2017 Skagit County Road Segment & Intersection Concurrency

INTRODUCTION

In conformance with Growth Management, RCW 36.70A, Skagit County Code 14.28.110 "Annual Concurrency Assessment" requires that the County Engineer annually produce this report to update the status of County road concurrency. The following is produced to meet said requirement.

REQUIREMENTS

The concurrency assessment requires that "*The County Engineer must evaluate the high traffic County road segments (any County road segment on which there are at least 8,000 average daily trips) and high traffic County road intersections (any County road intersection into which the total approach volume is at least 7,000 average daily trips and the approach volume from all of the minor legs totals at least 1,000 average daily trips) using a Highway Capacity Manual type method (as selected by the County Engineer) to determine whether these road segments and intersections comply with the level of service standards adopted in the Comprehensive Plan.*" The Levels of Service (LOS) are described as follows in Skagit County's Comprehensive Plan.

Policy 8A-2.1 Level of Service Standards – The Level of Service (LOS) standard for County roads is C. LOS D is acceptable for all road segments that:

a) Have Annualized Average Daily Traffic (AADT) greater than 7,000 vehicles; and

b) Are NOT federally functionally classified as a Local Access Road; and

c) Are designated as a County Freight and Goods Transportation Systems Route (FGTS).

The LOS standard for County road intersections is LOS D.

LEVEL OF SERVICE DATA

Road Segments

The methodology used to acquire the LOS of County road segments is outlined in Appendix C (Transportation Element Technical Appendix) of the Skagit County Comprehensive Plan.

> *"The Skagit County Public Works Traffic Engineering Unit has selected an LOS study volume unit threshold of 7,000 AADT. This threshold is an indicator that a road segment may be approaching the LOS C/D threshold and should be studied in depth."*

Table 1 shows the current County roads that meet the criteria for further study and the current LOS as determined using the Transportation Research Board's Highway Capacity Manual and Highway Capacity Software developed for this use by the University of Florida. Also shown is the projected 5-year LOS. This projected LOS was determined using a 2 percent yearly growth factor for each road segment. Projects along these roadways that are scheduled to be completed within this 5 year period were not significant enough to include as separate items. As one can see from Table 1, all the criteria for LOS concurrency have been met.

Table 1 – Road Segments

Road #	Road Name	FFC	Truck Rt	Beg MP	End MP	Length	2016 ADT	2017 ADT	2018 ADT	2019 ADT	2020 ADT	2021 ADT	2022 ADT	2017 LOS	2022 LOS
63000	COOK ROAD	07	T2	1.750	1.800	0.050	16492	16822	17158	17501	17851	18209	18573	These two segments	
63000	COOK ROAD	07	T2	1.800	1.860	0.060	16492	16822	17158	17501	17851	18209	18573	are in WSDOT ROW	
63000	COOK ROAD	07	T2	1.860	1.890	0.030	13903	14181	14465	14754	15049	15350	15657		
63000	COOK ROAD	07	T2	1.890	1.950	0.060	13903	14181	14465	14754	15049	15350	15657		
63000	COOK ROAD	07	T2	1.950	1.970	0.020	13903	14181	14465	14754	15049	15350	15657	D	D
63000	COOK ROAD	07	T2	1.970	2.191	0.221	13903	14181	14465	14754	15049	15350	15657		
63000	COOK ROAD	07	T2	2.191	3.080	0.889	13903	14181	14465	14754	15049	15350	15657		
63000	COOK ROAD	07	T2	3.080	3.360	0.280	13903	14181	14465	14754	15049	15350	15657		
63000	COOK ROAD	07	T2	3.360	3.820	0.460	12301	12547	12798	13054	13315	13581	13853		
63000	COOK ROAD	07	T2	3.820	4.100	0.280	12301	12547	12798	13054	13315	13581	13853	D	D
63000	COOK ROAD	07	T2	4.100	4.320	0.220	12301	12547	12798	13054	13315	13581	13853		
63000	COOK ROAD	07	T2	4.320	4.600	0.280	12301	12547	12798	13054	13315	13581	13853		
63000	COOK ROAD	07	T2	4.600	4.880	0.280	12004	12244	12489	12739	12994	13253	13518		
63000	COOK ROAD	07	T2	4.880	5.000	0.120	12004	12244	12489	12739	12994	13253	13518		
63000	COOK ROAD	07	T2	5.000	5.080	0.080	12004	12244	12489	12739	12994	13253	13518		
63000	COOK ROAD	07	T2	5.080	5.260	0.180	12004	12244	12489	12739	12994	13253	13518		
63000	COOK ROAD	07	T2	5.260	5.320	0.060	12004	12244	12489	12739	12994	13253	13518		
63000	COOK ROAD	07	T2	5.320	5.390	0.070	12004	12244	12489	12739	12994	13253	13518	D	D
63000	COOK ROAD	16	T2	5.390	5.470	0.080	12004	12244	12489	12739	12994	13253	13518		
63000	COOK ROAD	16	T2	5.470	5.500	0.030	12004	12244	12489	12739	12994	13253	13518		
63000	COOK ROAD	16	T2	5.500	5.510	0.010	12004	12244	12489	12739	12994	13253	13518		
63000	COOK ROAD	16	T2	5.510	5.620	0.110	12004	12244	12489	12739	12994	13253	13518		
80090	PIONEER HIGHWAY	07	T3	0.000	0.883	0.883	8325	8492	8661	8835	9011	9191	9375	C	C
80090	PIONEER HIGHWAY	07	T3	0.883	1.418	0.535	8445	8614	8786	8962	9141	9324	9510	C	C
80090	PIONEER HIGHWAY	07	T3	1.418	1.748	0.330	8445	8614	8786	8962	9141	9324	9510		
80090	PIONEER HIGHWAY	07	T3	1.748	3.065	1.317	8943	9122	9304	9490	9680	9874	10071	C	C
80090	PIONEER HIGHWAY	07	T2	3.065	3.089	0.024	11905	12143	12386	12634	12886	13144	13407	D	D

Road Intersections

Intersection LOS

As with Road Segment LOS, Intersection LOS methodology is outlined in the Transportation Element Technical Appendix (TETA) Appendix C of the Comprehensive Plan. Intersection LOS, according to the Highway Capacity Manual, cannot be determined at stop controlled intersections. The individual stop-controlled leg LOS can be determined, but the overall intersection LOS cannot be determined. With regard to stop-controlled intersections, the TETA states that;

> *"Intersection LOS will be calculated using Traffic Signal Warrants in conjunction with LOS methods. The analysis will use real time data which focuses on turn movements and volumes of the entire intersection. This type of analysis can be made on any intersection in the County Road System."*

Table 2 shows the signalized and unsignalized intersections on which Skagit County is collecting LOS data on a regular basis.

Table 2 – Intersections

Intersection Name	Intersection Type	NB Approach LOS	SB Approach LOS	EB Approach LOS	WB Approach LOS	Overall LOS
2017						
Cook Road / Old Hwy 99 N	Signalized	B	B	B	B	B
2022 Est						
Cook Road / Old Hwy 99 N	Signalized	B	B	B	C	B

The full Highway Capacity Reports on the intersection of Cook Road and Old Hwy 99 N for the current year and 5-year estimate are included in this Assessment as Appendix A and Appendix B respectively. This 5-year projected LOS was determined using a 2 percent yearly growth factor for each approach volume. This is by far the busiest intersection under Skagit County jurisdiction. The Highway Capacity Reports used for this Table were taken from 2016 counts as the traffic at this intersection was drastically affected by the Burlington Northern Overpass Replacement Project directly north of the intersection that closed Old Hwy 99 North beginning May 1, 2017. Said project will also affect reporting into 2018 as the bridge will not reopen until the fall of 2018.

It should be noted that this intersection was studied during the Peak PM hour for the Highway Capacity report as per industry standards and Concurrency requirements. However, during the Peak AM hour the LOS from the Westbound (WB) and Eastbound (EB) approaches would differ due to the prevailing traffic patterns for work-bound and home-bound trips. There are also two to three AM peak hour trains that travel through the at-grade rail crossing just east of the intersection that directly effect LOS during the morning commute.

SUMMARY

As of December 31, 2017 all Skagit County road segments and signalized intersections meet the current LOS standards as adopted in the Comprehensive Plan of Skagit County. Therefore, all Skagit County road segments and intersections are concurrent.

Analyst: Given Kutz
Agency: Skagit County
Date: 6/21/2017
Period: 5:00 pm
Project ID: 2016 Concurrency Assessment
E/W St: Cook Road

Inter.: Int #1
Area Type: All other areas
Jurisd: County
Year : 2016
N/S St: Old Hwy 99 N

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	1
LGConfig	L	TR		L	TR		L	TR		L	T	R
Volume	131	532	67	29	443	63	91	159	200	54	73	100
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
RTOR Vol		5			6			27			97	

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A		
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds	X		
WB Left	A				SB Left	A		
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	27.0				17.1			
Yellow	4.0				3.6			
All Red	1.0				1.0			

Cycle Length: 53.7 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	312	620	0.46	0.50	9.7	A		
TR	895	1781	0.72	0.50	13.3	B	12.6	B
Westbound								
L	242	481	0.13	0.50	7.4	A		
TR	894	1779	0.61	0.50	10.8	B	10.6	B
Northbound								
L	407	1277	0.24	0.32	13.8	B		
TR	526	1653	0.69	0.32	19.7	B	18.4	B
Southbound								
L	230	723	0.26	0.32	14.2	B		
T	576	1810	0.14	0.32	13.2	B	13.6	B
R	481	1509	0.01	0.32	12.5	B		

Intersection Delay = 13.5 (sec/veh) Intersection LOS = B

Baseline

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: Given Kutz
Agency/Co.: Skagit County
Date Performed: 6/21/2017
Analysis Time Period: 5:00 pm
Intersection: Int #1
Area Type: All other areas
Jurisdiction: County
Analysis Year: 2016
Project ID: 2016 Concurrency Assessment
E/W St: Cook Road N/S St: Old Hwy 99 N

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	131	532	67	29	443	63	91	159	200	54	73	100
% Heavy Veh	7	5	5	5	5	5	5	7	5	5	5	7
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
PK 15 Vol	36	145	18	8	120	17	25	43	54	15	20	27
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900		1900	1900		1900	1900	1900
ParkExist												
NumPark												
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	1
LGConfig	L	TR		L	TR		L	TR		L	T	R
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
RTOR Vol		5			6			27			97	
Adj Flow	142	645		32	544		99	361		59	79	3
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000		1.000	0.000		1.000	0.000	
Prop RTs	0.104			0.114			0.521			0.000	1.000	
Peds Bikes	0	0		0	0		0	0		0	0	
Buses	0	0		0	0		0	0		0	0	0
%InProtPhase												

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Arriv. Type	3	3		3	3		3	3		3	3	3
Unit Ext.	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Ext of g	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Ped Min g		3.2			3.2			3.2			3.2	

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A		
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds	X		
WB Left	A				SB Left	A		
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	27.0				17.1			
Yellow	4.0				3.6			
All Red	1.0				1.0			

Cycle Length: 53.7 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	131	532	67	29	443	63	91	159	200	54	73	100
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj flow	142	578	67	32	482	62	99	173	188	59	79	3
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	1
Lane group	L	TR		L	TR		L	TR		L	T	R
Adj flow	142	645		32	544		99	361		59	79	3
Prop LTs	1.000	0.000		1.000	0.000		1.000	0.000		1.000	0.000	
Prop RTs	0.104			0.114			0.521			0.000	1.000	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG	L	TR		L	TR		L	TR		L	T	R
So	1900	1900		1900	1900		1900	1900		1900	1900	1900
Lanes	1	1	0	1	1	0	1	1	0	1	1	1
fW	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fHV	0.935	0.952		0.952	0.952		0.952	0.944		0.952	0.952	0.935
fG	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fP	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fBB	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fA	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fLU	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fRT		0.984			0.983			0.922			1.000	0.850
fLT	0.349	1.000		0.266	1.000		0.706	1.000		0.399	1.000	
Sec.												
fLpb	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
fRpb		1.000			1.000			1.000			1.000	1.000
S	620	1781		481	1779		1277	1653		723	1810	1509
Sec.												

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)		Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound								
Prot								
Perm								
Left	L	142	620		0.23	0.50	312	0.46
Prot								
Perm								
Thru	TR	645	1781	#	0.36	0.50	895	0.72
Right								
Westbound								
Prot								
Perm								
Left	L	32	481		0.07	0.50	242	0.13
Prot								
Perm								
Thru	TR	544	1779		0.31	0.50	894	0.61
Right								
Northbound								
Prot								
Perm								
Left	L	99	1277		0.08	0.32	407	0.24
Prot								
Perm								
Thru	TR	361	1653	#	0.22	0.32	526	0.69
Right								
Southbound								
Prot								
Perm								
Left	L	59	723		0.08	0.32	230	0.26
Prot								
Perm								
Thru	T	79	1810		0.04	0.32	576	0.14
Right	R	3	1509		0.00	0.32	481	0.01

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.58
Total lost time per cycle, L = 9.60 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.71

Control Delay and LOS Determination

Appr/ Lane	Ratios		Unf Del	Prog Adj	Lane Grp	Incremental Factor	Del	Res Del	Lane Group		Approach	
Grp	v/c	g/C	d1	Fact	Cap	k	d2	d3	Delay	LOS	Delay	LOS
Eastbound												
L	0.46	0.50	8.6	1.000	312	0.11	1.1	0.0	9.7	A		
TR	0.72	0.50	10.4	1.000	895	0.28	2.9	0.0	13.3	B	12.6	B
Westbound												
L	0.13	0.50	7.1	1.000	242	0.11	0.2	0.0	7.4	A		
TR	0.61	0.50	9.6	1.000	894	0.19	1.2	0.0	10.8	B	10.6	B
Northbound												
L	0.24	0.32	13.5	1.000	407	0.11	0.3	0.0	13.8	B		
TR	0.69	0.32	16.0	1.000	526	0.26	3.7	0.0	19.7	B	18.4	B
Southbound												
L	0.26	0.32	13.6	1.000	230	0.11	0.6	0.0	14.2	B		
T	0.14	0.32	13.0	1.000	576	0.11	0.1	0.0	13.2	B	13.6	B

R	0.01	0.32	12.5	1.000	481	0.11	0.0	0.0	12.5	B

Intersection delay = 13.5 (sec/veh) Intersection LOS = B

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input

		EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach		M	M	M	M
Cycle length, C	53.7 sec				
Total actual green time for LT lane group, G (s)		27.0	27.0	17.1	17.1
Effective permitted green time for LT lane group, g(s)		27.0	27.0	17.1	17.1
Opposing effective green time, go (s)		27.0	27.0	17.1	17.1
Number of lanes in LT lane group, N		1	1	1	1
Number of lanes in opposing approach, No		1	1	1	1
Adjusted LT flow rate, VLT (veh/h)		142	32	99	59
Proportion of LT in LT lane group, PLT		1.000	1.000	1.000	1.000
Proportion of LT in opposing flow, PLTo		0.00	0.00	0.00	0.00
Adjusted opposing flow rate, Vo (veh/h)		544	645	79	361
Lost time for LT lane group, tL		5.00	5.00	4.60	4.60
Computation					
LT volume per cycle, LTC=VLTC/3600		2.12	0.48	1.48	0.88
Opposing lane util. factor, fLUo		1.000	1.000	1.000	1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)		8.11	9.62	1.18	5.38
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g		0.0	0.0	0.0	0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)		1.00	1.00	1.00	1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]		0.50	0.50	0.68	0.68
gq, (see Exhibit C16-4,5,6,7,8)		6.56	9.91	0.00	4.58
gu=g-gq if gq>=gf, or = g-gf if gq<gf		20.44	17.09	17.10	12.52
n=Max(gq-gf)/2,0)		3.28	4.96	0.00	2.29
PTHo=1-PLTo		1.00	1.00	1.00	1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]		1.00	1.00	1.00	1.00
EL1 (refer to Exhibit C16-3)		2.17	2.38	1.42	1.83
EL2=Max((1-Ptho**n)/Plto, 1.0)					
fmin=2(1+PL)/g or fmin=2(1+Pl)/g		0.15	0.15	0.23	0.23
gdiff=max(gq-gf,0)		0.00	0.00	0.00	0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)		0.35	0.27	0.71	0.40
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N**					
Left-turn adjustment, fLT		0.349	0.266	0.706	0.399

For special case of single-lane approach opposed by multilane approach, see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

Input

		EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach					
Cycle length, C	53.7 sec				
Total actual green time for LT lane group, G (s)					
Effective permitted green time for LT lane group, g(s)					
Opposing effective green time, go (s)					
Number of lanes in LT lane group, N					

Number of lanes in opposing approach, No				
Adjusted LT flow rate, VLT (veh/h)				
Proportion of LT in LT lane group, PLT	0.000	0.000	0.000	0.000
Proportion of LT in opposing flow, PLTo				
Adjusted opposing flow rate, Vo (veh/h)				
Lost time for LT lane group, tL				
Computation				
LT volume per cycle, LTC=VLTC/3600				
Opposing lane util. factor, fLUo	1.000	1.000	1.000	1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)				
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g				
Opposing platoon ratio, Rpo (refer Exhibit 16-11)				
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]				
gq, (see Exhibit C16-4,5,6,7,8)				
gu=g-gq if gq>=gf, or = g-gf if gq<gf				
n=Max(gq-gf)/2,0)				
PTHo=1-PLTo				
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]				
EL1 (refer to Exhibit C16-3)				
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g				
gdiff=max(gq-gf,0)				
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)				
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)				
or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT				

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns	EB	WB	NB	SB
Effective pedestrian green time, gp (s)	27.0	27.0	17.1	17.1
Conflicting pedestrian volume, Vped (p/h)	0	0	0	0
Pedestrian flow rate, Vpedg (p/h)	0	0	0	0
OCCpedg	0.000	0.000	0.000	0.000
Opposing queue clearing green, gq (s)	6.56	9.91	0.00	4.58
Eff. ped. green consumed by opp. veh. queue, gq/gp	0.243	0.367	0.000	0.268
OCCpedu	0.000	0.000	0.000	0.000
Opposing flow rate, Vo (veh/h)	544	645	79	361
OCCr	0.000	0.000	0.000	0.000
Number of cross-street receiving lanes, Nrec	1	1	1	1
Number of turning lanes, Nturn	1	1	1	1
ApbT	1.000	1.000	1.000	1.000
Proportion of left turns, PLT	1.000	1.000	1.000	1.000
Proportion of left turns using protected phase, PLTA	0.000	0.000	0.000	0.000
Left-turn adjustment, fLpb	1.000	1.000	1.000	1.000
Permitted Right Turns				
Effective pedestrian green time, gp (s)	27.0	27.0	17.1	17.1
Conflicting pedestrian volume, Vped (p/h)	0	0	0	0
Conflicting bicycle volume, Vbic (bicycles/h)	0	0	0	0
Vpedg	0	0	0	0
OCCpedg	0.000	0.000	0.000	0.000
Effective green, g (s)	27.0	27.0	17.1	17.1
Vbicg	0	0	0	0

OCCbicg	0.020	0.020	0.020	0.020
OCCr	0.000	0.000	0.000	0.000
Number of cross-street receiving lanes, Nrec	1	1	1	1
Number of turning lanes, Nturn	1	1	1	1
ApbT	1.000	1.000	1.000	1.000
Proportion right-turns, PRT	0.104	0.114	0.521	1.000
Proportion right-turns using protected phase, PRTA	0.000	0.000	0.000	0.000
Right turn adjustment, fRpb	1.000	1.000	1.000	1.000

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

	EBLT	WBLT	NBLT	SBLT
Cycle length, C 53.7 sec				
Adj. LT vol from Vol Adjustment Worksheet, v				
v/c ratio from Capacity Worksheet, X				
Protected phase effective green interval, g (s)				
Opposing queue effective green interval, gq				
Unopposed green interval, gu				
Red time r=(C-g-gq-gu)				
Arrival rate, qa=v/(3600(max[X,1.0]))				
Protected ph. departure rate, Sp=s/3600				
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)				
XPerm				
XProt				
Case				
Queue at beginning of green arrow, Qa				
Queue at beginning of unsaturated green, Qu				
Residual queue, Qr				
Uniform Delay, d1				

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay ds	Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
L	0.0	0.00	13.3	8.6	0.00	0.0	0.0	9.7
TR	0.0	0.00	13.3	10.4	0.00	0.0	0.0	13.3
	0.0						0.0	
Westbound								
L	0.0	0.00	13.3	7.1	0.00	0.0	0.0	7.4
TR	0.0	0.00	13.3	9.6	0.00	0.0	0.0	10.8
	0.0						0.0	
Northbound								
L	0.0	0.00	18.3	13.5	0.00	0.0	0.0	13.8
TR	0.0	0.00	18.3	16.0	0.00	0.0	0.0	19.7
	0.0						0.0	
Southbound								
L	0.0	0.00	18.3	13.6	0.00	0.0	0.0	14.2
T	0.0	0.00	18.3	13.0	0.00	0.0	0.0	13.2
R	0.0	0.00	18.3	12.5	0.00	0.0	0.0	12.5

Intersection Delay 13.5 sec/veh Intersection LOS B

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup	L	TR		L	TR		L	TR		L	T	R
Init Queue	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Flow Rate	142	645		32	544		99	361		59	79	3
So	1900	1900		1900	1900		1900	1900		1900	1900	1900
No.Lanes	1	1	0	1	1	0	1	1	0	1	1	1
SL	620	1781		481	1779		1277	1653		723	1810	1509
LnCapacity	312	895		242	894		407	526		230	576	481
Flow Ratio	0.2	0.4		0.1	0.3		0.1	0.2		0.1	0.0	0.0
v/c Ratio	0.46	0.72		0.13	0.61		0.24	0.69		0.26	0.14	0.01
Grn Ratio	0.50	0.50		0.50	0.50		0.32	0.32		0.32	0.32	0.32
I Factor		1.000			1.000			1.000			1.000	
AT or PVG	3	3		3	3		3	3		3	3	3
Pltn Ratio	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
PF2	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Q1	1.4	7.5		0.3	5.8		1.1	4.7		0.7	0.8	0.0
kB	0.3	0.5		0.2	0.5		0.3	0.3		0.2	0.4	0.3
Q2	0.2	1.2		0.0	0.7		0.1	0.7		0.1	0.1	0.0
Q Average	1.6	8.7		0.3	6.5		1.2	5.4		0.7	0.9	0.0
Q Spacing	25.0	25.0		25.0	25.0		25.0	25.0		25.0	25.0	25.0
Q Storage	155	0		275	0		170	0		280	0	100
Q S Ratio	0.3			0.0			0.2			0.1		0.0
70th Percentile Output:												
fB%	1.2	1.2		1.2	1.2		1.2	1.2		1.2	1.2	1.2
BOQ	1.9	10.2		0.3	7.7		1.4	6.4		0.9	1.1	0.0
QSRatio	0.3			0.0			0.2			0.1		0.0
85th Percentile Output:												
fB%	1.6	1.5		1.6	1.5		1.6	1.6		1.6	1.6	1.6
BOQ	2.5	13.2		0.5	10.1		1.9	8.4		1.2	1.4	0.1
QSRatio	0.4			0.0			0.3			0.1		0.0
90th Percentile Output:												
fB%	1.8	1.7		1.8	1.7		1.8	1.7		1.8	1.8	1.8
BOQ	2.8	14.4		0.5	11.0		2.1	9.2		1.3	1.6	0.1
QSRatio	0.4			0.0			0.3			0.1		0.0
95th Percentile Output:												
fB%	2.0	1.9		2.1	1.9		2.1	1.9		2.1	2.1	2.1
BOQ	3.2	16.2		0.6	12.5		2.4	10.5		1.5	1.9	0.1
QSRatio	0.5			0.1			0.4			0.1		0.0
98th Percentile Output:												
fB%	2.6	2.2		2.7	2.3		2.6	2.4		2.6	2.6	2.7
BOQ	4.1	19.2		0.8	15.1		3.1	12.8		1.9	2.4	0.1
QSRatio	0.7			0.1			0.5			0.2		0.0

ERROR MESSAGES

No errors to report.

Analyst: Given Kutz
Agency: Skagit County
Date: 6/21/2017
Period: 5:00 pm
Project ID: 2016 Concurrency Assessment
E/W St: Cook Road

Inter.: Int #1
Area Type: All other areas
Jurisd: County
Year : 2021
N/S St: Old Hwy 99 N

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	1
LGConfig	L	TR		L	TR		L	TR		L	T	R
Volume	145	587	74	32	489	70	100	176	221	60	81	110
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
RTOR Vol		5			6			27			97	

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A		
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds	X		
WB Left	A				SB Left	A		
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	27.0				17.1			
Yellow	4.0				3.6			
All Red	1.0				1.0			

Cycle Length: 53.7 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	268	534	0.59	0.50	12.8	B		
TR	895	1781	0.80	0.50	16.2	B	15.6	B
Westbound								
L	193	383	0.18	0.50	7.8	A		
TR	894	1778	0.67	0.50	12.0	B	11.8	B
Northbound								
L	403	1266	0.27	0.32	14.0	B		
TR	526	1652	0.76	0.32	23.1	C	21.2	C
Southbound								
L	198	621	0.33	0.32	14.9	B		
T	576	1810	0.15	0.32	13.2	B	13.8	B
R	481	1509	0.03	0.32	12.6	B		

Intersection Delay = 15.6 (sec/veh) Intersection LOS = B

Baseline

Phone: Fax:
E-Mail:

OPERATIONAL ANALYSIS

Analyst: Given Kutz
Agency/Co.: Skagit County
Date Performed: 6/21/2017
Analysis Time Period: 5:00 pm
Intersection: Int #1
Area Type: All other areas
Jurisdiction: County
Analysis Year: 2021
Project ID: 2016 Concurrency Assessment
E/W St: Cook Road N/S St: Old Hwy 99 N

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	145	587	74	32	489	70	100	176	221	60	81	110
% Heavy Veh	7	5	5	5	5	5	5	7	5	5	5	7
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
PK 15 Vol	39	160	20	9	133	19	27	48	60	16	22	30
Hi Ln Vol												
% Grade		0			0			0			0	
Ideal Sat	1900	1900		1900	1900		1900	1900		1900	1900	1900
ParkExist												
NumPark												
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	1
LGConfig	L	TR		L	TR		L	TR		L	T	R
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
RTOR Vol		5			6			27			97	
Adj Flow	158	713		35	602		109	402		65	88	14
%InSharedLn												
Prop LTs	1.000	0.000		1.000	0.000		1.000	0.000		1.000	0.000	
Prop RTs	0.105			0.116			0.525			0.000	1.000	
Peds Bikes	0	0		0	0		0	0		0	0	
Buses	0	0		0	0		0	0		0	0	0
%InProtPhase												

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Arriv. Type	3	3		3	3		3	3		3	3	3
Unit Ext.	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
I Factor		1.000			1.000			1.000			1.000	
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Ext of g	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Ped Min g		3.2			3.2			3.2			3.2	

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A		
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds	X		
WB Left	A				SB Left	A		
Thru	A				Thru	A		
Right	A				Right	A		
Peds	X				Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	27.0				17.1			
Yellow	4.0				3.6			
All Red	1.0				1.0			

Cycle Length: 53.7 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	145	587	74	32	489	70	100	176	221	60	81	110
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj flow	158	638	75	35	532	70	109	191	211	65	88	14
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	1
Lane group	L	TR		L	TR		L	TR		L	T	R
Adj flow	158	713		35	602		109	402		65	88	14
Prop LTs	1.000	0.000		1.000	0.000		1.000	0.000		1.000	0.000	
Prop RTs	0.105			0.116			0.525			0.000	1.000	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG	L	TR		L	TR		L	TR		L	T	R
So	1900	1900		1900	1900		1900	1900		1900	1900	1900
Lanes	1	1	0	1	1	0	1	1	0	1	1	1
fW	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fHV	0.935	0.952		0.952	0.952		0.952	0.944		0.952	0.952	0.935
fG	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fP	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fBB	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fA	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fLU	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
fRT		0.984			0.983			0.921			1.000	0.850
fLT	0.301	1.000		0.211	1.000		0.700	1.000		0.343	1.000	
Sec.												
fLpb	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
fRpb		1.000			1.000			1.000			1.000	1.000
S	534	1781		383	1778		1266	1652		621	1810	1509
Sec.												

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)		Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound								
Prot								
Perm								
Left	L	158	534		0.30	0.50	268	0.59
Prot								
Perm								
Thru	TR	713	1781	#	0.40	0.50	895	0.80
Right								
Westbound								
Prot								
Perm								
Left	L	35	383		0.09	0.50	193	0.18
Prot								
Perm								
Thru	TR	602	1778		0.34	0.50	894	0.67
Right								
Northbound								
Prot								
Perm								
Left	L	109	1266		0.09	0.32	403	0.27
Prot								
Perm								
Thru	TR	402	1652	#	0.24	0.32	526	0.76
Right								
Southbound								
Prot								
Perm								
Left	L	65	621		0.10	0.32	198	0.33
Prot								
Perm								
Thru	T	88	1810		0.05	0.32	576	0.15
Right	R	14	1509		0.01	0.32	481	0.03

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.64
Total lost time per cycle, L = 9.60 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.78

Control Delay and LOS Determination

Appr/ Lane	Ratios		Unf Del	Prog Adj	Lane Grp	Incremental Factor	Del	Res Del	Lane Group		Approach	
Grp	v/c	g/C	d1	Fact	Cap	k	d2	d3	Delay	LOS	Delay	LOS
Eastbound												
L	0.59	0.50	9.4	1.000	268	0.18	3.4	0.0	12.8	B		
TR	0.80	0.50	11.1	1.000	895	0.34	5.1	0.0	16.2	B	15.6	B
Westbound												
L	0.18	0.50	7.3	1.000	193	0.11	0.5	0.0	7.8	A		
TR	0.67	0.50	10.0	1.000	894	0.25	2.0	0.0	12.0	B	11.8	B
Northbound												
L	0.27	0.32	13.6	1.000	403	0.11	0.4	0.0	14.0	B		
TR	0.76	0.32	16.5	1.000	526	0.32	6.6	0.0	23.1	C	21.2	C
Southbound												
L	0.33	0.32	13.9	1.000	198	0.11	1.0	0.0	14.9	B		
T	0.15	0.32	13.1	1.000	576	0.11	0.1	0.0	13.2	B	13.8	B

R	0.03	0.32	12.6	1.000	481	0.11	0.0	0.0	12.6	B

Intersection delay = 15.6 (sec/veh) Intersection LOS = B

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input

		EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach		M	M	M	M
Cycle length, C	53.7 sec				
Total actual green time for LT lane group, G (s)		27.0	27.0	17.1	17.1
Effective permitted green time for LT lane group, g(s)		27.0	27.0	17.1	17.1
Opposing effective green time, go (s)		27.0	27.0	17.1	17.1
Number of lanes in LT lane group, N		1	1	1	1
Number of lanes in opposing approach, No		1	1	1	1
Adjusted LT flow rate, VLT (veh/h)		158	35	109	65
Proportion of LT in LT lane group, PLT		1.000	1.000	1.000	1.000
Proportion of LT in opposing flow, PLTo		0.00	0.00	0.00	0.00
Adjusted opposing flow rate, Vo (veh/h)		602	713	88	402
Lost time for LT lane group, tL		5.00	5.00	4.60	4.60
Computation					
LT volume per cycle, LTC=VLTC/3600		2.36	0.52	1.63	0.97
Opposing lane util. factor, fLUo		1.000	1.000	1.000	1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)		8.98	10.64	1.31	6.00
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g		0.0	0.0	0.0	0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)		1.00	1.00	1.00	1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]		0.50	0.50	0.68	0.68
gq, (see Exhibit C16-4,5,6,7,8)		8.42	12.51	0.00	5.92
gu=g-gq if gq>=gf, or = g-gf if gq<gf		18.58	14.49	17.10	11.18
n=Max(gq-gf)/2,0)		4.21	6.26	0.00	2.96
PTHo=1-PLTo		1.00	1.00	1.00	1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]		1.00	1.00	1.00	1.00
EL1 (refer to Exhibit C16-3)		2.29	2.54	1.43	1.90
EL2=Max((1-Ptho**n)/Plto, 1.0)					
fmin=2(1+PL)/g or fmin=2(1+Pl)/g		0.15	0.15	0.23	0.23
gdiff=max(gq-gf,0)		0.00	0.00	0.00	0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)		0.30	0.21	0.70	0.34
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N**					
Left-turn adjustment, fLT		0.301	0.211	0.700	0.343

For special case of single-lane approach opposed by multilane approach, see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

Input

		EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach					
Cycle length, C	53.7 sec				
Total actual green time for LT lane group, G (s)					
Effective permitted green time for LT lane group, g(s)					
Opposing effective green time, go (s)					
Number of lanes in LT lane group, N					

Number of lanes in opposing approach, No				
Adjusted LT flow rate, VLT (veh/h)				
Proportion of LT in LT lane group, PLT	0.000	0.000	0.000	0.000
Proportion of LT in opposing flow, PLTo				
Adjusted opposing flow rate, Vo (veh/h)				
Lost time for LT lane group, tL				
Computation				
LT volume per cycle, LTC=VLTC/3600				
Opposing lane util. factor, fLUo	1.000	1.000	1.000	1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)				
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g				
Opposing platoon ratio, Rpo (refer Exhibit 16-11)				
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]				
gq, (see Exhibit C16-4,5,6,7,8)				
gu=g-gq if gq>=gf, or = g-gf if gq<gf				
n=Max(gq-gf)/2,0)				
PTHo=1-PLTo				
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]				
EL1 (refer to Exhibit C16-3)				
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g				
gdiff=max(gq-gf,0)				
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)				
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)				
or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT				

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns	EB	WB	NB	SB
Effective pedestrian green time, gp (s)	27.0	27.0	17.1	17.1
Conflicting pedestrian volume, Vped (p/h)	0	0	0	0
Pedestrian flow rate, Vpedg (p/h)	0	0	0	0
OCCpedg	0.000	0.000	0.000	0.000
Opposing queue clearing green, gq (s)	8.42	12.51	0.00	5.92
Eff. ped. green consumed by opp. veh. queue, gq/gp	0.312	0.463	0.000	0.346
OCCpedu	0.000	0.000	0.000	0.000
Opposing flow rate, Vo (veh/h)	602	713	88	402
OCCr	0.000	0.000	0.000	0.000
Number of cross-street receiving lanes, Nrec	1	1	1	1
Number of turning lanes, Nturn	1	1	1	1
ApbT	1.000	1.000	1.000	1.000
Proportion of left turns, PLT	1.000	1.000	1.000	1.000
Proportion of left turns using protected phase, PLTA	0.000	0.000	0.000	0.000
Left-turn adjustment, fLpb	1.000	1.000	1.000	1.000
Permitted Right Turns				
Effective pedestrian green time, gp (s)	27.0	27.0	17.1	17.1
Conflicting pedestrian volume, Vped (p/h)	0	0	0	0
Conflicting bicycle volume, Vbic (bicycles/h)	0	0	0	0
Vpedg	0	0	0	0
OCCpedg	0.000	0.000	0.000	0.000
Effective green, g (s)	27.0	27.0	17.1	17.1
Vbicg	0	0	0	0

OCCbicg	0.020	0.020	0.020	0.020
OCCr	0.000	0.000	0.000	0.000
Number of cross-street receiving lanes, Nrec	1	1	1	1
Number of turning lanes, Nturn	1	1	1	1
ApbT	1.000	1.000	1.000	1.000
Proportion right-turns, PRT	0.105	0.116	0.525	1.000
Proportion right-turns using protected phase, PRTA	0.000	0.000	0.000	0.000
Right turn adjustment, fRpb	1.000	1.000	1.000	1.000

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

	EBLT	WBLT	NBLT	SBLT
Cycle length, C 53.7 sec				
Adj. LT vol from Vol Adjustment Worksheet, v				
v/c ratio from Capacity Worksheet, X				
Protected phase effective green interval, g (s)				
Opposing queue effective green interval, gq				
Unopposed green interval, gu				
Red time r=(C-g-gq-gu)				
Arrival rate, qa=v/(3600(max[X,1.0]))				
Protected ph. departure rate, Sp=s/3600				
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)				
XPerm				
XProt				
Case				
Queue at beginning of green arrow, Qa				
Queue at beginning of unsaturated green, Qu				
Residual queue, Qr				
Uniform Delay, d1				

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay ds	Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
L	0.0	0.00	13.3	9.4	0.00	0.0	0.0	12.8
TR	0.0	0.00	13.3	11.1	0.00	0.0	0.0	16.2
	0.0						0.0	
Westbound								
L	0.0	0.00	13.3	7.3	0.00	0.0	0.0	7.8
TR	0.0	0.00	13.3	10.0	0.00	0.0	0.0	12.0
	0.0						0.0	
Northbound								
L	0.0	0.00	18.3	13.6	0.00	0.0	0.0	14.0
TR	0.0	0.00	18.3	16.5	0.00	0.0	0.0	23.1
	0.0						0.0	
Southbound								
L	0.0	0.00	18.3	13.9	0.00	0.0	0.0	14.9
T	0.0	0.00	18.3	13.1	0.00	0.0	0.0	13.2
R	0.0	0.00	18.3	12.6	0.00	0.0	0.0	12.6

Intersection Delay 15.6 sec/veh Intersection LOS B

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup	L	TR		L	TR		L	TR		L	T	R
Init Queue	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Flow Rate	158	713		35	602		109	402		65	88	14
So	1900	1900		1900	1900		1900	1900		1900	1900	1900
No.Lanes	1	1	0	1	1	0	1	1	0	1	1	1
SL	534	1781		383	1778		1266	1652		621	1810	1509
LnCapacity	268	895		193	894		403	526		198	576	481
Flow Ratio	0.3	0.4		0.1	0.3		0.1	0.2		0.1	0.0	0.0
v/c Ratio	0.59	0.80		0.18	0.67		0.27	0.76		0.33	0.15	0.03
Grn Ratio	0.50	0.50		0.50	0.50		0.32	0.32		0.32	0.32	0.32
I Factor		1.000			1.000			1.000			1.000	
AT or PVG	3	3		3	3		3	3		3	3	3
Pltn Ratio	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
PF2	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Q1	1.7	8.8		0.3	6.8		1.2	5.4		0.7	0.9	0.1
kB	0.2	0.5		0.2	0.5		0.3	0.3		0.2	0.4	0.3
Q2	0.3	1.7		0.0	1.0		0.1	1.0		0.1	0.1	0.0
Q Average	2.0	10.5		0.3	7.7		1.3	6.4		0.8	1.0	0.2
Q Spacing	25.0	25.0		25.0	25.0		25.0	25.0		25.0	25.0	25.0
Q Storage	155	0		275	0		170	0		280	0	100
Q S Ratio	0.3			0.0			0.2			0.1		0.0
70th Percentile Output:												
fB%	1.2	1.2		1.2	1.2		1.2	1.2		1.2	1.2	1.2
BOQ	2.4	12.4		0.4	9.1		1.6	7.6		1.0	1.2	0.2
QSRatio	0.4			0.0			0.2			0.1		0.0
85th Percentile Output:												
fB%	1.6	1.5		1.6	1.5		1.6	1.5		1.6	1.6	1.6
BOQ	3.1	15.9		0.5	11.8		2.1	9.9		1.3	1.6	0.2
QSRatio	0.5			0.0			0.3			0.1		0.1
90th Percentile Output:												
fB%	1.8	1.6		1.8	1.7		1.8	1.7		1.8	1.8	1.8
BOQ	3.5	17.3		0.6	12.9		2.3	10.9		1.5	1.8	0.3
QSRatio	0.6			0.1			0.3			0.1		0.1
95th Percentile Output:												
fB%	2.0	1.8		2.1	1.9		2.1	1.9		2.1	2.1	2.1
BOQ	4.1	19.3		0.7	14.6		2.7	12.4		1.7	2.1	0.3
QSRatio	0.7			0.1			0.4			0.2		0.1
98th Percentile Output:												
fB%	2.6	2.1		2.7	2.3		2.6	2.3		2.6	2.6	2.7
BOQ	5.1	22.6		0.9	17.4		3.4	14.9		2.2	2.6	0.4
QSRatio	0.8			0.1			0.5			0.2		0.1

ERROR MESSAGES

No errors to report.