turn*	48	190	200	150
		Through/Right Turn	15	15	Continuous	Continuous
		Right Turn*	65	333	350	350

Notes:

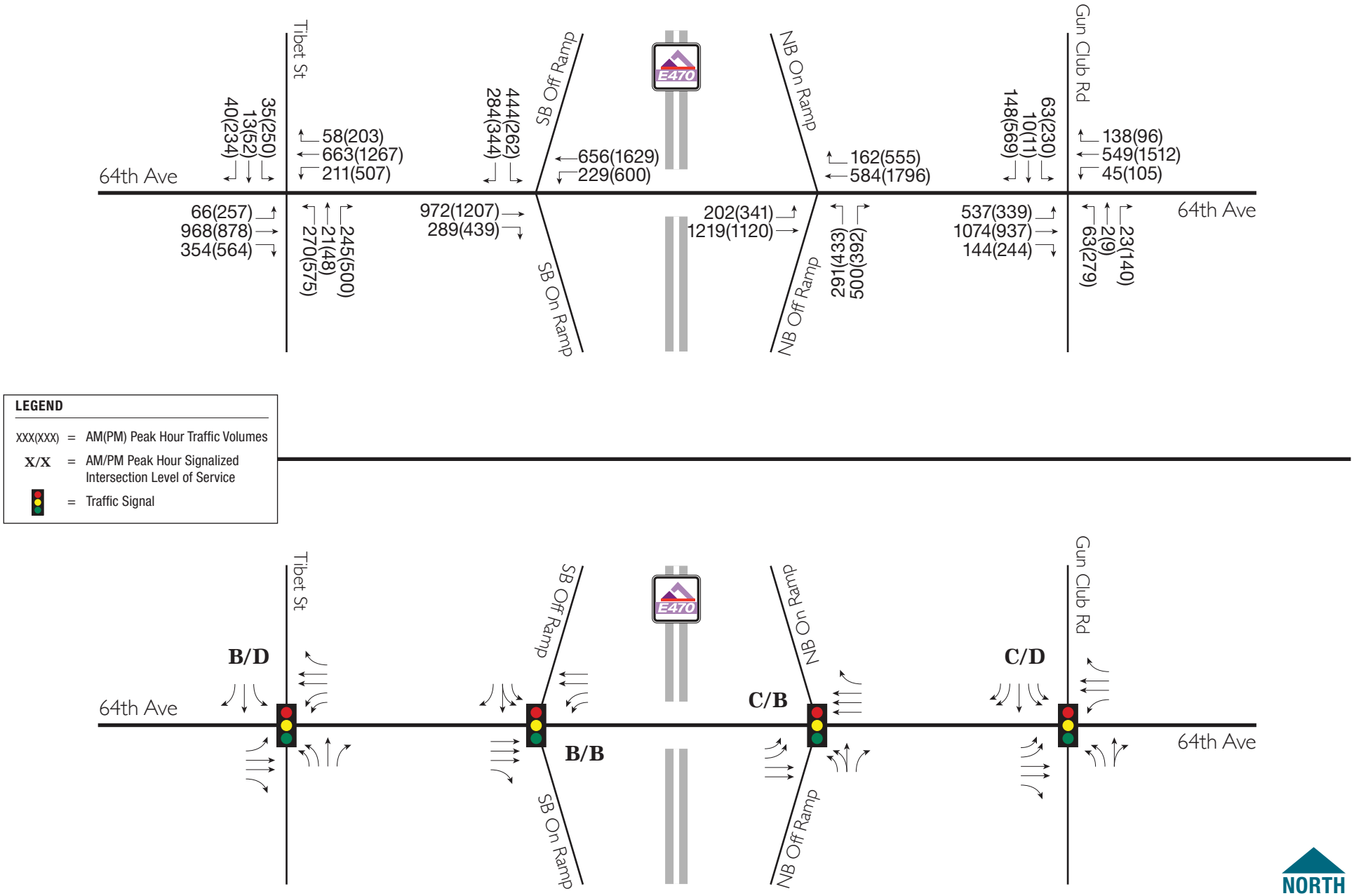
*Dual Left-Turn queues and storage are per lane.

[1] Calculations based on HCM methodology using a heavy vehicle percentage of 10 percent.

[2] Number shown is based on volume adjustments of 3 PCE per heavy vehicle

Recommendations

City of Aurora *Traffic Impact Study Guidelines* indicate that the *CDOT SHAC* be used to determine storage and taper lengths. These values yield overly conservative results and provide storage well in excess of 95th percentile queues (which already incorporate a heavy vehicle percentage), often by a factor of two to three. The *SHAC* procedures do not account for other conditions in the intersection such as low opposing through movements if a left-turn movement is in question. Rather, our recommendation is that the values in **Table 1** corresponding to the 95th percentile lengths be used for storage lengths plus tapers along 64th Avenue should be 144 feet (to provide the required 12:1 taper ratio for 12-foot lanes on streets with a posted speed 40 MPH and an NR-B classification as identified in the *CDOT SHAC*). Tapers at locations where dual lefts are present should be doubled to 288 feet. Longer tapers will be needed at locations where the median placement requires additional lane shifts and should hold to the above mentioned 12:1 taper ratio.



NOTE: Drawing Not to Scale

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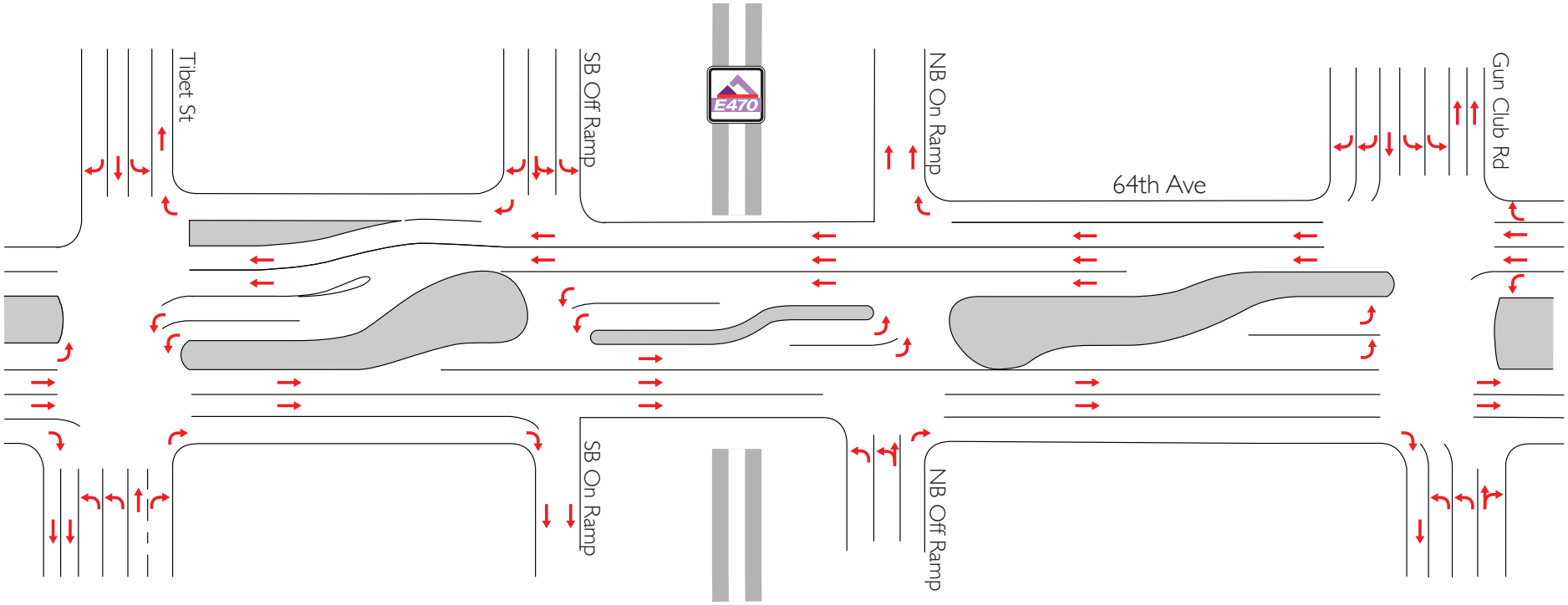
FIGURE 1

E470/64th Avenue Interchange
Year 2040 Peak Hour Forecasts and LOS

High Point Master Plan - MEMO 19161 1/6/20



NORTH

NOTE: Drawing Not to Scale

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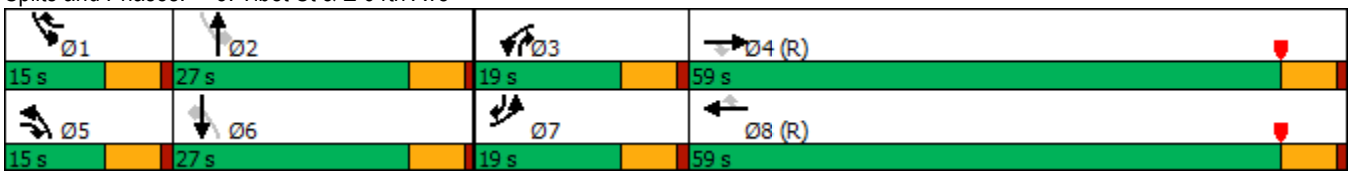
FIGURE 2

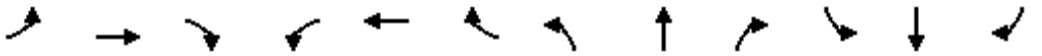
E470/64th Avenue Interchange Lane Geometry: Tibet Street to Gun Club Road

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	968	354	211	663	58	270	21	245	35	13	40
Future Volume (vph)	66	968	354	211	663	58	270	21	245	35	13	40
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	D.P+P	NA	pm+ov	D.P+P	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8	6		2	2		6
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	5.0	10.0	5.0	5.0	10.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	15.0	31.0	15.0	15.0	31.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Total Split (s)	19.0	59.0	15.0	19.0	59.0	15.0	15.0	27.0	19.0	15.0	27.0	19.0
Total Split (%)	15.8%	49.2%	12.5%	15.8%	49.2%	12.5%	12.5%	22.5%	15.8%	12.5%	22.5%	15.8%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?		Yes			Yes			Yes			Yes	
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None	None
Act Effct Green (s)	12.6	72.9	90.3	15.9	78.6	92.7	17.6	9.9	27.3	16.8	8.9	18.4
Actuated g/C Ratio	0.10	0.61	0.75	0.13	0.66	0.77	0.15	0.08	0.23	0.14	0.07	0.15
v/c Ratio	0.42	0.53	0.32	0.54	0.34	0.05	0.66	0.16	0.57	0.18	0.11	0.15
Control Delay	80.1	7.4	1.0	54.0	6.9	0.5	43.6	42.0	12.2	42.1	52.8	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.1	7.4	1.0	54.0	6.9	0.5	43.6	42.0	12.2	42.1	52.8	2.1
LOS	F	A	A	D	A	A	D	D	B	D	D	A
Approach Delay		9.3			17.1			29.2			25.6	
Approach LOS		A			B			C			C	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 100 (83%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.66	
Intersection Signal Delay: 15.9	Intersection LOS: B
Intersection Capacity Utilization 57.1%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 5: Tibet St & E 64th Ave





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	66	968	354	211	663	58	270	21	245	35	13	40
Future Volume (veh/h)	66	968	354	211	663	58	270	21	245	35	13	40
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752
Adj Flow Rate, veh/h	72	1052	168	229	721	-62	293	23	49	38	14	-93
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	10	10	10	10	10	10	10	10	10	10	10	10
Cap, veh/h	116	2099	1072	327	2204	1052	509	155	281	233	76	167
Arrive On Green	0.14	1.00	1.00	0.20	1.00	0.00	0.09	0.09	0.09	0.05	0.04	0.00
Sat Flow, veh/h	1668	3328	1485	3237	3328	1485	3237	1752	1485	1668	1752	1485
Grp Volume(v), veh/h	72	1052	168	229	721	-62	293	23	49	38	14	-93
Grp Sat Flow(s),veh/h/ln	1668	1664	1485	1618	1664	1485	1618	1752	1485	1668	1752	1485
Q Serve(g_s), s	4.9	0.0	0.0	7.9	0.0	0.0	10.3	1.5	3.3	2.4	0.9	0.0
Cycle Q Clear(g_c), s	4.9	0.0	0.0	7.9	0.0	0.0	10.3	1.5	3.3	2.4	0.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	116	2099	1072	327	2204	1052	509	155	281	233	76	167
V/C Ratio(X)	0.62	0.50	0.16	0.70	0.33	-0.06	0.58	0.15	0.17	0.16	0.18	-0.56
Avail Cap(c_a), veh/h	209	2099	1072	405	2204	1052	509	336	434	308	336	387
HCM Platoon Ratio	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.78	0.78	0.78	0.92	0.92	0.00	0.98	0.98	0.98	1.00	1.00	0.00
Uniform Delay (d), s/veh	50.2	0.0	0.0	46.2	0.0	0.0	49.3	50.5	40.8	45.9	55.3	0.0
Incr Delay (d2), s/veh	4.2	0.7	0.2	3.7	0.4	0.0	1.6	0.4	0.3	0.3	1.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.7	0.4	0.1	5.5	0.2	0.0	7.5	1.2	2.2	1.9	0.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	54.4	0.7	0.2	49.9	0.4	0.0	50.9	50.9	41.0	46.3	56.5	0.0
LnGrp LOS	D	A	A	D	A	A	D	D	D	D	E	A
Approach Vol, veh/h		1292			888			365			-41	
Approach Delay, s/veh		3.6			13.2			49.6			0.0	
Approach LOS		A			B			D			A	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.6	14.6	16.1	79.7	15.0	9.2	12.3	83.5
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	9.0	21.0	13.0	53.0	9.0	21.0	13.0	53.0
Max Q Clear Time (g_c+I1), s	4.4	5.3	9.9	2.0	12.3	2.9	6.9	2.0
Green Ext Time (p_c), s	0.0	0.1	0.2	9.7	0.0	0.0	0.1	5.2

Intersection Summary	
HCM 6th Ctrl Delay	13.8
HCM 6th LOS	B

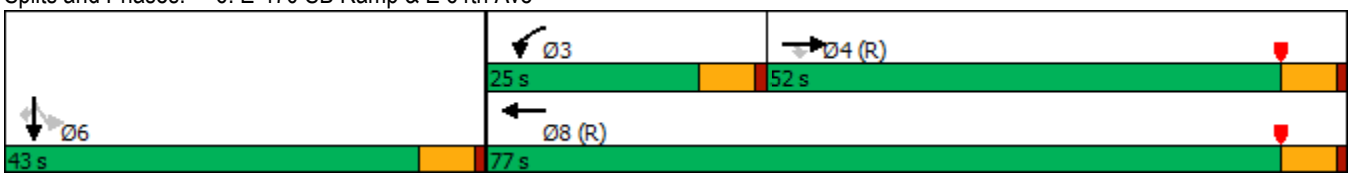
Notes

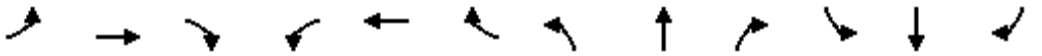
User approved pedestrian interval to be less than phase max green.

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	972	289	229	656	444	0	284
Future Volume (vph)	972	289	229	656	444	0	284
Turn Type	NA	Perm	Prot	NA	Perm	NA	Perm
Protected Phases	4		3	8		6	
Permitted Phases		4			6		6
Detector Phase	4	4	3	8	6	6	6
Switch Phase							
Minimum Initial (s)	10.0	10.0	5.0	10.0	5.0	5.0	5.0
Minimum Split (s)	25.0	25.0	15.0	25.0	15.0	15.0	15.0
Total Split (s)	52.0	52.0	25.0	77.0	43.0	43.0	43.0
Total Split (%)	43.3%	43.3%	20.8%	64.2%	35.8%	35.8%	35.8%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes					
Recall Mode	C-Max	C-Max	None	C-Max	None	None	None
Act Effct Green (s)	64.8	64.8	16.6	85.4	26.6	26.6	26.6
Actuated g/C Ratio	0.54	0.54	0.14	0.71	0.22	0.22	0.22
v/c Ratio	0.42	0.34	0.57	0.31	0.70	0.70	0.61
Control Delay	7.5	1.0	64.6	5.9	53.1	53.3	15.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.5	1.0	64.6	5.9	53.1	53.3	15.1
LOS	A	A	E	A	D	D	B
Approach Delay	6.0			21.1		38.3	
Approach LOS	A			C		D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 116 (97%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Natural Cycle: 55	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 18.8	Intersection LOS: B
Intersection Capacity Utilization 71.3%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 6: E-470 SB Ramp & E 64th Ave





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	972	289	229	656	0	0	0	0	444	0	284
Future Volume (veh/h)	0	972	289	229	656	0	0	0	0	444	0	284
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1752	1752	1752	1752	0				1752	1752	1752
Adj Flow Rate, veh/h	0	1057	97	249	713	0				483	0	113
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	10	10	10	10	0				10	10	10
Cap, veh/h	0	2888	897	352	2483	0				625	0	278
Arrive On Green	0.00	1.00	1.00	0.22	1.00	0.00				0.19	0.00	0.19
Sat Flow, veh/h	0	4940	1485	3237	3416	0				3337	0	1485
Grp Volume(v), veh/h	0	1057	97	249	713	0				483	0	113
Grp Sat Flow(s),veh/h/ln	0	1594	1485	1618	1664	0				1668	0	1485
Q Serve(g_s), s	0.0	0.0	0.0	8.5	0.0	0.0				16.5	0.0	8.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	8.5	0.0	0.0				16.5	0.0	8.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	2888	897	352	2483	0				625	0	278
V/C Ratio(X)	0.00	0.37	0.11	0.71	0.29	0.00				0.77	0.00	0.41
Avail Cap(c_a), veh/h	0	2888	897	566	2483	0				1084	0	482
HCM Platoon Ratio	1.00	2.00	2.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	0.84	0.84	0.96	0.96	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	45.2	0.0	0.0				46.3	0.0	42.9
Incr Delay (d2), s/veh	0.0	0.3	0.2	2.5	0.3	0.0				2.1	0.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.1	0.1	5.7	0.2	0.0				11.1	0.0	5.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.3	0.2	47.7	0.3	0.0				48.4	0.0	43.8
LnGrp LOS	A	A	A	D	A	A				D	A	D
Approach Vol, veh/h		1154			962						596	
Approach Delay, s/veh		0.3			12.6						47.5	
Approach LOS		A			B						D	

Timer - Assigned Phs		3	4		6		8				
Phs Duration (G+Y+Rc), s		17.0	76.5		26.5		93.5				
Change Period (Y+Rc), s		6.0	6.0		6.0		6.0				
Max Green Setting (Gmax), s		19.0	46.0		37.0		71.0				
Max Q Clear Time (g_c+I1), s		10.5	2.0		18.5		2.0				
Green Ext Time (p_c), s		0.5	9.0		2.0		5.2				

Intersection Summary	
HCM 6th Ctrl Delay	15.0
HCM 6th LOS	B

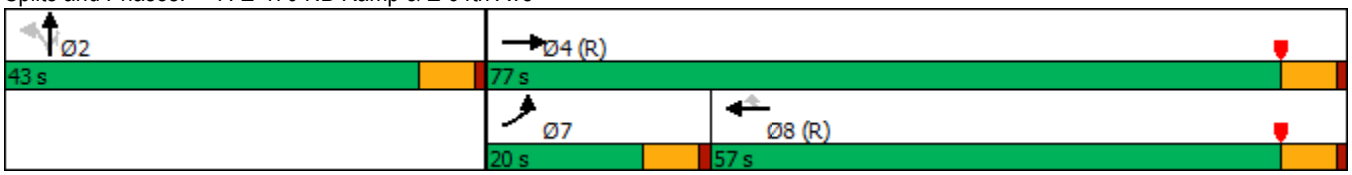
Notes

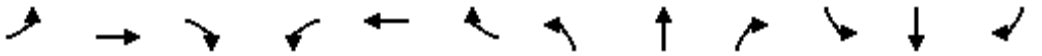
User approved volume balancing among the lanes for turning movement.

Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Configurations						
Traffic Volume (vph)	202	1219	584	162	0	500
Future Volume (vph)	202	1219	584	162	0	500
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		2	
Permitted Phases				8		2
Detector Phase	7	4	8	8	2	2
Switch Phase						
Minimum Initial (s)	5.0	10.0	10.0	10.0	5.0	5.0
Minimum Split (s)	15.0	31.0	31.0	31.0	15.0	15.0
Total Split (s)	20.0	77.0	57.0	57.0	43.0	43.0
Total Split (%)	16.7%	64.2%	47.5%	47.5%	35.8%	35.8%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?			Yes	Yes		
Recall Mode	None	C-Max	C-Max	C-Max	None	None
Act Effct Green (s)	14.6	73.0	54.4	54.4	39.0	39.0
Actuated g/C Ratio	0.12	0.61	0.45	0.45	0.32	0.32
v/c Ratio	0.57	0.66	0.30	0.23	0.62	1.02
Control Delay	50.0	16.1	11.4	3.6	40.8	78.9
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	50.0	16.2	11.4	3.6	40.8	78.9
LOS	D	B	B	A	D	E
Approach Delay		21.0	9.7		64.9	
Approach LOS		C	A		E	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 92 (77%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.02	
Intersection Signal Delay: 29.9	Intersection LOS: C
Intersection Capacity Utilization 71.3%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 7: E-470 NB Ramp & E 64th Ave





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	202	1219	0	0	584	162	291	0	500	0	0	0
Future Volume (veh/h)	202	1219	0	0	584	162	291	0	500	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1752	1752	0	0	1752	1752	1752	1752	1752			
Adj Flow Rate, veh/h	220	1325	0	0	635	-63	316	0	347			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	10	10	0	0	10	10	10	10	10			
Cap, veh/h	319	2209	0	0	2543	789	900	0	400			
Arrive On Green	0.20	1.00	0.00	0.00	0.18	0.00	0.27	0.00	0.27			
Sat Flow, veh/h	3237	3416	0	0	4940	1485	3337	0	1485			
Grp Volume(v), veh/h	220	1325	0	0	635	-63	316	0	347			
Grp Sat Flow(s),veh/h/ln	1618	1664	0	0	1594	1485	1668	0	1485			
Q Serve(g_s), s	7.6	0.0	0.0	0.0	13.7	0.0	9.2	0.0	26.7			
Cycle Q Clear(g_c), s	7.6	0.0	0.0	0.0	13.7	0.0	9.2	0.0	26.7			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	319	2209	0	0	2543	789	900	0	400			
V/C Ratio(X)	0.69	0.60	0.00	0.00	0.25	-0.08	0.35	0.00	0.87			
Avail Cap(c_a), veh/h	432	2209	0	0	2543	789	1084	0	482			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	0.33	0.33	1.00	1.00	1.00			
Upstream Filter(I)	0.88	0.88	0.00	0.00	0.96	0.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	46.4	0.0	0.0	0.0	28.8	0.0	35.4	0.0	41.8			
Incr Delay (d2), s/veh	2.5	1.1	0.0	0.0	0.2	0.0	0.2	0.0	13.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(95%),veh/ln	5.2	0.6	0.0	0.0	9.8	0.0	6.6	0.0	16.3			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	48.9	1.1	0.0	0.0	29.1	0.0	35.6	0.0	55.2			
LnGrp LOS	D	A	A	A	C	A	D	A	E			
Approach Vol, veh/h		1545			572			663				
Approach Delay, s/veh		7.9			32.3			45.8				
Approach LOS		A			C			D				
Timer - Assigned Phs		2		4			7	8				
Phs Duration (G+Y+Rc), s		36.4		83.6			15.8	67.8				
Change Period (Y+Rc), s		6.0		6.0			6.0	6.0				
Max Green Setting (Gmax), s		37.0		71.0			14.0	51.0				
Max Q Clear Time (g_c+I1), s		28.7		2.0			9.6	15.7				
Green Ext Time (p_c), s		1.6		13.2			0.3	4.4				

Intersection Summary	
HCM 6th Ctrl Delay	22.0
HCM 6th LOS	C

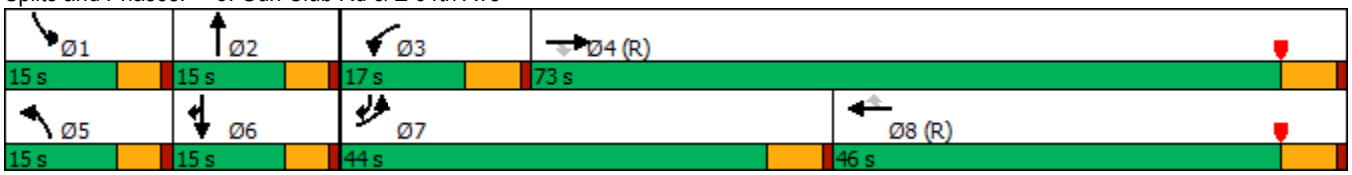
Notes

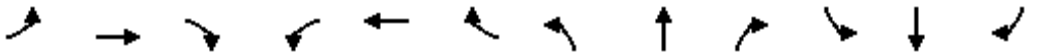
User approved volume balancing among the lanes for turning movement.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	537	1074	144	45	549	138	63	2	63	10	148
Future Volume (vph)	537	1074	144	45	549	138	63	2	63	10	148
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	pt+ov
Protected Phases	7	4		3	8		5	2	1	6	6 7
Permitted Phases			4			8					
Detector Phase	7	4	4	3	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	15.0	31.0	31.0	15.0	31.0	31.0	15.0	15.0	15.0	15.0	
Total Split (s)	44.0	73.0	73.0	17.0	46.0	46.0	15.0	15.0	15.0	15.0	
Total Split (%)	36.7%	60.8%	60.8%	14.2%	38.3%	38.3%	12.5%	12.5%	12.5%	12.5%	
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	
Lead-Lag Optimize?		Yes	Yes		Yes	Yes		Yes		Yes	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	
Act Effct Green (s)	29.6	81.1	81.1	10.9	60.1	60.1	8.9	7.5	11.0	7.5	41.1
Actuated g/C Ratio	0.25	0.68	0.68	0.09	0.50	0.50	0.07	0.06	0.09	0.06	0.34
v/c Ratio	0.75	0.53	0.15	0.33	0.36	0.18	0.29	0.23	0.23	0.10	0.16
Control Delay	45.0	11.0	2.8	50.8	22.5	10.1	55.1	25.4	57.2	63.2	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.0	11.0	2.8	50.8	22.5	10.1	55.1	25.4	57.2	63.2	5.1
LOS	D	B	A	D	C	B	E	C	E	E	A
Approach Delay		20.8			21.9			46.7		22.6	
Approach LOS		C			C			D		C	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 64 (53%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 22.0	Intersection LOS: C
Intersection Capacity Utilization 52.3%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 8: Gun Club Rd & E 64th Ave





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	537	1074	144	45	549	138	63	2	23	63	10	148
Future Volume (veh/h)	537	1074	144	45	549	138	63	2	23	63	10	148
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752
Adj Flow Rate, veh/h	584	1167	10	49	597	41	68	2	-29	68	11	134
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	10	10	10	10	10	10	10	10	10	10	10	10
Cap, veh/h	724	2338	1043	90	1772	791	148	0	124	148	114	732
Arrive On Green	0.15	0.47	0.47	0.02	0.18	0.18	0.05	0.06	0.00	0.05	0.06	0.06
Sat Flow, veh/h	3237	3328	1485	1668	3328	1485	3237	1752	0	3237	1752	2613
Grp Volume(v), veh/h	584	1167	10	49	597	41	68	-27	-27	68	11	134
Grp Sat Flow(s),veh/h/ln	1618	1664	1485	1668	1664	1485	1618	1752	1485	1618	1752	1306
Q Serve(g_s), s	20.9	29.1	0.4	3.5	18.9	2.8	2.5	0.0	0.0	2.5	0.7	4.7
Cycle Q Clear(g_c), s	20.9	29.1	0.4	3.5	18.9	2.8	2.5	0.0	0.0	2.5	0.7	4.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	724	2338	1043	90	1772	791	148	0	0	148	114	732
V/C Ratio(X)	0.81	0.50	0.01	0.55	0.34	0.05	0.46	0.00	0.00	0.46	0.10	0.18
Avail Cap(c_a), veh/h	1079	2338	1043	181	1772	791	297	0	0	297	161	802
HCM Platoon Ratio	0.67	0.67	0.67	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.55	0.55	0.55	0.95	0.95	0.95	1.00	0.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	48.5	17.2	9.6	57.5	30.9	24.3	55.8	0.0	0.0	55.8	52.8	32.8
Incr Delay (d2), s/veh	1.6	0.4	0.0	4.9	0.5	0.1	2.2	0.0	0.0	2.2	0.4	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	12.4	16.0	0.2	2.9	13.1	1.7	1.9	0.0	0.0	1.9	0.6	2.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	50.1	17.6	9.6	62.3	31.4	24.4	58.0	0.0	0.0	58.0	53.2	32.9
LnGrp LOS	D	B	A	E	C	C	E	A	A	E	D	C
Approach Vol, veh/h		1761			687			14			213	
Approach Delay, s/veh		28.3			33.2			281.9			42.0	
Approach LOS		C			C			F			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.5	11.8	10.4	88.3	9.5	11.8	30.8	67.9
Change Period (Y+Rc), s	5.0	5.0	6.0	6.0	5.0	5.0	6.0	6.0
Max Green Setting (Gmax), s	10.0	10.0	11.0	67.0	10.0	10.0	38.0	40.0
Max Q Clear Time (g_c+I1), s	4.5	0.0	5.5	31.1	4.5	6.7	22.9	20.9
Green Ext Time (p_c), s	0.1	0.0	0.0	9.8	0.1	0.1	1.9	3.7

Intersection Summary	
HCM 6th Ctrl Delay	32.0
HCM 6th LOS	C

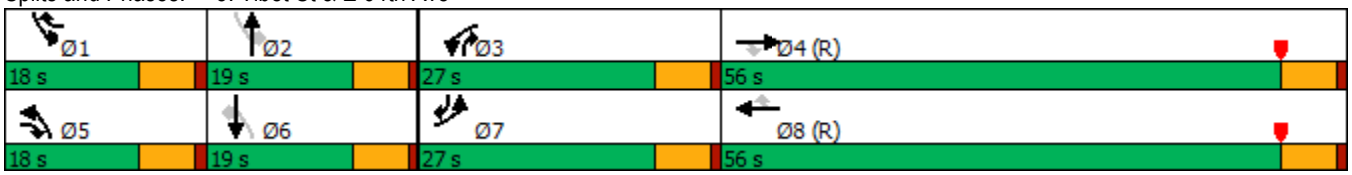
Notes

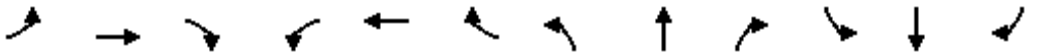
User approved pedestrian interval to be less than phase max green.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	257	878	564	507	1267	203	575	48	508	250	52	234
Future Volume (vph)	257	878	564	507	1267	203	575	48	508	250	52	234
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	D.P+P	NA	pm+ov	D.P+P	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8	6		2	2		6
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	5.0	10.0	5.0	5.0	10.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	15.0	31.0	15.0	15.0	31.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Total Split (s)	27.0	56.0	18.0	27.0	56.0	18.0	18.0	19.0	27.0	18.0	19.0	27.0
Total Split (%)	22.5%	46.7%	15.0%	22.5%	46.7%	15.0%	15.0%	15.8%	22.5%	15.0%	15.8%	22.5%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?		Yes			Yes			Yes			Yes	
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None	None
Act Effct Green (s)	23.7	50.0	68.0	27.0	53.4	71.4	20.2	9.3	40.0	20.2	9.3	36.6
Actuated g/C Ratio	0.20	0.42	0.57	0.22	0.44	0.60	0.17	0.08	0.33	0.17	0.08	0.30
v/c Ratio	0.86	0.70	0.66	0.77	0.94	0.23	1.30	0.39	1.01	1.09	0.43	0.50
Control Delay	71.5	27.3	5.0	56.7	38.0	0.5	180.9	51.1	71.0	127.4	61.7	25.4
Queue Delay	0.0	0.0	0.3	0.0	44.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.5	27.3	5.4	56.7	82.4	0.5	180.9	51.1	71.0	127.4	61.7	25.5
LOS	E	C	A	E	F	A	F	D	E	F	E	C
Approach Delay		26.7			67.4			126.1			76.6	
Approach LOS		C			E			F			E	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 4 (3%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Natural Cycle: 120	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.30	
Intersection Signal Delay: 67.8	Intersection LOS: E
Intersection Capacity Utilization 87.3%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 5: Tibet St & E 64th Ave





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	257	878	564	507	1267	203	575	48	508	250	52	234
Future Volume (veh/h)	257	878	564	507	1267	203	575	48	508	250	52	234
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752
Adj Flow Rate, veh/h	279	954	396	551	1377	96	625	52	335	272	57	118
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	10	10	10	10	10	10	10	10	10	10	10	10
Cap, veh/h	292	1387	767	566	1387	767	616	190	421	301	190	421
Arrive On Green	0.35	0.83	0.83	0.23	0.55	0.55	0.03	0.04	0.04	0.10	0.11	0.11
Sat Flow, veh/h	1668	3328	1485	3237	3328	1485	3237	1752	1485	1668	1752	1485
Grp Volume(v), veh/h	279	954	396	551	1377	96	625	52	335	272	57	118
Grp Sat Flow(s),veh/h/ln	1668	1664	1485	1618	1664	1485	1618	1752	1485	1668	1752	1485
Q Serve(g_s), s	19.6	13.4	9.5	20.3	49.2	3.1	12.0	3.5	13.0	12.0	3.6	7.4
Cycle Q Clear(g_c), s	19.6	13.4	9.5	20.3	49.2	3.1	12.0	3.5	13.0	12.0	3.6	7.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	292	1387	767	566	1387	767	616	190	421	301	190	421
V/C Ratio(X)	0.96	0.69	0.52	0.97	0.99	0.13	1.01	0.27	0.80	0.90	0.30	0.28
Avail Cap(c_a), veh/h	292	1387	767	566	1387	767	616	190	421	301	190	421
HCM Platoon Ratio	2.00	2.00	2.00	1.33	1.33	1.33	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	0.46	0.46	0.46	0.45	0.45	0.45	0.94	0.94	0.94	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.5	7.0	4.7	45.8	26.6	11.3	51.8	53.3	42.5	47.0	49.3	33.5
Incr Delay (d2), s/veh	25.1	1.3	1.1	19.1	14.6	0.2	38.9	0.7	9.7	28.7	0.9	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	11.3	4.4	3.2	12.2	23.0	1.8	11.3	2.8	15.1	8.8	2.9	4.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	63.7	8.3	5.8	64.9	41.2	11.4	90.7	54.0	52.2	75.7	50.2	33.8
LnGrp LOS	E	A	A	E	D	B	F	D	D	E	D	C
Approach Vol, veh/h		1629			2024			1012			447	
Approach Delay, s/veh		17.2			46.2			76.0			61.4	
Approach LOS		B			D			E			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	18.0	19.0	27.0	56.0	18.0	19.0	27.0	56.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	12.0	13.0	21.0	50.0	12.0	13.0	21.0	50.0
Max Q Clear Time (g_c+I1), s	14.0	15.0	22.3	15.4	14.0	9.4	21.6	51.2
Green Ext Time (p_c), s	0.0	0.0	0.0	9.3	0.0	0.2	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	44.2
HCM 6th LOS	D

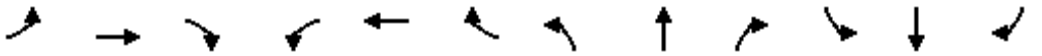
Notes

User approved pedestrian interval to be less than phase max green.

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	1207	439	600	1629	262	0	344
Future Volume (vph)	1207	439	600	1629	262	0	344
Turn Type	NA	Perm	Prot	NA	Perm	NA	Perm
Protected Phases	4		3	8		6	
Permitted Phases		4			6		6
Detector Phase	4	4	3	8	6	6	6
Switch Phase							
Minimum Initial (s)	10.0	10.0	5.0	10.0	5.0	5.0	5.0
Minimum Split (s)	25.0	25.0	15.0	25.0	15.0	15.0	15.0
Total Split (s)	47.0	47.0	36.0	83.0	37.0	37.0	37.0
Total Split (%)	39.2%	39.2%	30.0%	69.2%	30.8%	30.8%	30.8%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes					
Recall Mode	C-Max	C-Max	None	C-Max	None	None	None
Act Effct Green (s)	45.8	45.8	28.1	79.8	28.2	28.2	28.2
Actuated g/C Ratio	0.38	0.38	0.23	0.66	0.24	0.24	0.24
v/c Ratio	0.73	0.56	0.88	0.81	0.39	0.39	0.92
Control Delay	25.9	2.9	73.1	10.8	41.2	41.3	63.1
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	25.9	2.9	73.1	10.9	41.2	41.3	63.1
LOS	C	A	E	B	D	D	E
Approach Delay	19.7			27.6		53.6	
Approach LOS	B			C		D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 7 (6%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 28.3	Intersection LOS: C
Intersection Capacity Utilization 76.3%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 6: E-470 SB Ramp & E 64th Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↱	↰↰	↑↑					↰	↲	↱
Traffic Volume (veh/h)	0	1207	439	600	1629	0	0	0	0	262	0	344
Future Volume (veh/h)	0	1207	439	600	1629	0	0	0	0	262	0	344
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1752	1752	1752	1752	0				1752	1752	1752
Adj Flow Rate, veh/h	0	1312	260	652	1771	0				285	0	178
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	10	10	10	10	0				10	10	10
Cap, veh/h	0	2333	724	704	2514	0				483	0	215
Arrive On Green	0.00	0.98	0.98	0.43	1.00	0.00				0.14	0.00	0.14
Sat Flow, veh/h	0	4940	1485	3237	3416	0				3337	0	1485
Grp Volume(v), veh/h	0	1312	260	652	1771	0				285	0	178
Grp Sat Flow(s),veh/h/ln	0	1594	1485	1618	1664	0				1668	0	1485
Q Serve(g_s), s	0.0	1.8	0.8	22.9	0.0	0.0				9.6	0.0	14.0
Cycle Q Clear(g_c), s	0.0	1.8	0.8	22.9	0.0	0.0				9.6	0.0	14.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	2333	724	704	2514	0				483	0	215
V/C Ratio(X)	0.00	0.56	0.36	0.93	0.70	0.00				0.59	0.00	0.83
Avail Cap(c_a), veh/h	0	2333	724	809	2514	0				862	0	384
HCM Platoon Ratio	1.00	2.00	2.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	0.40	0.40	0.35	0.35	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.8	0.8	33.0	0.0	0.0				48.0	0.0	49.9
Incr Delay (d2), s/veh	0.0	0.4	0.6	6.5	0.6	0.0				1.2	0.0	7.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.7	0.5	9.6	0.4	0.0				7.1	0.0	9.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	1.2	1.3	39.5	0.6	0.0				49.1	0.0	57.8
LnGrp LOS	A	A	A	D	A	A				D	A	E
Approach Vol, veh/h		1572			2423						463	
Approach Delay, s/veh		1.2			11.1						52.5	
Approach LOS		A			B						D	

Timer - Assigned Phs		3	4		6		8				
Phs Duration (G+Y+Rc), s		32.1	64.5		23.4		96.6				
Change Period (Y+Rc), s		6.0	6.0		6.0		6.0				
Max Green Setting (Gmax), s		30.0	41.0		31.0		77.0				
Max Q Clear Time (g_c+I1), s		24.9	3.8		16.0		2.0				
Green Ext Time (p_c), s		1.2	12.7		1.4		23.8				

Intersection Summary	
HCM 6th Ctrl Delay	11.9
HCM 6th LOS	B

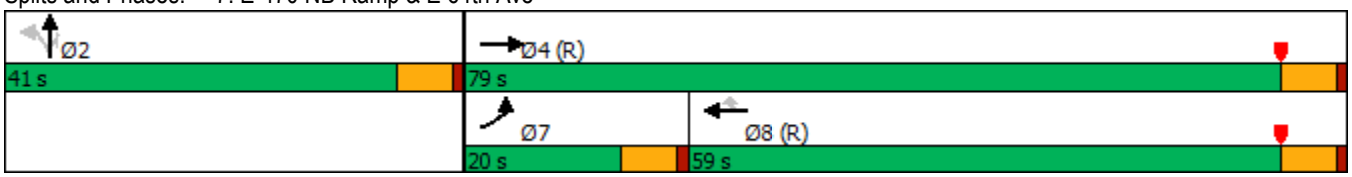
Notes

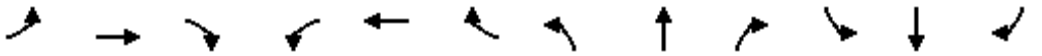
User approved volume balancing among the lanes for turning movement.

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Configurations							
Traffic Volume (vph)	341	1120	1796	555	433	0	392
Future Volume (vph)	341	1120	1796	555	433	0	392
Turn Type	Prot	NA	NA	Perm	Perm	NA	Perm
Protected Phases	7	4	8			2	
Permitted Phases				8	2		2
Detector Phase	7	4	8	8	2	2	2
Switch Phase							
Minimum Initial (s)	5.0	10.0	10.0	10.0	5.0	5.0	5.0
Minimum Split (s)	15.0	31.0	31.0	31.0	15.0	15.0	15.0
Total Split (s)	20.0	79.0	59.0	59.0	41.0	41.0	41.0
Total Split (%)	16.7%	65.8%	49.2%	49.2%	34.2%	34.2%	34.2%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead		Lag	Lag			
Lead-Lag Optimize?			Yes	Yes			
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None
Act Effct Green (s)	15.6	75.6	54.0	54.0	32.4	32.4	32.4
Actuated g/C Ratio	0.13	0.63	0.45	0.45	0.27	0.27	0.27
v/c Ratio	0.90	0.59	0.92	0.65	0.56	0.56	0.93
Control Delay	71.9	21.2	29.5	3.9	42.7	42.8	63.0
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay	71.9	21.3	29.5	3.9	42.7	42.8	63.0
LOS	E	C	C	A	D	D	E
Approach Delay		33.1	23.5			52.4	
Approach LOS		C	C			D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 117 (98%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 31.6	Intersection LOS: C
Intersection Capacity Utilization 76.3%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 7: E-470 NB Ramp & E 64th Ave





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	341	1120	0	0	1796	555	433	0	392	0	0	0
Future Volume (veh/h)	341	1120	0	0	1796	555	433	0	392	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1752	1752	0	0	1752	1752	1752	1752	1752			
Adj Flow Rate, veh/h	371	1217	0	0	1952	364	471	0	230			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	10	10	0	0	10	10	10	10	10			
Cap, veh/h	378	2381	0	0	2624	814	616	0	274			
Arrive On Green	0.23	1.00	0.00	0.00	0.73	0.73	0.18	0.00	0.18			
Sat Flow, veh/h	3237	3416	0	0	4940	1485	3337	0	1485			
Grp Volume(v), veh/h	371	1217	0	0	1952	364	471	0	230			
Grp Sat Flow(s),veh/h/ln	1618	1664	0	0	1594	1485	1668	0	1485			
Q Serve(g_s), s	13.7	0.0	0.0	0.0	29.0	11.8	16.1	0.0	17.9			
Cycle Q Clear(g_c), s	13.7	0.0	0.0	0.0	29.0	11.8	16.1	0.0	17.9			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	378	2381	0	0	2624	814	616	0	274			
V/C Ratio(X)	0.98	0.51	0.00	0.00	0.74	0.45	0.76	0.00	0.84			
Avail Cap(c_a), veh/h	378	2381	0	0	2624	814	973	0	433			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00			
Upstream Filter(I)	0.65	0.65	0.00	0.00	0.20	0.20	1.00	0.00	1.00			
Uniform Delay (d), s/veh	45.9	0.0	0.0	0.0	11.2	8.9	46.4	0.0	47.2			
Incr Delay (d2), s/veh	32.8	0.5	0.0	0.0	0.4	0.4	2.0	0.0	8.1			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(95%),veh/ln	9.7	0.3	0.0	0.0	8.0	4.3	10.9	0.0	11.4			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	78.7	0.5	0.0	0.0	11.6	9.3	48.4	0.0	55.3			
LnGrp LOS	E	A	A	A	B	A	D	A	E			
Approach Vol, veh/h		1588			2316			701				
Approach Delay, s/veh		18.8			11.3			50.7				
Approach LOS		B			B			D				
Timer - Assigned Phs		2		4			7	8				
Phs Duration (G+Y+Rc), s		28.2		91.8			20.0	71.8				
Change Period (Y+Rc), s		6.0		6.0			6.0	6.0				
Max Green Setting (Gmax), s		35.0		73.0			14.0	53.0				
Max Q Clear Time (g_c+I1), s		19.9		2.0			15.7	31.0				
Green Ext Time (p_c), s		2.2		11.3			0.0	15.8				
Intersection Summary												
HCM 6th Ctrl Delay			19.9									
HCM 6th LOS			B									

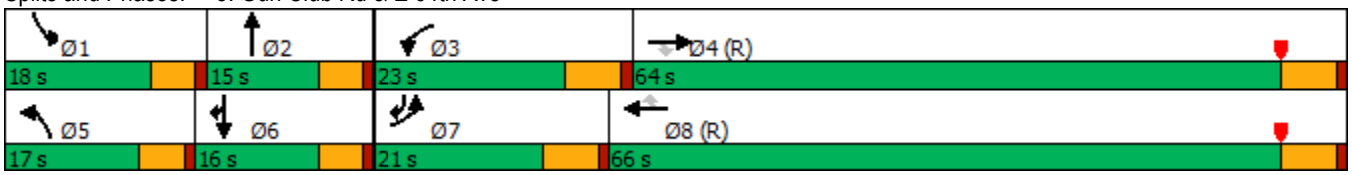
Notes

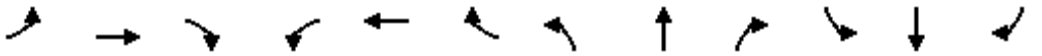
User approved volume balancing among the lanes for turning movement.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	339	937	244	105	1512	96	279	9	230	11	569
Future Volume (vph)	339	937	244	105	1512	96	279	9	230	11	569
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	pt+ov
Protected Phases	7	4		3	8		5	2	1	6	6 7
Permitted Phases			4			8					
Detector Phase	7	4	4	3	8	8	5	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	15.0	31.0	31.0	15.0	31.0	31.0	15.0	15.0	15.0	15.0	
Total Split (s)	21.0	64.0	64.0	23.0	66.0	66.0	17.0	15.0	18.0	16.0	
Total Split (%)	17.5%	53.3%	53.3%	19.2%	55.0%	55.0%	14.2%	12.5%	15.0%	13.3%	
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	
Lead-Lag Optimize?		Yes	Yes		Yes	Yes		Yes		Yes	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	
Act Effct Green (s)	15.0	61.8	61.8	13.2	60.0	60.0	12.0	10.5	12.5	11.0	32.0
Actuated g/C Ratio	0.12	0.52	0.52	0.11	0.50	0.50	0.10	0.09	0.10	0.09	0.27
v/c Ratio	0.93	0.60	0.30	0.63	1.00	0.13	0.95	0.60	0.75	0.08	0.83
Control Delay	72.0	18.5	4.6	80.9	37.7	0.4	93.8	20.0	66.2	49.5	45.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.0	18.5	4.6	80.9	37.7	0.4	93.8	20.0	66.2	49.5	45.2
LOS	E	B	A	F	D	A	F	C	E	D	D
Approach Delay		28.2			38.3			68.1		51.2	
Approach LOS		C			D			E		D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 84 (70%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Natural Cycle: 100	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.00	
Intersection Signal Delay: 40.0	Intersection LOS: D
Intersection Capacity Utilization 85.5%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 8: Gun Club Rd & E 64th Ave





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	339	937	244	105	1512	96	279	9	140	230	11	569
Future Volume (veh/h)	339	937	244	105	1512	96	279	9	140	230	11	569
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752
Adj Flow Rate, veh/h	368	1018	118	114	1643	-5	303	10	98	250	12	509
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	10	10	10	10	10	10	10	10	10	10	10	10
Cap, veh/h	405	1805	805	138	1664	742	324	14	134	304	161	566
Arrive On Green	0.13	0.54	0.54	0.11	0.67	0.00	0.10	0.10	0.10	0.09	0.09	0.09
Sat Flow, veh/h	3237	3328	1485	1668	3328	1485	3237	139	1366	3237	1752	2613
Grp Volume(v), veh/h	368	1018	118	114	1643	-5	303	0	108	250	12	509
Grp Sat Flow(s),veh/h/ln	1618	1664	1485	1668	1664	1485	1618	0	1506	1618	1752	1306
Q Serve(g_s), s	13.5	24.2	4.7	8.0	57.8	0.0	11.2	0.0	8.4	9.1	0.8	11.0
Cycle Q Clear(g_c), s	13.5	24.2	4.7	8.0	57.8	0.0	11.2	0.0	8.4	9.1	0.8	11.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.91	1.00		1.00
Lane Grp Cap(c), veh/h	405	1805	805	138	1664	742	324	0	147	304	161	566
V/C Ratio(X)	0.91	0.56	0.15	0.83	0.99	-0.01	0.94	0.00	0.73	0.82	0.07	0.90
Avail Cap(c_a), veh/h	405	1805	805	236	1664	742	324	0	147	351	161	566
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.68	0.68	0.68	0.49	0.49	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	51.8	18.1	13.7	52.6	19.7	0.0	53.6	0.0	52.6	53.4	49.8	45.7
Incr Delay (d2), s/veh	18.1	0.9	0.3	6.1	12.7	0.0	33.7	0.0	17.1	13.0	0.2	17.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	9.7	12.8	2.8	5.6	23.2	0.0	10.0	0.0	6.9	7.6	0.6	13.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.9	19.0	13.9	58.6	32.5	0.0	87.4	0.0	69.7	66.4	50.0	63.0
LnGrp LOS	E	B	B	E	C	A	F	A	E	E	D	E
Approach Vol, veh/h		1504			1752			411			771	
Approach Delay, s/veh		31.0			34.3			82.7			63.9	
Approach LOS		C			C			F			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.3	16.7	15.9	71.1	17.0	16.0	21.0	66.0
Change Period (Y+Rc), s	5.0	5.0	6.0	6.0	5.0	5.0	6.0	6.0
Max Green Setting (Gmax), s	13.0	10.0	17.0	58.0	12.0	11.0	15.0	60.0
Max Q Clear Time (g_c+I1), s	11.1	10.4	10.0	26.2	13.2	13.0	15.5	59.8
Green Ext Time (p_c), s	0.2	0.0	0.1	8.3	0.0	0.0	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	42.8
HCM 6th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.